

प्रगति प्रतिवेदन: Progress Report

Volume 3: Agronomy, Soil Science & Plant Physiology

अखिल भारतीय समन्वित अनुसंधान परियोजना: चावल

All India Coordinated Research Project on Rice (AICRPR)



2025



भाकृअनुप-भारतीय चावल अनुसंधान संस्थान

भारतीय कृषि अनुसंधान परिषद

ICAR-Indian Institute of Rice Research

Indian Council of Agricultural Research
Rajendranagar, Hyderabad - 500 030

PROGRESS REPORT 2025

CROP PRODUCTION

AGRONOMY

**ALL INDIA CO-ORDINATED
RESEARCH PROJECT ON RICE
(AICRPR)**



**ICAR- INDIAN INSTITUTE OF RICE RESEARCH
RAJENDRA NAGAR, HYDERABAD – 500030**

website: <http://www.icar-iirr.org>

email: director.iirr@icar.org.in

Correct Citation:

Indian Institute of Rice Research 2026. Progress Report 2025, Volume – 3, Crop Production (Agronomy, Soil Science and Plant Physiology), All India Co-ordinate Research Project on Rice (AICRPR). Pp. 4.1 - 4.540 (Agronomy), Pp. 5.1 - 5.151 (Soil Science) and Pp. 6.1 - 6.166 (Plant Physiology).

PREFACE

AICRPR experiments conducted by Agronomists at different locations during *rabi* 2024-25 and *Kharif* 2025 for understanding the response of rice crop to management practices, resource conservation and climatic variations in developing efficient crop and resource management technologies to maximize the productivity and ensure profitability on a sustainable basis are compiled in this report. AICRPR Agronomists conducted 333 experiments at 47 locations (Funded and Voluntary) consisting of, evaluation of promising entries (103 cultures) belonging to 21 groups viz., Early Hill (EH), Medium Hill (MH), Japonica, Early (TP and DS), IME, IM, Late, AL& ISTVT, CSTVT, AGT, Aerobic, MS, LPT, LNT, Biofortified, BT, RSL, SDW, Early (Rabi) NIL HT (HT- herbicide - resistant mutant, Nitrogen and Phosphorous use efficiency) trials in different establishment systems, for their response to nutrient management at 50 and 100 % Recommended Dose of Fertilizer(RDF). In addition, 12 trials on resource conservation, weed management, rice-based crop diversification systems and five multi-disciplinary collaborative trials (Soil science, Entomology, Pathology and Economics) and one climate change mitigation trial, for developing cost-effective technologies in rice and rice-based cropping systems in India.

The coordinated program in soil science addressed the issues related to sustaining productivity of soil and crop systems on a long-term basis, management of sodic and acid soils and their management using different formulations, residue management in rice-based cropping systems, assessment of Carbon dynamics in rice ecologies and recarbonising rice soils for sustainable production, assessment of bio fortified genotypes to Zn applications and collaborative trials such as nano-fertilisers for increasing use efficiency, yield maximization in different zones and organic rice cultivation with Agronomy & Entomology. A total of nine trials were conducted during *rabi* 2024-25 and *kharif* 2025 in 24 locations (11 funded as well as 13 voluntary centres) representing typical soil and crop systems and important rice-growing regions.

The coordinated program in plant physiology addressed the issues related to various abiotic stress tolerance namely, moisture deficit stress, high temperature stress, salinity, osmotic stress, anaerobic germination, submergence stress, low light stress etc. In addition to this, for understanding physiological aspects of DSR, a new coordinated trial on dry direct seed rice has been initiated from *Kharif* 2025. The focus of the coordinated program in plant physiology being the identification of donors, traits and physiological mechanisms for climate resilience rice cultivation. With this background, six coordinated trials were conducted during *Kharif* 2025 and *Rabi* 2025 season namely- 1. Phenotyping of rice germplasm for physiological traits for Dry Direct Seeded Rice (DDSR), 2. Phenotyping of elite rice genotypes for Drought Tolerance, 3. Evaluation of rice genotypes for heat tolerance suitable for future climate, 4. Physiological characterization of selected genotypes for multiple abiotic stress tolerance, 5. Screening for submergence tolerance and 6. Screening of rice varieties for tolerance to low-light. Physiological studies under All India Co-Ordinated Rice Improvement Program were conducted at nine funded centers, (Coimbatore, Maruteru, Pantnagar, Pattambi, Rewa, Raipur, Karjat, Titabar and Kaul), two ICAR institutions (IIRR Hyderabad and NRRI Cuttack) and four voluntary centers (RARS Chinsurah, NDUAT Faizabad, PJNAR Karaikal, and BAU Ranchi).

I congratulate and compliment the Cooperating Scientists, technical staff and Principal Investigators of the program in Agronomy, Soil Science and Physiology Sections for their excellent effort in conducting the trials, monitoring, data collection and compilation, analysis and preparation of this voluminous report, which will benefit to develop suitable technologies.



(R.M. SUNDARAM),
DIRECTOR

AGRONOMY

4. AGRONOMY

CONTENTS

S.No.	Title		Page Nos.	
			Text	Table
	SUMMARY		4.1	-
4.1.	AVT-2 AGRONOMIC EVALUATION TRIALS (AETs)			
	Nutrient response trials on selected AVT-2 rice cultures under optimum and low input management & Evaluation of Herbicide tolerant cultivars			
4.1a	AVT 2 – E(H)		4.15	4.17
4.1b	AVT 2 – M(H)		4.16	4.19
4.1c	AVT 2 - Japonica		4.16	4.22
4.1d	AVT 2 - E (TP)		4.25	4.26
4.1e	AVT 2 - IME (TP)		4.42	4.43
4.1f	AVT 2 - IM (TP)		4.65	4.66
4.1g	AVT 2 – Late		4.117	4.118
4.1h	AVT 2 - Aerobic		4.126	4.127
4.1i	AVT 2 - MS		4.143	4.144
4.1j	AVT 2 – Bio fort		4.153	4.154
4.1k	AVT 2 - AL&ISTVT		4.164	4.165
4.1l	AVT 2 - CSTVT		4.168	4.169
4.1m	AVT 2 - AGT		4.173	4.174
4.1n	AVT 2 LPT (Phosphorous efficient cultivars)		4.180	4.181
4.1o	AVT 2 - LNT (Nitrogen efficient cultivars)		4.195	4.197
4.1p	AVT 2 - Nil and Gel		4.215	4.216
4.1q	AVT 1- NIL (HT cultivars- trait verifications)		4.224	4.225
4.1r	AVT 2 - Basmati		4.228	4.229
4.1s	AVT 2 – E(DS)		4.233	4.234
4.1t	AVT 2 – Early Rabi		4.233	4.239
4.1u	AVT 2 - RSL		4.244	4.245
4.1v,w	GYEL		4.253	4.255
4.2	RESOURCE CONSERVATION TECHNOLOGIES TRIALS (RCTs)			
4.2.1	RCT-1	Water management (IoT based sensors) for enhancing water use efficiency and productivity of DSR and transplanted rice (Modified) (Interdisciplinary with Agricultural Engineering)	4.267	4.269
4.2.2	RCT-2	Suitable package of practices for higher yield in DSR DSR systems		
	RCT-2.2.1	Identification of suitable sowing method of Dry DSR for higher productivity in different zones	4.277	4.279
	RCT-2.2.2	Evaluation of varieties for their suitability and enhancement of the productivity in dry direct seeded rice (un-puddle soil)	4.296	4.298
4.2.3	RCT-3	Suitable package of practices for higher yield in Wet DSR systems		
	RCT-2.3.1	Identification of suitable sowing method of Wet DSR for higher productivity in different zones	4.302	4.306

	RCT-2.3.2	Evaluation of varieties for their suitability and enhancement of the productivity in Wet direct seeded rice (puddle soil)	4.330	4.331
4.3	RICE BASED CROP DIVERSIFICATION SYSTEM TRIALS (RBCDTs)			
4.3.1	RBCDS-1	Conservation Agriculture / System based Management Practices in rice and rice-based cropping systems (crop diversification) for higher profitability (Interdisciplinary with Entomology and Pathology)	4.335	4.340
4.3.2	RBCDS-2	Analysis of long term meteorological data of AICRIP centres (temp and rainfall) for identifying the reasons for yield reduction (Collection of 25 years data)- Computer Sciences and Statistics	4.345	
4.4	WEED MANAGEMENT TRIALS (WMTs)			
4.4.1	WMT-1	Long term trial on weed dynamics in rice based cropping systems under different establishment methods	4.347	4.357
4.4.2	WMT-2	Farmers field weed monitoring in different rice establishment systems	4.456	4.466
4.4.3	WMT-3	Management of Weedy rice in problematic areas in DSR system	4.469	4.477
4.4.4	WMT-4	Integrated Pest Management in DSR system – (Entomology and Pathology)	4.484	4.489
4.5	INTER DISCIPLINARY TRIALS (IDTs)			
4.5.1	IDT-1	a) Yield maximization of rice in different zones (Interdisciplinary with Soil Science)	4.493	4.495
4.5.2	IDT-2	Agronomic evaluation of the package of practices of the best farmers of the state/ region and yield gap analysis of the region. (Agronomy and Agricultural Economics)	4.512	4.513
4.5.3	IDT-3	Evaluation of Organic fertilizers and Natural farming practices for enhancing the productivity and soil health (Interdisciplinary trial – Agronomy, Soil Science and Crop protection)	4.514	-
4.5.4	IDT-4	Nano-fertilizers for increasing nutrient use efficiency, yield and economic returns in transplanted rice (New trial)- (Interdisciplinary with Agronomy and IFFCO)	4.514	-
4.5.5	IDT-5	Evaluation of drone for its suitability to various Agronomy interventions	4.515	4.518
4.6	CLIMATE CHANGE MITIGATION TRIALS (CCMTs)			
4.6.1	CMT-1	Evaluation Cleanrise™ for sustainable rice production and reducing the methane emissions (New experiment – Collaboration with String Bio and Soil Science Section)	4.527	4.530

Annexure I to V

I	Major weeds observed during Kharif 2025	i
II	Weather parameters at different centres during crop growth period, <i>kharif</i> 2025	ii
III	Details of product/material manufacturers	viii
IV	Abbreviations	ix
V	List of Co-operators	x
	Acknowledgement	xvi

SUMMARY

Crop production experiments under All India Coordinated Research Project on Rice (AICRPR) were conducted by Agronomists, Soil scientists and Physiologists at different locations during *rabi* 2024-25 and *kharif* 2025 for understanding the response of rice crop to management practices, resource conservation and climatic variations for developing efficient crop and resource management technologies that maximize the productivity and ensure high profitability to increase the farmers income on a sustainable basis are compiled in this report.

A total of 333 experiments were conducted at 47 locations (39 funded and 8 voluntary centres) consisting of evaluation of promising cultivars (103 cultures) belonging to 21 groups viz., Early Hill, Medium Hill (MH), Japonica, early (TP and DS), IME, IM, Late, , CSTVT, AL& ISTVT, Aerobic, MS, Bio-fortified, LPT(Phosphorus efficient cultivars), LNT (Nitrogen Efficient Cultivars), Basmati, RSL, SDW, NIL (HT- herbicide – trait verification), E(DS), RSL, Early (Rabi) Nitrogen and Phosphorous use efficiency) in the transplanted situation, for their response to integrated nutrient management at 50 and 100% Recommended Dose of Fertilizer (RDF). In addition, 12 trials on Resource Conservation, Rice-based cropping systems, Weed Management, and five Multi-Disciplinary trials.

4.1. AGRONOMIC EVALUATION TRIALS (AETs)

The development of high- yielding and improved varieties and hybrids is one of the major components of rice production technology. In rice growing regions, nutrient management is also the most important yield limiting factor for production. Adaptation of cultivars with high Nutrient use efficiency is a potential strategy for optimizing nutrient requirements, lowering cost of cultivation and reducing the environmental pollution. Optimization of nutrient use not only enhances grain yield through better nutrient use efficiency but also reduces the cost of cultivation. In order to find out the production potential of promising cultivars and their response to varying levels of nutrients and to identify the optimum dose, the effect on late planted rice situations and efficient N and P cultivars, Nutrient management trials (NMTs) were constituted and conducted during *kharif* 2025. A total of 103 AVT-2 entries belonging to 21 categories were evaluated at different locations under two levels of nutrient application, i.e., 50 and 100 % of the recommended dose of nutrients along with standard and local cultivars to identify stable, high yielding and efficient genotypes.

4.1(a) AVT 2 E(H)

Cultivars IET 31381, IET 31386 & IET 31389 were evaluated with Shalimar Rice 3, Vivekdhan 86, VL Dhan 86 and local check at three locations (**Almora, Khudwani and Malan**) under two different recommended doses of fertilizer (50% and 100% RDF). Nutrient management with 100% RDF was found to be promising and also exhibited higher nutrient recovery at both the locations. Popular variety VL Dhan 86 and tested culture IET 31381, IET 31386 & IET 31389 were found to be promising based on grain yield efficiency index.

4.1(b) AVT 2 M(H)

Cultivars IET 31413 was evaluated in comparison with Vivekdhan 62, VL Dhan 68 and Local checks at three locations (**Khudwani, Malan and Upper Shillong**) under two fertilizer doses (50% RDF & 100% RDF) under upland hill conditions. integrated agronomic management with 100% RDF was found to be promising and also exhibited higher nutrient recovery. Among the cultures, IET 31413 and Vivekdhan 62 were found to be promising in terms of higher grain yield efficiency index.

4.1 (c) AVT 2 Japonica

Cultivars IET 31431 was evaluated in comparison with Brigunhan, Varundhan and Shalimarrice5 and local checks at three locations (**Khudwani, Malan and Upper Shillong**) under two fertilizer doses (50% RDF & 100% RDF) under upland hill conditions. integrated agronomic management with 100% RDF was found to be promising and also exhibited higher nutrient recovery. Among the cultures IET 31431, Brigudhan and Varundhan were found to be promising in terms of higher grain yield efficiency index.

4.1 (d) AVT 2 E (Transplanted)

Three AVT-2 entries (IET 30637, IET 31436 (H) and IET 31501) were evaluated for their response to 50% and 100% level of nutrients on grain yield in comparison to standard varieties i.e. Narendra 97(E), CO-51(NC) PR 124 (N), Luit (NE), Sahbhagidhan (C & W), MTU 1153 (S), US 314 (Hybrid) as well as local checks at 16 locations viz., **Coimbatore (150-50-50), Dhangain (90-50-30), Masodha (120-60-40), Ghahraghat (120-60-40), Gangavathi (150-75-75), Jagdalpur (120-60-30), Karjat (100-50-50), Mandya (125:62:62), Nagaina (120-60-40), Nawagam (80-25-0), Maruteru (90:60:60), Puducherry (120-40-40), Ranchi (80-40-20), Varanasi (120-50-40), Warangal (120-60-40), and Sabour (100- 40-20)**. The experiments were conducted in a split plot design at all the locations. The treatments were two levels of fertilizer input (50% and 100% RDF) as main plot and varieties assigned to sub plots. Mean grain yield across all the 16 locations, recommended input of nutrients (100% RDF) was found promising with 15.5 % higher grain yield and also exhibited higher nutrient efficiency. Further, the performance of IET 31501 (5.13 t/ha) followed by IET 31436 (H) (5.12 t/ha) were promising over MTU 1153 (S) (4.89 t/ha) and CO-51 (4.87 t/ha).

4.1(e) AVT 2 - Irrigated Medium Early

AVT-2 IME cultures (IET 30692, IET 30713, IET 31448-H, IET 31452-H, IET 31456-H, IET 31461-H, IET 31466-H, IET 31589, IET 31603, IET 31608, a total of ten cultures were evaluated at 17 locations viz., **Aduthurai (150-50-50), Chinsurah (80-40-40), Dhangain (110-50-40), Gangavathi (150:75:75), (120:60:40), Ghahraghat (120:60:60), Karjat (100:50:50), Kota (120:60:40), Ludhiana (150-30-30), Mandya (125:62:62), Maruteru (90:60:60), Masodha (120-60-40), Nagaina (120-60-40), Navsari (100-30-0), Nawagam (100-25-0), Puducherry (120-40-40), Rajendranagar (120-60-40) and Varanasi (120:60:40)** in comparison to high yielding standard checks (US-312, Krishnahamsa and Local checks respective local checks) under two recommended dose of fertilizers (50% and 100% RDF). Mean across the locations, nutrient management with 100% RDF application recorded better

yield over 50% RDF at all the locations with 19.3% higher grain yield. Among the cultures, IET 31448 (5.48 t/ha), IET 31452 (5.21 t/ha), IET 31456 (5.16 t/ha) performed better and recorded higher mean grain yield across the locations as compared to other test entries and checks.

4.1(f) AVT 2 - Irrigated Medium

Sixteen AVT-2 entries IET 29860, IET 29877, IET 31478(H), IET 31479(H), IET 31480(H), IET 31481(H), IET 31492(H), IET 31618, IET 31633, IET 31637, IET 31638, IET 31639, IET 31640, IET 31641, IET 31643 and IET 31659 of medium duration were evaluated for their response to nutrients on yield attributes and grain yield at 17 different locations viz., **Aduthurai (150-50-50), Chinsurah (80-40-40), Coimbatore (150-50-50), Dhangain (120-60-40), Masodha (120-60-40), Jagdalpur (100-50-30), Karjat (100-50-50), Maruteru (90-60-60), Nagina (120-60-40), Navsari (100-30-0), Nawagam (100-25-0), Pantnagar (120-60-40), Puducherry (120-40-40), ARI-Rajendranagar (120-60-40), Titabar (60-20-40), Varanasi (150-60-40) and Warangal (120-60-40)** under two different levels of nutrient input (50% and 100% RDF). among cultures IET 31480(H) (5.18 t/ha) followed by IET 29860 (4.95 t/ha), and IET 31638 (4.94 t/ha) were found promising on the basis of overall mean grain yield across the locations. Interaction effect of nutrients and cultures found significant at **Aduthurai, Coimbatore, Jagdalpur, Masodha, Nawagam, Pantnagar, Puducherry and Varanasi**. Application of 100% RFD resulted in better yields of cultivars at these locations.

4.1(g) AVT 2 – Late

Four AVT-2 late duration entries (IET 30882(H)(R), IET 31686(H), IET 31709(H), IET 31714 (H) were evaluated for its response to graded levels nutrients on grain yield and yield attributes at 7 locations i.e. **Aduthurai (150-50-50), Chinsurah (80-40-40), Chiplima (80-40-40), Dhangain (120-60-40), Karjat (100-50-50), Mandya (125-62-62) and Nawagam (80-25-0)** under two levels of RDF (50% and 100% RDF). 100% RDF was found to be promising with 19 % increased grain yield and also exhibited higher nutrient recovery efficiency (8.53 kg grain/kg Nutrient). IET cultures were found to be promising in terms of higher grain yield at most of the locations however IET 28524 (5.36 t/ha) recorded better mean yields at higher RDF application.

4.1(h) AVT 2 – Aerobic

Eight AVT-2 entries (IET 30045, IET 30919, IET 31740, IET 31741, IET 31757, IET 31760, IET 31765 and IET 31775) were evaluated against CR Dhan 201, CR Dhan 202, AAUDR-1 (W), MAS 946-1(S), DRRH4 (Hybrid), DRR Dhan 54, Pusa 44 (RP) and local check) for their response to two fertilizer levels on grain yield at 8 locations viz., **Dhangain (100-50-40), Jagdalpur (100-50-25), Ludhiana (150-30-30), Nawagam (80-25-0), Pantnagar (120-60-40), Raipur (120-60-40), Sabour (120-60-40) and Varanasi (120-50-40)**. Application of 100% RDF was found to be promising (18.4% higher grain yield) and also exhibited higher nutrient response. Across the locations, the performance of IET 31740 (4.80 t/ha) followed by IET 30045 (4.80 t/ha) were found to be promising.

4.1(i) AVT 2-MS

One entry IET 31494(H) of medium slender group was evaluated for their response to two levels of nutrients (50% and 100% RDF) on grain yield at nine different locations i.e., **Dhangain (120-60-40), Karjat (100-50-50), Kaul (150-60-60), Mandya (125-62-62), Maruteru (90-60-60), Masodha (120-60-40), Nagina (120-60-40), Nawagam (100-25-0) and Raipur (120-60-40)**. Application of 100% RDF was found to be promising (22.8% higher yield) and also exhibited higher nutrient response. Entry IET 31494(H) was found to be promising with better yields over other test entries and checks at 100% of RDF application at respective locations.

4.1(j) AVT 2-Biofortified

Six AVT-2 Biofortified cultures (IET 31925, IET 31927, IET 31938, IET 31939, IET 31947 and IET 31961) were evaluated for its response to different levels of nutrients (50% and 100% RDF) on grain yield from eight locations viz., **Gangavathi (150-75-75), Kaul (150-60-60), Kota (150-75-60), Nagina (120-60-40), Nawagam (100-25-0), Pusa (120-60-40), Raipur (120-60-40) and Warangal (120-60-40)**. Mean over the locations, IET 31927 (4.90 t/ha) followed by IET 31925 (4.86 t/ha) and IET 31947 (4.82 t/ha) performed better and were found superior over test cultures.

4.1(k) AVT 2 - AL & ISTVT

Saline tolerant cultures (three) Viz., IET 31858, IET 31861, IET 31862 were evaluated for its response to different doses of nutrients on grain yield at **Navasari (120-30-0), Panvel (100-50-50) and Pusa (120-60-40)**. In this trial, 100% RDF was found to be promising however, exhibited higher nutrient efficiency than 50%. IET 31861 and IET 31862 cultures were found to be promising over other local checks at **Panvel and Pusa**.

4.1(l) AVT 2 - CSTVT

Two cultures viz., IET 31877 and IET 31878 were evaluated in comparison with standard check varieties (Pusa 44, CSR-10, Bhootnath and FL 478) at **Chinsura (80-40-40), Gangavathi (150-75-75), Vytilla (75-108-20), Navsari (120-30-0)** and under two recommended level of input (50 and 100% RDF). Among test cultures at **Gangavathi** IET 31877 resulted in the highest grain yield (5.15 t/ha) over checks. Similarly, at Vytilla, IET 31878 resulted higher grain yield of 5.13 t/ha than those of checks. Average yield of culture IET 30201 (4.63 t/ha) found to be promising over checks. Interaction effects of N levels and varieties were found to be non-significant at all locations except **Vytilla**.

4.1(m) AVT 2 - AGT

One AVT-2 AGT culture IET 31909 was evaluated for its response to different levels of nutrients (50% and 100% RDF) on grain yield from six locations viz., **Chinsurah (60-30-30), Dhangain (100-50-40), Masodha (120-60-40), Nagina (120-60-40), Navsari (120-30-0), Titabar (60-20-40)**. Grain yield differences among the tested cultures were found to be significant at all the locations. At Masodha IET 31909 (2.89 t/ha) resulted on par yield with GAR 14 (2.92 t/ha). At **Nagina**, the highest grain yield was recorded under IET 31909 (3.38

t/ha) and found promising over other test cultures. Interaction effects among RDF x varieties was found to be significant at all the locations except at **Chinsurah, Dhangain and Masodha**.

4.1(n) AVT 2 - Phosphorous efficient cultivars (LPT)

The trial was conducted at seven locations (**Gangavathi, Mandya, Maruteru, Pusa, Raipur, Ranchi and Varanasi**). Split plot design was adopted with 3 main plots of phosphorus levels (P₁- No Phosphorus (Control) (N and K Constant), P₂: 50% of recommended P dose (N and K is constant) and P₃: 100 % of recommended dose of P (N and K constant). Subplots consist of advanced cultures and checks. Interaction effect of phosphorus level and advanced cultures on grain yield was found significant only at **Mandya, Pusa and Varanasi** while, higher 'P' application recorded better yields (50 and 100% of recommended P) at these centers. At **Mandya** under 50% RDP, IET 31979 (5.81 t/ha), IET 31976 (5.43 t/ha) and IET 31969 (5.09 t/ha) were promising. At **Pusa** under no P application, IET 31966 (2.84 t/ha), IET 31985 (2.69 t/ha) and IET 31986 (2.69 t/ha) were promising. Under 50% RDP, IET31966 (3.71 t/ha), IET 31986 (3.49 t/ha) and IET 31985 (3.46 t/ha) were promising. At **Varanasi** under 50% RDP, IET 31980 (4.53 t/ha), IET 31107 (3.53 t/ha) and IET 31969 (3.33 t/ha) were promising.

4.1(o) AVT 2 - Nitrogen efficient cultivars (LNT)

Interaction effect of nitrogen level and advanced cultures on grain yield was found significant at **Karjat, Pantnagar, and Varanasi**. However, the objective is to find out suitable and efficient cultivars under low recommended N application for reducing nitrogen input without any yield penalty. At **Karjat**, under no application of nitrogen, IET 31990 (3.64 t/ha), IET 31998 (3.20 t/ha) and IET 31993 (3.16 t/ha) performed well. Similarly, under 50% RDN, IET 31990 and IET 29577 resulted grain yield of 5.61 t/ha and 4.86 t/ha, respectively and found promising. At **Pantnagar**, under no application of nitrogen, IET 32009 (2.29 t/ha), IET 31994 (2.20 t/ha) and IET 31998 (2.15 t/ha) performed well. Similarly, under 50% RDN, IET 32009, IET 31994 and IET 31998 resulted 4.68 t/ha, 4.24 t/ha and 4.13 t/ha, respectively and found promising. At **Varanasi**, under 50% RDN, IET 32009 and IET 31998 resulted 4.23 t/ha and 3.97 t/ha, respectively and found promising.

4.1(p) AVT 2 – NIL & GEL

Two AVT-2 NIL & GEL culture IET 32964 and IET 32990 were evaluated for its response to different levels of nutrients (50% and 100% RDF) on grain yield from eight locations viz., **Chinsurah (80-40-40), Dhangain (110-50-40), Gangavathi (150-75-75), Jagdalpur (100-50-25), Masodha (120-60-40), Nagina (120-60-40), Navsari (100-30-0) and Titabar (60-20-40)**. Grain yield differences among the tested cultures were found to be significant at all the locations except **Chinsurah**. The highest grain yield was recorded by IET 32990 (5.16 t/ha) at **Dhangain**, IET 32964 (4.51 t/ha) and IET 32990 (4.15 t/ha) at **Masodha**, IET 32964 (3.68 t/ha) and IET 32990 (3.61 t/ha) at **Nagina**, IET 32964 (5.28 t/ha) at **Navsari** and IET 32964 (5.27 t/ha) at **Titabar** found promising over other test cultures.

4.1 (q) AVT 1- NIL – HT

Advanced varietal trial 1-NIL (Herbicide Tolerant Genotypes), was conducted at six locations (**Cuttack, Coimbatore, IIRR Hyderabad, Naira Chinsura, Nagina**) to evaluate the performance of ten entries with nominated herbicide tolerant lines (NILs) including three susceptible check and one herbicide tolerant check against two herbicides i.e., Imazethapyr and Byspyribac sodium (NC) along with weed free check and weedy check. Data of four centers (**Cuttack, Coimbatore, Nagina and Naira**) were rejected due to recording of high yield with one or more the susceptible entries. In case of imazethapyr treatment, the lines G1 (5.28 t/ha) exhibited significantly superior grain yield over all other entries whereas G4, G5 and G6 showed comparable yield but superior over with G2 (4.80 t/ha) with no or low phytotoxicity to Imazethapyr which might have contributed to higher crop growth and grain yield.

4.1 (r) AVT 2- BT

Two BT cultures (IET 31299 and IET 32297) were evaluated for its response to nutrient application in terms of grain yield and yield attributes at five locations i.e., **Kaul (90-30-0), Ludhiana (40-30-30), IARI (120-60-40), Nagina (120-60-40)** and **Pantnagar (120-60-40)** under two different nutrient levels (50% and 100% RFD). Grain yield differences among the tested cultures were significant at all locations. Significantly higher maximum grain yield was recorded by IET 31299 (3.79 t/ha) and IET 32297 (3.71 t/ha) at **Nagina** and IET 32297 (4.26 t/ha) at **Pantnagar** over local checks. Among the entries tested at all locations, mean grain yield of IET culture 31299 (4.14 t/ha) was the highest.

4.1(s) AVT 2 - EDS

One cultures (IET 32100) was evaluated for its response to nutrient application in terms of grain yield and yield attributes at five locations i.e., **Coimbatore (150-50-50), Jagdalpur (100-50-30), Raipur (120-60-60), Ranchi (80-40-30)** and **Rewa (100-60-40)** under two different nutrient levels (50% and 100% RFD). Significantly higher maximum grain yield was recorded by IET 32100 at Coimbatore (4.25 t/ha), Jagdalpur (5.72 t/ha), Ranchi (4.11 t/ha) and Rewa (5.51 t/ha) over local checks.

4.1(t) AVT 2 – E(Rabi)

Two AVT-2 entries (IET 31368 and IET 32072) were evaluated against CO-51, Narendra 97€, MTU 1153(S) and local check BPT 5204 for their response to two fertilizer levels on grain yield at 5 locations viz., **Coimbatore (100-50-50), Dhangain (100-50-30), Gangavathi (150-75-75), Mandya (125-62-62)** and **Warangal (100-60-40)**. Among the entries tested, IET 32072 (5.51 t/ha), IET 31368 (5.29 t/ha) recorded higher yield at **Coimbatore**. In other locations the new 2 entries did not perform better than check.

4.1(u) AVT 2 - Rainfed Shallow Lowland

Six AVT-2cultures (IET 32175, IET 31246, IET 31220, IET 31237, IET 33264 and IET 33262) of rainfed shallow land were evaluated for its response to levels RDF on grain yield at **Chinsurah (80:40:40), Dhangain (120:60:40), Ghaghraghat (120:60:40), and Titabar (60:20:40)** under two levels of RDF (50% and 100% RDF). In this trial, 100% RDF was found

to be promising and also exhibited higher nutrient recovery efficiency. Across locations, among the IET cultures, IET 31246 (4.86t/ha) followed by IET 31220 (4.51 t/ha) were found promising in terms of higher mean grain yield and nutrient response.

4.2 RESOURCE CONSERVATION TECHNOLOGIES TRIALS (RCTs)

4.2.1. Water management (IoT based Sensors) for enhancing water use efficiency and productivity of DSR and transplanted rice (*Kharif 2025*)

To evaluate the suitable and promising irrigation management practices in different crop establishment methods a trial was conducted at five **locations** in four **Zones (Chiplima, Gangavathi, Khudwani, Ludhiana and Mandya)**. Across the locations Wet DSR recorded higher mean grain yield (5.59 t/ha), particularly in Zone III (**Chiplima**: 5.10 t/ha) and in Zone VII (**Gangavathi**: 4.59 t/ha; **Mandya**: 5.88 t/ha) followed by mechanised transplanting (**Mandya**: 6.19 t/ha). Dry DSR performed well under favourable conditions in Zone I (**Khudwani**: 7.04 t/ha) and Zone II (**Ludhiana**: 5.83 t/ha). Among irrigation practices, alternate wetting and drying (AWD) recorded the highest mean grain yield (5.37 t/ha) across locations. AWD also reduced total water input (e.g., **Chiplima**: 979 mm; **Mandya**: 1356 mm; **Khudwani**: 1176 mm) and lowered cost of cultivation (e.g., **Chiplima**: ₹73,754/ha; **Gangavathi**: ₹50,343/ha) compared to flooding. Irrespective of establishment method, AWD maintained comparable or higher yields while improving water use efficiency (up to 43.53 kg/ha-cm in **Mandya**), indicating its effectiveness as a water-saving and cost-efficient irrigation management.

4.2.2. Suitable package of practices for higher yield in Dry DSR

4.2.2.1. Identification of suitable sowing method of Dry DSR for higher productivity in different rice zones, *Kharif-2025*.

The trial was conducted at 12 locations (**Khudwani, Chatha, Ludhiana, Pantnagar, Pusa, Varanasi, Jagdalpur, Raipur, Rewa, Nawagam, Gangavathi and Mandya**) to identify suitable sowing method in Dry DSR in six Zones. Across the locations, raised bed sowing (4.6–4.9 t/ha), mechanized line sowing (5.0–5.1 t/ha) and location-specific methods (up to 5.2 t/ha) recorded superior grain yield compared to broadcasting (3.8 t/ha). However, at six locations (**Ludhiana, Pusa, Varanasi, Raipur, Rewa and Mandya**), different sowing methods of dry DSR were comparable, with grain yield varying within a narrow range of about 3.0–4.5 t/ha (**Varanasi**), 4.0–4.3 t/ha (**Ludhiana**), 4.3 – 4.9 t/ha (**Raipur**), 2.6 – 4.6 t/ha (**Rewa**) and 3.9–4.9 t/ha (**Mandya**).

4.2.2.2. Evaluation of varieties for their suitability and enhancement of the productivity in Dry Direct Seeded Rice (Un-puddled soil), *kharif-2025*

The trial was conducted in four Zones in four locations (**Nawagam, Rajendranagar, Raipur and Ranchi**) to evaluate suitable varieties under dry Direct Seeded Rice System. Across the locations, grain yield varied between 3.73 and 6.10 t/ha, with superior performance recorded by IRRI 1 (6.10 t/ha), DRR Dhan 60 (5.47 t/ha), CG Baraki Dhan-2 (5.10 t/ha), Naveen (5.04 t/ha), DRR Dhan 42 (4.99 t/ha), Sabhagidhan (4.65 t/ha) and DRR Dhan 44 (4.58

t/ha). These varieties also recorded higher grain yield, yield attributes, with tillers ranging up to 593 m⁻², panicles up to 566 m⁻², and test weight up to 31.0 g, indicating their better adaptability and suitability under dry direct seeded rice conditions across different agro-climatic zones.

4.2.3. Suitable package of practices for higher yield in Wet DSR

4.2.3.1. Identification of suitable sowing method of Wet DSR for higher productivity in different zones (Puddled) Soil

To identify suitable sowing methods, in Wet DSR, a trial was conducted across 15 locations (**Aduthurai, Chatha, Chiplima, Coimbatore, Karjat, Mandya, Maruteru, Navasari, Nawagam, Pattambi, Puducherry, Pusa, Rewa, Titabar and Varanasi**). Mechanized line sowing (drum seeder) consistently recorded higher grain yield (4.5–6.62 t/ha), followed by manual line sowing (4.0–5.2 t/ha) and raised bed sowing (4.0–5.6 t/ha). At several locations (e.g., **Chiplima, Titabar, Chinsurah** and **Nawagam**), line sowing and improved methods achieved higher yields of 5.3–5.9 t/ha, whereas at **Puducherry**, the highest grain yield of 6.62 t/ha was recorded, highlighting the suitability of DSR methods. However, at a few locations (e.g., **Mandya** and **Pattambi**), yield differences among methods were non-significant. The mechanized and line sowing methods proved superior and more economical, ensuring higher productivity and better resource-use efficiency in wet DSR systems.

4.2.3.2. Evaluation of varieties for their suitability and enhancement of the productivity in wet direct seeded rice (Puddled soil), *kharif*-2025

The multi-location trial conducted at three locations (**Kota, Raipur and Warangal**) to evaluate suitable varieties in wet direct seeded rice. The results clearly highlighted the importance of varietal selection for enhancing productivity under wet direct seeded rice conditions. Across locations, DRR Dhan 60 (3.78–5.92 t/ha), DRR Dhan 44 (3.91–5.84 t/ha) and IRRI 1 (up to 6.13 t/ha) emerged as high-yielding performers, while locally adapted cultivars such as Bastar Dhan-1 (4.30 t/ha), KNM 118 (5.96 t/ha) and WGL 915 (5.01 t/ha) also exhibited strong and competitive performance. Despite these trends, varietal differences at individual locations were often non-significant, with grain yield varying of 2.10–6.13 t/ha (**Kota**), 2.10–4.30 t/ha (**Raipur**) and 3.78–5.96 t/ha (**Warangal**).

4.3 Rice Based Crop Diversification System Trials (RBCD's)

4.3.1. Conservation Agriculture/system based management practices in rice and rice-based cropping systems (crop diversification) for higher profitability

The trial on Conservation Agriculture (CA) and crop diversification in rice-based systems at Karjat and Ghaghrahat reveals that while traditional transplanting remains the most productive method, specific diversification options like Chickpea and Mustard offer viable pathways for system profitability. **Zone VI (Karjat):** Transplanting and Conventional Tillage remained superior, with a mean Rice Equivalent Yield (REY) of 6.82 t/ha. Minimum Tillage faced a "yield penalty" of approximately 0.66 t/ha compared to conventional methods.

Chickpea emerged as the most resilient Rabi crop (7.04 t/ha REY), outperforming Maize and Wheat. At **Ghaghraghat (Zone III)**: Weed biomass in aerobic systems was three times higher (45.27 g/m²) than in transplanted systems (14.53 g/m²). This massive spike in weed competition was identified as the primary biological constraint depressing yield at this station. Transplanting (M1) achieved the highest grain yield (3.53 t/ha) and system REY (7.81 t/ha). Aerobic rice (M3) lagged significantly due to moisture stress and nutrient uptake issues in the local sandy loam soil. The Rice–Mustard (C2) sequence was the most effective strategy. Although Mustard had lower absolute yields than wheat, its higher market value resulted in a superior REY (6.75 t/ha).

4.3.2. Analysis of long-term meteorology data (temperatures and rainfall) for identifying the reasons for yield reduction

The dataset consists of rice yield data and meteorological data of 10 locations i.e. **Navasari, Rajendranagar, Mandya, Coimbatore, Gangavathi, Kaul, Khudwani, Ludhiana, Pattambi, Chinsurah and Karaikal** for the years 2005 to 2025. This data includes yield of rice crop (t/ha), rainfall of the crop season(mm) and mean weekly minimum temperature and maximum temperature of the crop season(⁰C). The Random forest ($R^2=0.95$) algorithm performed well in predicting the yield of the rice crop. Although the model performed well, its predictive capability can be further enhanced by incorporating larger multi-year datasets.

4.4. WEED MANAGEMENT TRIALS

4.4.1. Long term trial on Weed Dynamics in Direct Seeded Rice (DSR)

The *Kharif 2025*, long-term monitoring trials on Direct Seeded Rice (DSR) across major Indian agro-climatic zones reveal that while puddled systems typically offer a yield advantage, the success of dry seeding depends heavily on zone-specific weed management. **Zone I (Hilly Areas) At Malan**, un-puddled dry direct seeding significantly outperformed puddled systems (3.53 t/ha) under weed-free condition. The region hosts a highly heterogeneous weed community where grasses, sedges, and broad-leaved weeds (BLW) coexist equally. However, a "late-season weed flush" was observed as herbicide efficiency dropped by the panicle initiation stage. **Zone II (Northern Zone) In Pantnagar**, both puddled and dry establishment methods proved viable, with puddled conditions showing higher synergy with herbicides (5.51 t/ha). Mechanical weeding emerged as the most economical, offering the highest profitability (2.81 BCR) under dry seeding. **At Chatha**, puddled wet DSR was significantly superior for yield. A notable finding was that mechanical weeding outperformed the weed-free check, likely due to secondary benefits like soil aeration and improved root growth, consistently yielding 3.14 t/ha regardless of the seeding method. **Zone III (Eastern Zone) At Chiplima**, a clear preference for puddled wet seeding, which achieved 4.27 t/ha compared to 3.81 t/ha in dry seeding. The puddled environment maximized the efficacy of weed management, with the combination reaching 5.20 t/ha. Herbicide application was identified as the most profitable strategy (2.57 BCR), while manual weeding was the most expensive, exceeding Rs 72,000/ha. **Zone IV (North Eastern Zone) At Titabar**, puddled wet

seeding held a substantial 28.5% yield advantage over dry seeding. High weed pressure was evident, as the weed-free treatment under puddled conditions peaked at 5.03 t/ha. **Zone V (Central Zone), Jagdalpur** showed that both puddled and dry DSR are equally viable, with no significant difference in grain yield. Herbicide-based treatments were highly effective, exceeding 92% weed control efficiency (WCE) at the panicle initiation stage. Rotational herbicide application provided the best economic returns, making it a robust site for DSR adoption due to stable herbicide efficacy across moisture regimes. **Zone VI (Western Zone), Nawagam** is characterized as a "robust" site where establishment methods do not significantly alter outcomes (4.0 t/ha). However, the center faces high sedge persistence (42%). Herbicide sequences (Pyrazosulfuron-ethyl and Pendimethalin) proved highly adaptable here, maintaining stable control regardless of moisture levels. **Zone VII (Southern Zone), at Aduthurai**, Puddled systems were significantly superior. The region faces intense grass dominance (up to 82% RWD), which is further exacerbated by dry seeding. At **Gangavathi**, No significant yield difference was found between M1 and M2. A distinct "weed shift" was documented; while herbicides cleared sedges and BLWs, it allowed grasses to surge to 88% density. At **Moncompu**, in this high-rainfall zone, chemical intervention is mandatory for dry DSR. The region also faces a major threat from weedy rice, which complicates traditional management. At **Pattambi**, "Sedge-climax" flora (up to 100% sedge density). Puddled wet DSR combined with rotational herbicides reached yields above 5.5 t/ha, while manual weeding was found to be economically non-viable, costing up to Rs 40,000/ha. **ARI-Rajendranagar**: This was the most efficient location, recording the highest BCR (approaching 4.0). Interestingly, it had the lowest herbicide efficiency (30–50%).

Rabi Summary:

Zone VII – South (Karaikal & Pattambi)

In **Karaikal**, mechanized transplanting proved to be the superior establishment method, achieving the highest grain yield (4.56 t/ha) and dry matter accumulation compared to Wet and Dry DSR. In **Pattambi**, puddled direct seeding emerged as the top performer with a significant yield of 8.86 t/ha, outperforming mechanized transplanting primarily due to prohibitive cultivation costs (up to Rs. 75,220/ha) and a resulting lower B:C ratio. Across both locations, un-puddled dry seeding recorded significantly low yields. Regarding weed management, chemical control (S3) was the most consistent and economically viable subplot treatment at both centers, delivering the highest B:C ratios (2.14 in Karaikal and 1.32 in Pattambi). A critical interaction was observed in Pattambi, where the combination of puddled direct seeding with chemical control (M2S3) reached a peak yield of 11.50 t/ha. This underscores that while establishment methods may vary by local soil and climate, the synergy between a puddled environment and early-season chemical knockdown is the most effective strategy for maximizing *Rabi* rice productivity.

4.4.2. Farmers field weed monitoring in different rice establishment systems

The *Kharif 2025* weed monitoring survey conducted across five Zones and 11 locations in India reveals a significant shift in weed dynamics, characterized by the emergence of

drought-tolerant grasses, perennial sedges, and the increasing threat of weedy rice. Management strategies range from 100% chemical-led systems in the North to entirely manual, labour-intensive practices in the West and Northeast. **Zone II (Northern) Ludhiana (Punjab):** Features a highly mature chemical management system. Dominant weeds include *Echinochloa crus-galli* and the emerging drought-tolerant *Eleusine aegyptiaca*. Farmers use Pre-emergence+Post-emergence, achieving high yields of up to 8.2 t/ha. **Pantnagar (Uttarakhand):** Exhibits a standardized "Three-Tier" approach: Pretilachlor (PE), followed by Bispyribac-sodium (POE), and one manual weeding. Yields are stable at 5.0–5.5 t/ha. **Zone III (Eastern): Chinsurah (West Bengal):** High weed diversity exists between districts. In Hooghly, aquatic weeds like *Algae* and *Marsilea* are common, while Purulia faces perennial threats like *Cynodon dactylon*. Chemical-led integrated management (Pyrazosulfuron-ethyl + POE) was found to be Rs 10,000–12,000/ha cheaper than purely manual weeding. **Zone IV (North Eastern): Titabar (Assam):** 100% of farmers rely on manual weeding, reflecting a traditional approach. Fields are characterized by aquatic weeds like *Ceratophyllum* and *Marsilea quadrifolia*, indicating poor drainage. Yields remain respectable at 3.6–4.4 t/ha despite low herbicide adoption. **Zone VI (Western): Navsari/Tapi (Gujarat):** This region reports zero reliance on herbicides, depending entirely on two manual weedings. While effective, this labour-intensive method costs up to Rs 10,200/ha. Yields fluctuate significantly between villages (3.2 to 5.0 t/ha), suggesting that other inputs like irrigation may be limiting factors. **Zone VII (Southern): Karaikal (Puducherry):** Dominated by the sedge *Cyperus difformis* (Rank 1 in 90% of farms). Farmers skip pre-emergence steps entirely, relying on "Triple Protection" (Post-emergence tank mixes + manual weeding). **Moncompu (Kerala):** A critical finding here is the widespread emergence of Weedy Rice (*Oryza sativa f. sp. spontanea*). Farmers use new-generation herbicides like Vivaya to achieve peak yields of 7.5 t/ha. **Pattambi (Kerala):** High moisture favors *Isachne miliaceae* and *Water Hyacinth*. The survey found chemical weed management as effective and economic solution to weed problems.

4.4.3. Weedy rice management in DSR

During the *Kharif* 2025 season, trials for weedy rice management in Direct Seeded Rice (DSR) were conducted in four zones. Results highlighting that while weed-free and hand weeding treatments generally provide the highest control, chemical interventions like pretilachlor and pyrazosulfuron-ethyl offer more economically viable alternatives depending on the region. **Zone I (Hilly Area - Malan):** Chemical weed control proved superior to manual methods, with pretilachlor significantly reducing weedy rice density and biomass. (This resulted in a grain yield of 2.83 t/ha, second only to the weed-free treatment, effectively suppressing a mixed weed flora of grasses, sedges, and broad-leaved weeds (BLW)). **Zone II (Northern - Chatha):** Hand weeding and the stale seed bed technique were the most effective, yielding 3.22 t/ha and 3.16 t/ha respectively. Pretilachlor remained the top-performing herbicide, while the weedy check suffered a drastic yield loss, producing only 1.15 t/ha. **Zone V (Central - Jagdalpur & Rewa):** At Jagdalpur, yields were the highest of all locations (up to 7.38 t/ha under weed free). Pyrazosulfuron-ethyl was identified as the most economical choice, offering the highest B:C ratio (2.92) despite the dominance of sedges and BLW. At

Rewa, high environmental variability led to non-significant yield differences. **Zone VII (Southern - Gangavathi):** The weed flora was heavily dominated by sedges, which were most effectively managed through manual weeding and pretilachlor. Hand weeding (T5) and T7 led in productivity (4.24–4.36 t/ha), but pyrazosulfuron-ethyl (T3) and pretilachlor (T1) provided competitive and favourable B:C ratios.

4.4.4. Integrated Pest Management – on farm management of insects, diseases and weeds in DSR. Special interdisciplinary trial (Entomology, Pathology and Agronomy), *Kharif 2025*

During the *Kharif 2025* season, across five Zones and nine Locations, Integrated Pest Management (IPM) consistently outperformed traditional farmers' practices in Direct Seeded Rice (DSR), delivering significant grain yield advantages. In **Zone II (Northern - Ludhiana)**, IPM enhanced resource use efficiency and yield (1.64%), while in **Zone III (Eastern - Chinsurah)**, 9.82% yield gain. **Zone IV (North Eastern - Titabar)** recorded the most dramatic response, with a substantial 28.28% yield advantage, proving that IPM effectively mitigated the severe weed competition that acted as a major limiting factor in that region. In **Zone VI (Western - Navsari)**, sustained weed suppression resulted in an 8.56% yield increase. **Zone VII (Southern)** showed that, Puducherry and Mandya recorded impressive yield increases of 15.17% and 13.45%, respectively, while Aduthurai, Coimbatore, and Gangavathi further confirmed the superiority of IPM in reducing weed biomass and enhancing crop performance. Overall, these results underscore that across all zones, IPM provides a robust, interdisciplinary solution for early-stage weed suppression and sustained crop vigour in DSR systems.

4.5. INTER DISCIPLINARY TRIALS

4.5.1. Yield maximization of rice in different zones specific to DSR system (Wet or Dry)

A multi-location trial was conducted during *Kharif 2025* across in six Zones 15 locations (**Khudwani, Malan, Pantnagar, Ranchi, Bankura, Chinsurah, Chinsurah (rabi), Ghaghraghat, Titabar, Raipur, Maruteru, Warangal, Pattambi, Pattambi (rabi), Mandya, Gangavathi and Karaikal**) to evaluate seven nutrient management treatments to maximize rice yield under DSR systems. Across the 15 locations, 125% Location Specific Recommended Dose of Fertilizer + FYM @ 5 t/ha consistently recorded higher or comparable grain yield, mainly due to improved tillering, panicle formation and grain filling. The integrated nutrient management approach of increased fertilizer with organic inputs demonstrated superior yield performance and economic returns under diverse soil types and agro-climatic conditions.

4.5.2. Assessment of yield gap analysis – Interdisciplinary with Economics (Yield Gaps in Rice in different Zones)

Impact of Conventional Cultivation system on Yield Variability Across Indian States

The trial was conducted in selected Districts across five rice-growing States of India — **Assam, Gujarat, Kerala, Puducherry, Uttarakhand and West Bengal** —to assess the yield

gap in rice cultivation. Using primary data from 25 to 50 farmers in each state and potential yields from research stations and progressive farmers were gathered to serve as benchmarks for evaluating the yield gap under field conditions. The study revealed that the presence of yield gaps in rice cultivation across Indian States, ranging from -15% to -4.38%, with an average of -4.35%. These yield gaps are indicative of untapped productivity potential. Minimizing yield gaps is necessary to enhance rice output, improve livelihoods, and contribute to national food security.

Impact of Direct Seeded Rice (DSR) system on Yield Variability across Indian States

A comparative analysis of rice yield performance between Direct Seeded Rice (DSR) and Transplanted Rice (TPR) was conducted across Districts in four major rice-growing States—**Assam, Gujarat, Kerala and Puducherry**—using farmer-reported data collected through structured questionnaires. The results indicate that, on average, DSR yields are 14.80% lower than TPR yields, reflecting current agronomic and adoption challenges. Notably, **Gujarat, Assam and Puducherry** experienced significant yield reductions under DSR, likely due to factors such as weed infestation, poor crop establishment and moisture stress. However, **Kerala** showed a positive yield gain of 3.57% under DSR, attributed to favourable agroecological conditions and effective management. These findings highlight the need for region-specific adaptation strategies, including improved DSR-compatible varieties and enhanced weed and water management, to improve the productivity and scalability of DSR.

4.5.3. Evaluation of Organic fertilizers and Natural farming practices for enhancing the productivity and soil health

For detailed report refer Soil Science Progress Report.

4.5.4. Nano-fertilizers for increasing nutrient use efficiency, yield and economic returns in transplanted rice

For detailed report refer Soil Science Progress Report.

4.5.5. Evaluation of drone for its suitability to various agronomy interventions

To evaluate the suitability and cost-effectiveness of drone (UAV) technology for various agronomic interventions in rice cultivation across eight locations (**Ludhiana, Mandya, Rajendranagar, Navsari, Nawagam, Puducherry, Chinsurah and Moncompu**) in four Zones. The results of eight locations revealed that pre-emergence and post-emergence application of herbicides by drone-based application was comparable to knapsack sprayer in controlling grasses, sedges and broad-leaved weeds, leading to similar crop growth, yield attributes and grain yield. While costs of cultivation varied, drone-based application resulted in labour savings and favourable economic returns. These findings indicate that drones are an effective and feasible tool for precision herbicide application in rice cultivation.

4.6. Climate Change Mitigation Trials (CCMT's)

4.6.1. Evaluating the potential impact of CleanRise™ on mitigating greenhouse gas emission and yield improvement in Paddy, *Kharif*-2025

CleanRise™ performance under different crop establishment methods viz., transplanted rice and direct-seeded rice (DSR), with different nitrogen levels and agro-ecological conditions was evaluated. During *Kharif*, 2025 at 12 locations in six zones viz; **Pantnagar, Ludhiana, Varanasi, Titabar, Raipur, Karjat, Nawagam, Coimbatore, Gangavathi, IIRR, Maruteru and Moncompu**. Results showed that, CleanRise™ application in Transplanting method with 100% Recommended Dose of Fertilizers + 60 g/ha application three times i.e., seedling treatment, foliar spray at maximum tillering and foliar spray at recorded higher grain yield, yield attributes. The results of greenhouse gas emission data from two locations showed lower methane (CH₄) emission from Direct Seeded Rice with 100% RDF + 60 g/ha in three foliar applications at 20–25 DAS, maximum tillering and panicle initiation indicating the potential of DSR in reducing methane emissions in rice cultivation.

[illegible]

AGRONOMY- 4

4.1 AGRONOMIC EVALUATION TRIALS (AETs)

The development of high- yielding pest disease resistant; nutrient efficient and improved varieties, and hybrids is one of the major components of AICRPR programme of Agronomy. In rice growing regions, nutrient management is also the most important yield limiting factor for production. Adaptation of cultivars with high Nutrient use efficiency in two different planting situations is a potential strategy for optimizing nutrient requirements, lowering cost of cultivation and reducing the environmental pollution. Optimization of nutrient use not only enhances grain yield through better nutrient use efficiency but also reduces the cost of cultivation. In order to find out the production potential of promising cultivars and their response to varying levels of nutrients and to identify the optimum dose, the effect on late planted rice situations and efficient N and P cultivars, Nutrient management trials (NMTs) were constituted and conducted during *kharif* 2025. A total of 103 AVT-2 entries belonging to 21 categories were evaluated at different locations under two levels of nutrient application, i.e., 50 and 100 % of the recommended dose of nutrients along with standard and local cultivars to identify stable and efficient genotypes. NTLs and DSR cultivars were also evaluated to develop nutrient efficient and DSR suitable cultivars for sustainable rice production

4.1 (a) AVT-2 Early Hill

Cultivars IET 31381, IET 31386 & IET 31389 were evaluated with Shalimar Rice 3, Vivekdhan 86, VL Dhan 86 and local check at three locations (**Almora, Khudwani and Malan**) under two different recommended doses of fertilizer (50% and 100% RFD). The data received from two locations was summarized and presented in **Table 4.1(a)**.

Different doses of fertilizer exhibited varying differences in grain yield and yield attributes at two locations. Application of 100% RFD recorded higher yield at **Almora, Khudwani and Malan** (4.51, 8.57, and 3.64 t/ha) and was found significantly superior to 50% RFD at **Khudwani and Malan**. Interaction effects of fertilizer doses and varieties was non-significant at both the locations. Averaged across the locations, Nutrient response (kg grain / kg N) was higher at 100% RFD compared to 50% RFD.

The grain yield of the locations with different varieties ranged from 2.16 to 5.62 t/ha in **Almora**, 6.57 to 9.40 t/ha in **Khudwani**, 2.27 to 4.72 t/ha in **Malan**. Grain yield of varieties differed significantly at both the locations with different doses of RFD except at **Almora**. Among the varieties tested, Local check- Shalimar Rice-4 (8.85 t/ha) at **Khudwani** and Vivekdhan 86 (2.62 t/ha) at **Malan** were found promising over other varieties. Among the cultures, IET 31389 (4.94 t/ha at **Almora**; 7.70 t/ha at **Khudwani**) and IET 31381 (4.37 t/ha) at **Malan** were found promising. Mean over the three locations, IET 31386 was found promising over other tested varieties and entries.

In this trial, nutrient management with 100% RFD was found to be promising and also exhibited higher nutrient recovery at both the locations. Popular variety VL Dhan 86 and tested

culture IET 31381, IET 31386 & IET 31389 were found to be promising based on grain yield efficiency index.

4.1 (b) AVT-2 Medium Hill (MH)

Cultivars IET 31413 was evaluated in comparison with Vivekdhan 62, VL Dhan 68 and Local checks at three locations (**Khudwani**, **Malan** and **Upper Shillong**) under two fertilizer doses (50% RFD & 100% RFD) under upland hill conditions. The data received from four locations was summarized and presented in **Table 4.1.(b)**.

The application of 100% RFD gave significantly higher grain yield at **Khudwani** (6.73 t/ha), **Upper Shillong** (3.75 t/ha) and **Wangbal** (1.88 t/ha). Interaction effect of varieties and fertilizer levels are non-significant at all the centers except **Upper Shillong**. Nutrient response (kg grain/kg fertilizer) was higher at 100% RDF as compared to 50% RDF at four locations.

The grain yield of the locations ranged from 6.00 to 7.83 t/ha at **Khudwani**, 2.72 to 4.54 t/ha at Malan and 0.53 to 3.83 at **Upper Shillong**. The tested culture IET 31413 at **Khudwani** (6.60 t/ha), **Malan** (4.24 t/ha) and **Upper Shillong** (0.90 t/ha) was found to be promising over Vivekdhan62 and VL Dhan 68.

In this trial, integrated agronomic management with 100% RFD was found to be promising and also exhibited higher nutrient recovery. Among the cultures, IET 31413 and Vivekdhan 62 were found to be promising in terms of higher grain yield efficiency index.

4.1 (c) AVT-2 Japonica

Cultivars IET 31431 was evaluated in comparison with Brigunhan, Varundhan and Shalimarrice5 and local checks at three locations (**Khudwani**, **Malan** and **Upper Shillong**) under two fertilizer doses (50% RFD & 100% RFD) under upland hill conditions. The data received from four locations was summarized and presented in **Table 4.1.(c)**.

The application of 100% RFD gave significantly higher grain yield at **Khudwani** (5.56 t/ha), Malan (2.91 t/ha) and **Upper Shillong** (3.90 t/ha). Interaction effect of varieties and fertilizer levels are non-significant at all the centers. Nutrient response (kg grain/kg fertilizer) was higher at 100% RDF as compared to 50% RDF at four locations.

The grain yield of the locations ranged from 3.80 to 6.80 t/ha at **Khudwani**, 1.02 to 3.79 t/ha at Malan and 2.02 to 5.60 at **Upper Shillong**. The cultivar IET 31431 tested was found to be promising and comparable with other checks at all the locations.

In this trial, integrated agronomic management with 100% RFD was found to be promising and also exhibited higher nutrient recovery. Among the cultures IET 31431, Brigudhan and Varundhan were found to be promising in terms of higher grain yield efficiency index.

Table 4.1(a): Summary of data on grain yield and ancillary character of selected AET- early hill (irrigated) cultures grown under transplanted conditions at low and optimum graded levels of recommended nutrient (NPK) doses, kharif 2025.

Fertilizer-levels	Varieties	KHUDWANI							Almora	
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	Grain Yield (t/ha)	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
F1 - 50% RFD	V1	6.57	12	399	2.27	26.93	97		3.85	
	V2	7.27	9	422	2.59	27.12	99		3.95	
	V3	7.17	10	389	2.42	26.17	97		4.25	
	V4	7.70	8	397	2.89	27.17	86		2.16	
	V5	-		-	-	-	-		3.38	
	V6	6.93	11	377	2.77	25.85	96		-	
	V7	8.30	5	402	3.28	28.53	92		3.33	
F2 - 100% RFD	V1	8.37	3	434	2.93	28.93	98	17.14	5.02	11.77
	V2	8.13	6	455	2.70	26.93	100	8.19	5.24	12.93
	V3	8.10	7	446	2.77	28.40	98	8.86	5.62	13.73
	V4	9.07	2	453	3.51	28.47	86	13.05	3.10	9.37
	V5	-		-	-	-	-		4.11	7.23
	V6	8.37	3	408	2.75	26.20	97	13.71	-	-
	V7	9.40	1	456	3.61	29.03	94	10.48	3.95	6.20
Interaction										
F at same V		NS		NS	NS	NS	NS		NS	
V at same F		NS		NS	NS	NS	NS		NS	
Means of F levels:										
F1		7.32	2	398	2.70	26.96	95		3.49	
F2		8.57	1	442	3.05	27.99	96	11.90	4.51	10.21
C.D.(0.05)		0.19		NS	NS	0.32	0.41		NS	
C.V.(%)		1.66		9.45	11.37	0.82	0.3		13.49	
Mean of varieties:										
V1		7.47	6	417	2.60	27.93	98	17.14	4.44	11.77
V2		7.70	3	439	2.65	27.03	99	8.19	4.59	12.93
V3		7.64	5	417	2.60	27.29	98	8.86	4.94	13.73
V4		8.39	2	425	3.20	27.82	86	13.05	2.63	9.37
V5		-		-	-	-	-		3.75	7.23
V6		7.65	4	392	2.76	26.03	97	13.71	-	-
V7		8.85	1	429	3.45	28.78	93	10.48	3.64	6.20
C.D.(0.05)		0.62		22.2	0.3	0.95	1.01		0.45	
C.V.(%)		6.44		4.39	8.76	2.87	0.88		9.09	
Expt. Mean		7.95		420	2.87	27.48	95		4.00	
Soil type		Silty clay loam							Clay Loam	
pH		6.70							6.70	
Fertilizer levels (kg/ha)										
F1		60:30:15							50:30:20	
F2		120:60:30							100:60:40	
Varieties										
V1		IET 31381							IET 31381	
V2		IET 31386							IET 31386	
V3		IET 31389							IET 31389	
V4		Shalimar Rice 3							Shalimar Rice 3	
V5		-							Vivekdhan 86	
V6		VL Dhan 86(N)							-	
V7		Local Check(Shalimar rice -4 (135-137 days))							LC (VL Dhan 89)	
Available NPK in Soil		297:16.3:282							-	

Table 4.1(a): Contd.

Fertilizer-levels	Varieties	MALAN							Over All Mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)		
F1 - 50% RFD	V1	4.02	4	243	3.24	31.45	86		5.30	11
	V2	3.92	5	232	3.08	29.03	86		5.60	8
	V3	3.64	6	226	2.96	26.65	84		5.41	9
	V4	2.52	10	175	2.28	23.98	76		5.11	12
	V5	2.27	12	194	2.26	23.81	84		2.27	14
	V6	-		-	-	-	-		6.93	2
	V7	2.51	11	202	2.44	24.34	84		5.41	9
F2 - 100% RFD	V1	4.72	1	258	3.46	32.60	87	8.24	6.55	3
	V2	4.48	3	254	3.39	30.25	85	6.59	6.31	4
	V3	4.50	2	242	3.32	29.42	84	10.12	6.30	5
	V4	2.84	7	185	2.52	24.71	75	3.76	5.96	7
	V5	2.55	9	203	2.60	24.43	84	3.29	2.55	13
	V6	-		-	-	-	-		8.37	1
	V7	2.73	8	221	3.69	24.60	84	2.59	6.07	6
Interaction										
F at same V		NS		NS	NS	NS	NS			
V at same F		NS		NS	NS	NS	NS			
Means of F levels:										
F1		3.15	2	212	2.71	26.54	83		5.24	2
F2		3.64	1	227	3.16	27.67	83	5.76	6.11	1
C.D.(0.05)		0.39		NS	0.41	NS	NS			
C.V.(%)		8		5.23	9.63	3.96	0.35			
Mean of varieties:										
V1		4.37	1	251	3.35	32.03	87	8.24	5.92	3
V2		4.20	2	243	3.24	29.64	85	6.59	5.95	2
V3		4.07	3	234	3.14	28.04	84	10.12	5.85	4
V4		2.68	4	180	2.40	24.35	76	3.76	5.53	6
V5		2.41	6	199	2.43	24.12	84	3.29	2.41	7
V6									7.65	1
V7		2.62	5	212	3.07	24.47	84	2.59	5.74	5
C.D.(0.05)		0.5		14.48	0.47	1.19	1.01			
C.V.(%)		12.19		5.47	13.38	3.64	1			
Expt. Mean		3.39		220	2.94	27.11	83			
Soil type		Silty Clay								
pH		Loam								
Fertilizer levels (kg/ha)		5.30								
F1		45:20:20								
F2		90:40:40								
Varieties										
V1		IET 31381								
V2		IET 31386								
V3		IET 31389								
V4		Shalimar								
V4		Rice 3								
V4		Vivekdhan								
V5		86								
V6		-								
Available NPK in Soil		Local Check(HPR 1068 (Duration 120-125 days))								
		338:16.0:224								

Table 4.1(b): Summary of data on grain yield and ancillary character of selected AET- mid hill (irrigated) cultures grown under transplanted conditions at low and optimum graded levels of recommended nutrient(NPK) doses, kharif 2025.

Fertilizer-levels	Varieties	KHU DWANI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
F1 - 50% RFD	V1	6.07	5	529	1.57	26.10	131	
	V2	4.63	8	406	1.45	25.53	91	
	V3	6.00	6	381	2.08	26.53	87	
	V4	6.73	4	425	1.96	28.73	90	
F2 - 100% RFD	V1	7.13	2	581	1.70	26.30	136	10.60
	V2	5.00	7	551	1.53	25.80	91	3.70
	V3	6.97	3	512	2.39	26.63	88	9.70
	V4	7.83	1	535	2.60	29.33	92	11.00
Interaction								
F at same V		NS		NS	NS	NS	2.11	
V at same F		NS		NS	NS	NS	2.09	
Means of F levels:								
F1		5.86	2	436	1.77	26.72	100	
F2		6.73	1	545	2.06	27.02	102	8.75
C.D.(0.05)		0.22		78.57	0.06	NS	1.29	
C.V.(%)		2.02		9.12	1.78	1.25	0.73	
Mean of varieties:								
V1		6.60	2	555	1.64	26.20	134	10.60
V2		4.82	4	479	1.49	25.67	91	3.70
V3		6.49	3	447	2.24	26.58	87	9.70
V4		7.28	1	480	2.28	29.03	91	11.00
C.D.(0.05)		0.42		61.3	0.26	0.62	1.49	
C.V.(%)		5.3		9.94	10.83	1.84	1.17	
Expt. Mean		6.30		490	1.91	26.87	101	
Soil type		Silty clay loam						
pH		6.70						
Fertilizer levels (kg/ha)								
F1		60:30:10						
F2		120:60:20						
Varieties								
V1		IET 31413						
V2		Vivekdhan 62						
V3		V L Dhan 68(N)						
V4		Local Check(Shalimar rice -4)						
Available NPK in Soil		302.3: 18.3: 278.5						

Table 4.1(b): Contd.

Fertilizer-levels	Varieties	MALAN						Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	
F1 - 50% RFD	V1	3.93	2	215	3.65	26.98	90	
	V2	3.50	5	200	3.32	24.00	96	
	V3	2.72	8	177	3.15	20.93	92	
	V4	3.18	7	222	2.17	25.93	86	
F2 - 100% RFD	V1	4.54	1	243	3.79	28.35	91	7.18
	V2	3.65	3	218	3.74	25.65	95	1.76
	V3	3.24	6	201	3.55	23.23	92	6.12
	V4	3.58	4	239	2.69	26.87	86	4.71
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Means of F levels:								
	F1	3.33	2	204	3.07	24.46	91	
	F2	3.75	1	225	3.44	26.03	91	4.94
C.D.(0.05)		0.36		20.53	NS	NS	NS	
C.V.(%)		5.83		5.45	7.07	6.13	0.22	
Mean of varieties:								
	V1	4.24	1	229	3.72	27.67	91	7.18
	V2	3.58	2	209	3.53	24.83	96	1.76
	V3	2.98	4	189	3.35	22.08	92	6.12
	V4	3.38	3	230	2.43	26.40	86	4.71
C.D.(0.05)		0.35		20.01	0.34	1.73	1.87	
C.V.(%)		7.79		7.42	8.33	5.45	1.63	
Expt. Mean		3.54		214	3.26	25.24	91	
Soil type		Silty Clay Loam						
pH		5.20						
Fertilizer levels (kg/ha)								
	F1	45:20:20						
	F2	90:40:40						
Varieties								
	V1	IET 31413						
	V2	Vivekdhan 62						
	V3	V L Dhan 68(N)						
	V4	Local Check(HPR 1068 (Duration 120-125 days))						
Available NPK in Soil		-						

Table 4.1(b): Contd.

Fertilizer-levels	Varieties	UPPER SHILLONG							Over All Mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)		
F1 - 50% RFD	V1	0.83	4	64	1.60	2.46	128		3.61	7
	V2	-		-	-	-	-		4.07	5
	V3	0.53	6	10	1.44	2.74	124		3.08	8
	V4	2.97	2	247	3.36	2.36	116		4.29	3
F2 - 100% RFD	V1	0.97	3	126	1.57	2.69	126	1.56	4.21	4
	V2	-		-	-	-	-	-	4.33	2
	V3	0.83	4	12	1.43	2.44	123	3.33	3.68	6
	V4	3.83	1	260	3.58	2.54	121	9.56	5.08	1
Interaction										
F at same V		0.36		26.44	NS	0.13	NS			
V at same F		0.32		39.83	NS	0.16	NS			
Means of F levels:										
	F1	1.44	2	107	2.13	2.52	122		3.54	2
	F2	1.88	1	133	2.19	2.56	123	4.81	4.12	1
C.D.(0.05)		0.16		NS	NS	NS	NS			
C.V.(%)		4.62		17.92	12.83	2.93	0.67			
Mean of varieties:										
	V1	0.90	2	95	1.59	2.58	127	1.56	3.91	3
	V2	-		-	-	-	-		4.20	2
	V3	0.68	3	11	1.44	2.59	123	3.33	3.38	4
	V4	3.40	1	253	3.47	2.45	118	9.56	4.69	1
C.D.(0.05)		0.25		18.7	0.12	0.09	2.81			
C.V.(%)		11.51		11.73	4.21	2.67	1.72			
Expt. Mean		1.66		120	2.16	2.54	123			
Soil type		Sandy Clay Loam								
pH		5.96								
Fertilizer levels (kg/ha)										
	F1	40:30:20								
	F2	80:60:40								
Varieties										
	V1	IET 31413								
	V2	Vivekdhan 62								
	V3	V L Dhan 68(N)								
	V4	Local Check(Meg2 , 175 days)								
Available NPK in Soil		351.23-35.84-95.2								

Table 4.1(c): Summary of data on grain yield and ancillary character of selected AET- japonica (irrigated) cultures grown under transplanted conditions at low and optimum graded levels of recommended nutrient(NPK) doses, kharif 2025.

Fertilizer -levels	Varieties	KHUDWANI						Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	
F1 - 50% RFD	V1	5.47	4	368	2.50	26.62	109	
	V2	5.20	7	243	5.62	30.95	100	
	V3	4.50	8	323	3.75	28.53	105	
	V4	4.13	9	436	1.44	25.27	81	
	V5	5.23	6	459	1.53	28.40	85	
F2 - 100% RFD	V1	6.03	2	458	3.30	26.03	112	5.89
	V2	6.80	1	334	6.52	31.53	102	16.84
	V3	5.77	3	330	4.19	28.25	105	13.37
	V4	3.80	10	522	1.62	30.15	83	-3.47
	V5	5.40	5	513	2.09	27.65	87	1.79
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Means of F levels:								
F1		4.91	2	366	2.97	27.95	96	
F2		5.56	1	431	3.54	28.72	98	6.88
C.D.(0.05)		0.58		42.64	NS	NS	NS	
C.V.(%)		7		6.81	18.19	5.72	1.88	
Mean of varieties:								
V1		5.75	2	413	2.90	26.33	111	5.89
V2		6.00	1	289	6.07	31.24	101	16.84
V3		5.14	4	326	3.97	28.39	105	13.37
V4		3.97	5	479	1.53	27.71	82	-3.47
V5		5.32	3	486	1.81	28.03	86	1.79
C.D.(0.05)		0.69		44.56	0.77	2.19	1.08	
C.V.(%)		10.75		9.13	19.4	6.33	0.91	
Expt. Mean		5.23		399	3.26	28.34	97	
Soil type		Silty clay loam						
pH		6.50						
Fertilizer levels (kg/ha)								
F1		50:30:15						
F2		100:60:30						
Varieties								
V1		IET 31431						
V2		Bhrigudhan						
V3		Varundhan						
V4		Shalimar Rice 5						
V5		Local Check(Shalimar rice-9 (131-135 days))						
Available NPK in Soil		311.3 :17.8 :293.7						

Table 4.1(c): Contd.

Fertilizer-levels	Varieties	MALAN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
F1 - 50% RFD	V1	2.82	5	206	3.10	31.57	81	
	V2	2.95	3	208	3.33	34.27	72	
	V3	2.64	7	199	3.20	29.23	79	
	V4	1.02	10	185	1.19	28.77	60	
	V5	2.40	8	172	1.78	30.80	83	
F2 - 100% RFD	V1	3.59	2	229	3.56	32.83	81	9.06
	V2	3.79	1	239	3.71	36.53	72	9.88
	V3	2.89	4	227	3.40	30.13	79	2.94
	V4	1.54	9	193	1.41	29.70	60	6.12
	V5	2.72	6	177	2.57	31.17	83	3.76
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Means of F levels:								
F1		2.37	2	194	2.52	30.93	75	
F2		2.91	1	213	2.93	32.07	75	6.35
C.D.(0.05)		0.41		17.71	0.33	NS	NS	
C.V.(%)		9.81		5.54	7.63	4.58	0.88	
Mean of varieties:								
V1		3.21	2	218	3.33	32.20	81	9.06
V2		3.37	1	223	3.52	35.40	72	9.88
V3		2.77	3	213	3.30	29.68	79	2.94
V4		1.28	5	189	1.30	29.24	60	6.12
V5		2.56	4	174	2.18	30.99	83	3.76
C.D.(0.05)		0.35		13.91	0.22	1.38	1.27	
C.V.(%)		10.96		5.59	6.54	3.57	1.39	
Expt. Mean		2.64		203	2.73	31.50	75	
Soil type		Silty Clay Loam						
pH		5.20						
Fertilizer levels (kg/ha)								
F1		45:20:20						
F2		90:40:40						
Varieties								
V1		IET 31431						
V2		Bhrigudhan						
V3		Varundhan						
V4		Shalimar Rice 5						
V5		Local Check(Norin 18 (Duration 125-130 days))						
Available NPK in Soil		335:16:6:226						

Table 4.1(c): Contd.

Fertilizer-levels	Varieties	UPPER SHILLONG						Over All Mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering		
F1 - 50% RFD	V1	3.14	8	295	2.40	2.80	115	3.81	6
	V2	3.17	7	136	4.75	3.20	103	3.77	7
	V3	4.33	2	129	2.90	2.82	115	3.82	5
	V4	2.02	10	133	2.18	2.79	83	2.39	10
	V5	3.51	6	196	3.18	2.78	116	3.71	8
F2 - 100% RFD	V1	3.92	3	274	2.20	2.78	115	8.67	3
	V2	3.72	4	161	4.30	3.32	103	6.11	1
	V3	5.60	1	247	3.35	3.24	115	14.11	2
	V4	2.57	9	206	2.17	3.11	83	6.11	9
	V5	3.69	5	247	2.58	2.76	120	2.00	4
Interaction									
F at same V		NS		40.99	NS	NS	NS		
V at same F		NS		37.7	NS	NS	NS		
Means of F levels:									
F1		3.23	2	178	3.08	2.88	106	3.50	2
F2		3.90	1	227	2.92	3.04	107	7.40	1
C.D.(0.05)		0.38		11.19	0.02	NS	NS		
C.V.(%)		6.76		3.52	0.53	11.49	1.19		
Mean of varieties:									
V1		3.53	3	284	2.30	2.79	115	8.67	3
V2		3.45	4	148	4.53	3.26	103	6.11	2
V3		4.97	1	188	3.13	3.03	115	14.11	1
V4		2.30	5	170	2.18	2.95	83	6.11	5
V5		3.60	2	221	2.88	2.77	118	2.00	4
C.D.(0.05)		0.36		28.98	0.45	0.34	1.63		
C.V.(%)		8.19		11.71	12.24	9.29	1.25		
Expt. Mean		3.57		202	3.00	2.96	107		
Soil type		Sandy Clay Loam							
pH		5.96							
Fertilizer levels (kg/ha)									
F1		40:30:20							
F2		80:60:40							
Varieties									
V1		IET 31431							
V2		Bhrigudhan							
V3		Varundhan							
V4		Shalimar Rice 5							
V5		Local Check(Meg2, 175 days)							
Available NPK in Soil		351.23-20.16-108.26							

4.1(d) AET – AVT 2 Early (Transplanted)

Three AVT-2 entries (IET 30637, IET 31436 (H) and IET 31501) were evaluated for their response to 50% and 100% level of nutrients on grain yield in comparison to standard varieties i.e. Narendra 97(E), CO-51(NC) PR 124 (N), Luit (NE), Sahbhagidhan (C & W), MTU 1153 (S), US 314 (Hybrid) as well as local checks at 16 locations viz., **Coimbatore (150-50-50), Dhangain (90-50-30), Masodha (120-60-40), Ghahraghat (120-60-40), Gangavathi (150-75-75), Jagdalpur (120-60-30), Karjat (100-50-50), Mandya (125:62:62), Nagaina (120-60-40), Nawagam (80-25-0), Maruteru (90:60:60), Puducherry (120-40-40), Ranchi (80-40-20), Varanasi (120-50-40), Warangal (120-60-40), and Sabour (100- 40-20)**. The experiments were conducted in a split plot design at all the locations. The treatments were two levels of fertilizer input (50% and 100% RDF) as main plot and varieties assigned to sub plots. The data received from these locations are summarized and presented in **Table 4.1(d)**.

Interaction effects of nutrient levels x cultivars on grain yield was non-significant at all the locations except Puducherry. Different doses of RDF (50% and 100%) exhibited significant differences on grain yield at most of the locations except **Karjat, Mandya, Varanasi and Warangal**. Grain yield increased was significant with increasing level of input from 50 to 100% RFD at all the locations. Application of 100% NPK recorded significantly higher yield at **Coimbatore (5.83 t/ha), Dhangain (6.59 t/ha), Masodha (3.95 t/ha), Ghahraghat (3.68 t/h), Gangavathi (3.76 t/ha), Jagdalpur (5.92 t/ha), Mandya (6.59 t/ha), Nagaina (4.57 t/ha), Nawagam (5.95 t/ha), Maruteru (4.86 t/ha), Puducherry (6.50 t/ha), Ranchi (4.02 t/ha) and Sabour (4.26 t/ha)**, Nutrient response (kg grain / kg nutrient) was higher at application of 100 % RDF at **Coimbatore (9.29), Dhangain (11.71), Masodha (8.15), Ghahraghat (3.09), Gangavathi (4.57), Jagdalpur (3.93), Mandya (8.54) Nagaina (17.48), Nawagam (9.09), Maruteru (2.76), Puducherry (11.80 t/ha), Ranchi (5.14), Warangal (8.10) and Sabour (6.22)** compared to 50% NPK.

Grain yield differences among the tested genotypes were significant at all the locations. Significantly higher mean maximum yield was recorded by IET 31501 at **Coimbatore (5.76 t/ha), Masodha (4.35 t/ha) and Varanasi (6.98 t/ha)**. Similarly, IET 30637 recorded the highest grain yield at **Karjat (4.66 t/ha)** only. IET 31436 (H) recorded the highest grain yield at **Dhangain (7.26 t/ha), Jagdalpur (7.68 t/ha), Nagaina (4.00 t/ha), Maruteru (5.15 t/ha), Puducherry (6.39 t/ha) and Warangal (6.74 t/ha)**.

Mean grain yield across all the 16 locations, recommended input of nutrients (100% RDF) was found promising with 15.5 % higher grain yield and also exhibited higher nutrient efficiency. Further, the performance of IET 31501 (5.13 t/ha) followed by IET 31436 (H) (5.12 t/ha) were promising over MTU 1153 (S) (4.89 t/ha) and CO-51 (4.87 t/ha).

Table 4.1(d): Summary of data on grain yield and ancillary characters of selected AET Early (TP) cultures grown under transplanted conditions at low and optimum recommended fertilizer doses, kharif 2025.

F-levels	Varieties	COMBATORE							DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowerin g	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowerin g	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.86	14	273	3.66	24.0	84		5.53	14	256	4.06	18.5	106	
	V2	4.99	12	284	3.85	24.5	85		6.64	6	323	4.52	23.0	95	
	V3	5.08	11	291	4.01	25.2	86		6.47	9	297	4.38	24.6	95	
	V4	4.77	15	270	3.67	25.1	82		5.43	15	274	4.13	23.9	94	
	V5	-	-	-	-	-	-		-	-	-	-	-	-	
	V6	4.27	19	226	3.60	25.6	80		4.69	18	240	3.32	22.4	89	
	V7	4.19	20	221	3.95	25.0	80		3.41	20	234	2.61	24.3	84	
	V8	4.52	17	253	3.83	24.0	82		5.30	16	246	3.72	18.5	90	
	V9	4.71	16	265	3.96	22.7	82		6.13	12	275	4.28	24.1	103	
	V10	4.43	18	240	3.84	24.6	82		6.57	8	283	4.32	22.7	95	
	V11	4.89	13	277	3.89	24.4	84		5.78	13	251	3.80	17.2	91	
F2: Optimum input (100% NPK)	V1	5.97	4	338	3.88	24.2	85	8.88	6.62	7	282	4.11	17.9	107	12.82
	V2	6.28	2	350	4.13	24.6	86	10.32	7.87	1	343	4.95	23.9	96	14.47
	V3	6.44	1	356	4.33	25.5	86	10.88	7.60	2	330	4.43	23.4	96	13.29
	V4	5.91	6	337	3.98	25.3	83	9.12	6.23	11	287	4.36	21.9	98	9.41
	V5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	V6	5.34	9	290	3.92	25.8	81	8.56	5.25	17	251	3.64	24.3	91	6.59
	V7	5.18	10	282	4.17	25.5	81	7.92	4.29	19	235	2.95	18.9	84	10.35
	V8	5.69	7	320	4.13	24.1	83	9.36	6.38	10	261	3.74	18.2	91	12.71
	V9	5.94	5	333	4.17	22.7	83	9.84	7.03	5	308	4.37	22.5	103	10.59
	V10	5.54	8	305	4.11	24.9	83	8.88	7.52	3	308	4.41	22.8	97	11.18
	V11	6.03	3	348	4.18	24.5	84	9.12	7.11	4	276	4.10	17.9	90	15.65
Interaction F at same V V at same F		NS		NS	NS	NS	NS		NS		NS	NS	1.5	1	
		NS		NS	NS	NS	NS		NS		NS	NS	1.6	1	
F1 F2		4.67	2	260	3.83	24.51	83		5.60	2	268	3.91	21.92	94	
		5.83	1	326	4.10	24.71	84	9.29	6.59	1	288	4.11	21.16	95	11.71
C.D.(0.05) C.V.(%)		0.06		4	0.08	NS	NS		0.16		NS	NS	0.5	0.3	
		1.02		1	1.92	1.1	1		2.39		8	15.61	2.3	0.3	

Table 4.1(d): Contd.

N-levels		Varieties	COIMBATORE							DHANGAIN						
			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:																
V1			5.42	4	306	3.77	24.1	85	8.88	6.08	6	269	4.09	18.2	106	12.82
V2			5.64	2	317	3.99	24.6	85	10.32	7.26	1	333	4.74	23.5	95	14.47
V3			5.76	1	324	4.17	25.3	86	10.88	7.04	3	314	4.41	24.0	96	13.29
V4			5.34	5	304	3.83	25.2	83	9.12	5.83	8	281	4.25	22.9	96	9.41
V5			-	-	-	-	-	-	-	-	-	-	-	-	-	-
V6			4.81	9	258	3.76	25.7	81	8.56	4.97	9	245	3.48	23.3	90	6.59
V7			4.69	10	252	4.06	25.3	81	7.92	3.85	10	235	2.78	21.6	84	10.35
V8			5.11	7	287	3.98	24.0	82	9.36	5.84	7	254	3.73	18.4	90	12.71
V9			5.33	6	299	4.07	22.7	83	9.84	6.58	4	291	4.33	23.3	103	10.59
V10			4.99	8	273	3.98	24.8	82	8.88	7.05	2	296	4.37	22.8	96	11.18
V11			5.46	3	313	4.04	24.4	84	9.12	6.45	5	263	3.95	17.5	91	15.65
C.D.(0.05)			0.12		6.01	0.11	0.4	1		0.48		36	0.66	1.1	1	
C.V. (%)			2.03		1.75	2.43	1.4	1		6.77		11	14.07	4.3	1	
Expt. Mean			5.25		293	3.96	24.61	83	9.29	6.09		278	4.01	21.54	95	11.71
Soil type			Clay loam							Clay loam						
pH			8.10							6.56						
N - levels (kg/ha)																
F1			75:25:25							45:25:15						
F2			150:50:50							90:50:30						
Recomd N:P:K (kg/ha)			150:50:50							90:50:30						
Varieties																
V1			IET 30637							IET 30637						
V2			IET 31436(H)							IET 31436(H)						
V3			IET 31501							IET 31501						
V4			CO-51 (NC)							CO-51 (NC)						
V5																
V6			Narendra 97(E)							Narendra 97(E)						
V7			Luit (NE)							Luit (NE)						
V8			Sahbhagidhan (C&W)							Sahbhagidhan (C&W)						
V9			MTU 1153 (S)							MTU 1153 (S)						
V10			US 314 (Hybrid)							US 314 (Hybrid)						
V11			Local Check (CO 54)							Local Check (Sabour Kunwar)						
Available N:P:K soil			208:21:451							330:44:240						

Table 4.1(d): Contd.

F-levels	Varieties	MASODHA						GHAGHRAGHAT							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.57	10	254	4.17	20.6	74		2.45	12	101	3.07	20.8	74	
	V2	3.33	13	253	3.47	20.5	73		3.04	9	108	3.30	21.0	74	
	V3	4.22	4	260	3.42	24.1	73		3.98	4	110	3.47	20.3	79	
	V4	4.09	6	250	2.50	19.2	72		4.09	3	112	3.60	22.4	81	
	V5	-	-	-	-	-	-		-	-	-	-	-	-	
	V6	2.73	16	250	4.11	18.9	75		2.85	11	111	3.43	19.5	76	
	V7	3.12	14	253	3.13	20.7	77		-	-	-	-	-	-	
	V8	2.71	17	230	3.49	20.1	80		-	-	-	-	-	-	
	V9	2.26	19	239	3.72	20.4	77		-	-	-	-	-	-	
	V10	2.42	18	251	3.28	18.0	70		-	-	-	-	-	-	
	V11	2.04	20	251	1.35	19.4	65		3.62	6	107	3.40	20.9	78	
F2: Optimum input (100% NPK)	V1	4.54	2	268	5.15	22.8	71	8.82	2.95	10	107	3.40	18.7	75	4.55
	V2	4.66	1	269	4.28	24.6	69	12.09	3.58	7	103	3.60	19.1	79	4.91
	V3	4.47	3	267	3.15	24.9	71	2.27	4.13	2	111	3.77	18.7	80	1.36
	V4	3.45	12	266	2.41	20.6	69	-5.82	4.30	1	114	3.73	22.1	82	1.91
	V5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	V6	3.75	9	265	4.20	23.4	70	9.27	3.33	8	111	3.53	20.5	77	4.36
	V7	3.49	11	267	3.32	21.8	70	3.36	-	-	-	-	-	-	-
	V8	3.91	8	264	3.94	22.7	69	10.91	-	-	-	-	-	-	-
	V9	4.16	5	259	4.46	21.8	69	17.27	-	-	-	-	-	-	-
	V10	3.95	7	264	4.19	21.6	70	13.91	-	-	-	-	-	-	-
	V11	3.07	15	255	1.37	20.1	64	9.36	3.78	5	107	3.50	20.4	78	1.45
Interaction F at same V V at same F		0.64		NS	NS	NS	NS		NS		NS	NS	NS	NS	
		0.67		NS	NS	NS	NS		NS		NS	NS	NS	NS	
	F1	3.05	2	249	3.26	20.20	74		3.34	2	108	3.38	20.83	77	
	F2	3.95	1	264	3.65	22.42	69	8.15	3.68	1	109	3.59	19.91	78	3.09
	C.D.(0.05) C.V.(%)	0.12 3.01	15 5		0.18 4.68	0.3 1.4	4 5		0.08 1.54		NS 2	NS 10.49	NS 5.9	NS 2	

Table 4.1(d): Contd.

N-levels		Varieties		MASODHA						GHAGHRAGHAT							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
Mean of varieties:																	
	V1	4.06	2	261	4.66	21.7	72	8.82	2.70	6	104	3.24	19.8	75	4.55		
	V2	4.00	3	261	3.88	22.5	71	12.09	3.31	4	106	3.45	20.1	76	4.91		
	V3	4.35	1	264	3.29	24.5	72	2.27	4.06	2	111	3.62	19.5	79	1.36		
	V4	3.77	4	258	2.46	19.9	71	-5.82	4.20	1	113	3.67	22.2	82	1.91		
	V5	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	V6	3.24	7	257	4.16	21.1	73	9.27	3.09	5	111	3.48	20.0	77	4.36		
	V7	3.31	6	260	3.23	21.3	73	3.36	-	-	-	-	-	-	-		
	V8	3.31	5	247	3.72	21.4	75	10.91	-	-	-	-	-	-	-		
	V9	3.21	8	249	4.09	21.1	73	17.27	-	-	-	-	-	-	-		
	V10	3.19	9	258	3.74	19.8	70	13.91	-	-	-	-	-	-	-		
	V11	2.56	10	253	1.36	19.8	64	9.36	3.70	3	107	3.45	20.7	78	1.45		
C.D.(0.05)		0.47		13	0.74	1.6	4		0.44		9	NS	1.3	3			
C.V. (%)		11.55		4	18.41	6.3	4		10.36		7	7.09	5.5	3			
Expt. Mean		3.50		257	3.46	21.31	71		3.51		109	3.48	20.37	78			
Soil type		Sandy loam							Sandy loam								
pH		7.40							7.40								
N - levels (kg/ha)																	
F1		60:30:20							60:30:20								
F2		120:60:40							120:60:40								
Recomnd N:P:K (kg/ha)		120:60:40							120:60:40								
Varieties																	
V1		IET 30637							IET 30637								
V2		IET 31436(H)							IET 31436(H)								
V3		IET 31501							IET 31501								
V4		CO-51 (NC)							CO-51 (NC)								
V5																	
V6		Narendra 97(E)							Narendra 97(E)								
V7		Luit (NE)							-								
V8		Sahbhagidhan (C&W)							-								
V9		MTU 1153 (S)							-								
V10		US 314 (Hybrid)							-								
V11		Local Check (NDR 97) 110 Days							Local Check (IR 64 sub1)								
Available N:P:K soil		75:13:22							200:24:234								

Table 4.1(d): Contd.

F-levels	Varieties	GANGAVATHI					JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle Weight (g)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	2.41	20	2.73	18.00		4.77	17	215	3.33	21.7	95	
	V2	2.55	18	2.93	20.33		7.33	3	202	3.53	27.3	85	
	V3	2.98	15	1.80	19.67		6.00	8	225	4.80	27.7	89	
	V4	2.53	19	1.93	19.33		7.07	4	283	3.87	21.7	86	
	V5	-	-	-	-		-	-	-	-	-	-	
	V6	2.82	16	1.80	18.33		4.97	15	274	3.13	25.3	81	
	V7	3.29	11	2.00	21.00		4.27	20	287	3.80	24.7	93	
	V8	3.38	10	2.40	19.33		4.70	19	179	3.93	25.0	91	
	V9	3.61	8	2.93	21.00		4.87	16	216	3.73	26.3	83	
	V10	3.77	6	2.93	19.67		5.10	13	744	4.47	25.0	102	
	V11	3.44	9	2.93	17.33		6.03	7	244	4.67	26.0	80	
F2: Optimum input (100% NPK)	V1	2.81	17	2.73	20.33	2.67	5.30	10	216	3.87	23.3	96	5.05
	V2	3.20	13	3.40	21.33	4.33	8.03	1	208	3.87	22.7	87	6.67
	V3	3.69	7	2.40	21.67	4.73	6.20	6	258	4.87	28.0	91	1.90
	V4	3.28	12	2.67	21.67	5.00	7.60	2	278	3.67	28.3	87	5.05
	V5	-	-	-	-	-	-	-	-	-	-	-	-
	V6	3.20	13	2.47	21.33	2.53	5.30	10	260	3.13	22.0	82	3.14
	V7	4.25	4	2.60	22.00	6.40	4.77	17	300	3.27	25.7	94	4.76
	V8	3.80	5	3.13	22.33	2.80	5.03	14	222	3.87	25.3	92	3.14
	V9	4.52	2	3.53	22.33	6.07	5.17	12	191	4.93	25.3	85	2.86
	V10	4.60	1	3.53	21.00	5.53	5.47	9	218	4.60	25.7	104	3.52
	V11	4.28	3	3.67	18.00	5.60	6.37	5	258	5.07	26.3	82	3.24
Interaction F at same V V at same F F1 F2 C.D.(0.05) C.V.(%)		NS		NS	NS		NS		NS	NS	1.5	NS	
		NS		NS	NS		NS		NS	NS	1.3	NS	
		3.08	2	2.44	19.40		5.51	2	287	3.93	25.07	89	
		3.76	1	3.01	21.20	4.57	5.92	1	241	4.11	25.27	90	3.93
		0.23		0.30	1.74		0.40		NS	NS	NS	1	
		6.11		10.03	7.71		6.36		72	13.91	3.9	1	

Table 4.1(d): Contd.

N-levels		Varieties	GANGAVATHI					JAGDALPUR						
Mean of varieties:			Grain Yield (t/ha)	Rank	Panicle Weight (g)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
V1			2.61	10	2.73	19.2	2.67	5.04	7	215	3.60	22.5	95	5.05
V2			2.88	9	3.17	20.8	4.33	7.68	1	205	3.70	25.0	86	6.67
V3			3.34	6	2.10	20.7	4.73	6.10	4	242	4.83	27.8	90	1.90
V4			2.91	8	2.30	20.5	5.00	7.34	2	281	3.77	25.0	87	5.05
V5			-	-	-	-	-	-	-	-	-	-	-	-
V6			3.01	7	2.14	19.8	2.53	5.14	6	267	3.13	23.7	82	3.14
V7			3.77	4	2.30	21.5	6.40	4.52	10	294	3.53	25.2	93	4.76
V8			3.59	5	2.77	20.8	2.80	4.87	9	201	3.90	25.2	92	3.14
V9			4.07	2	3.23	21.7	6.07	5.02	8	204	4.33	25.8	84	2.86
V10			4.19	1	3.23	20.3	5.53	5.29	5	481	4.53	25.3	103	3.52
V11			3.86	3	3.30	17.7	5.60	6.20	3	251	4.87	26.2	81	3.24
C.D.(0.05)			1.03		0.69	NS		0.46		245	0.81	0.90	1	
C.V. (%)			25.67		21.51	11.57		6.82		79	17.14	3.04	1	
Expt. Mean			3.42		2.73	20.30		5.72		264	4.02	25.17	89	
Soil type			Clay loam											
pH			5.85											
N - levels (kg/ha)														
F1			60:30:15											
F2			120:60:30											
Recomnd N:P:K (kg/ha)			120:60:30											
Varieties														
V1			IET 30637											
V2			IET 31436(H)											
V3			IET 31501											
V4			CO-51 (NC)											
V5														
V6			Narendra 97(E)											
V7			Luit (NE)											
V8			Sahbhagidhan (C&W)											
V9			MTU 1153 (S)											
V10			US 314 (Hybrid)											
V11			Local Check (GNV 1089) 125 Days											
Available N:P:K soil			-											
			Narendra 97(E) Luit (NE) Sahbhagidhan (C&W) MTU 1153 (S) US 314 (Hybrid) Local Check (Samleshwari) 110-115 Days											

Table 4.1(d): Contd.

F-levels	Varieties	KARJAT							MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.51	4	379	4.37	18.9	87		3.99	15	342	3.55	22.0	82	
	V2	4.46	6	317	3.93	23.5	81		5.35	8	324	3.72	23.6	90	
	V3	4.48	5	333	4.33	24.3	82		5.32	9	321	3.25	22.3	86	
	V4	2.8	17	262	2.81	19.1	82		5.29	10	324	2.72	19.0	80	
	V5	-	-	-	-	-	-		-	-	-	-	-	-	
	V6	2.13	20	260	1.92	20.7	77		-	-	-	-	-	-	
	V7	2.67	19	237	2.72	23.5	78		4.46	13	346	3.33	26.0	78	
	V8	3.25	14	218	2.79	23.5	83		4.05	14	325	3.00	24.2	80	
	V9	3.26	13	301	3.11	24.4	83		5.39	7	315	3.89	24.2	84	
	V10	3.32	12	288	2.89	22.8	83		-	-	-	-	-	-	
	V11	3.8	8	308	3.67	21.0	83		3.43	16	324	2.32	25.1	87	
F2: Optimum input (100% NPK)	V1	4.81	1	387	4.44	19.6	90	3.00	4.92	11	384	3.61	22.6	82	7.47
	V2	4.58	3	337	4.04	24.8	82	1.20	6.23	3	336	4.25	24.1	90	7.07
	V3	4.63	2	336	4.43	24.4	84	1.50	6.25	2	326	3.96	25.1	85	7.47
	V4	2.91	15	275	3.07	19.6	89	1.10	5.63	5	328	2.80	19.5	80	2.73
	V5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	V6	2.69	18	266	1.99	23.2	79	5.60	-	-	-	-	-	-	-
	V7	2.85	16	244	2.87	25.1	79	1.80	6.05	4	354	3.41	26.4	78	12.77
	V8	3.41	11	228	3.05	24.6	89	1.60	4.60	12	330	3.13	24.5	80	4.42
	V9	3.66	9	323	3.22	24.7	89	4.00	6.48	1	331	4.38	24.7	84	8.76
	V10	3.46	10	295	3.05	22.9	85	1.40	-	-	-	-	-	-	-
	V11	4.17	7	315	3.81	23.2	85	3.70	5.63	5	359	4.23	25.6	87	17.67
Interaction F at same V V at same F		NS		NS	NS	0.8	NS		NS		NS	NS	NS	NS	
		NS		NS	NS	0.8	NS		NS		NS	NS	NS	NS	
	F1	3.47	2	290	3.25	22.17	82		4.66	2	328	3.22	23.28	83	
	F2	3.72	1	301	3.40	23.19	85	2.49	5.72	1	344	3.72	24.05	83	8.54
	C.D.(0.05) C.V.(%)	NS 9.72		NS 4	0.06 1.55	0.4 1.5	3 3		NS 21.84		NS 8	NS 12.98	NS 10.6	NS 0.3	

Table 4.1(d): Contd.

N-levels	Varieties	KARJAT						MANDYA									
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
Mean of varieties:																	
V1		4.66	1	383	4.41	19.26	88	3.00	4.46	7	363	3.58	22.26	82	7.47		
V2		4.52	3	327	3.99	24.15	82	1.20	5.79	2	330	3.99	23.81	90	7.07		
V3		4.56	2	334	4.38	24.34	83	1.50	5.79	3	324	3.61	23.67	86	7.47		
V4		2.86	8	269	2.94	19.34	86	1.10	5.46	4	326	2.76	19.26	80	2.73		
V5		-	-	-	-	-	-	-	-	-	-	-	-	-	-		
V6		2.41	10	263	1.96	21.92	78	5.60	-	-	-	-	-	-	-		
V7		2.76	9	240	2.80	24.32	79	1.80	5.26	5	350	3.37	26.20	78	12.77		
V8		3.33	7	223	2.92	24.02	86	1.60	4.33	8	328	3.07	24.33	80	4.42		
V9		3.46	5	312	3.17	24.52	86	4.00	5.94	1	323	4.14	24.45	84	8.76		
V10		3.39	6	291	2.97	22.85	84	1.40	-	-	-	-	-	-	-		
V11		3.99	4	312	3.74	22.08	84	3.70	4.53	6	342	3.28	25.35	87	17.67		
C.D.(0.05)		0.41		22	0.61	0.5	3		1.23		30	NS	1.4	0.4			
C.V. (%)		10.46		6	15.65	2.0	3		20.00		7	26.68	5.0	0.4			
Expt. Mean		3.59		295	3.33	22.68	84		5.19		336	3.47	23.66	83			
Soil type		-							Red Sandy loam								
pH		-							7.46								
N - levels (kg/ha)																	
F1		50:25:25							62.5:31:31								
F2		100:50:50							125:62:62								
Recomnd N:P:K (kg/ha)		100:50:50							125:62:62								
Varieties																	
V1		IET 30637							IET 30637								
V2		IET 31436(H)							IET 31436(H)								
V3		IET 31501							IET 31501								
V4		CO-51 (NC)							CO-51 (NC)								
V5		Narendra 97(E)							-								
V6		Luit (NE)							Luit (NE)								
V7		Sahbhagidhan (C&W)							Sahbhagidhan (C&W)								
V8		MTU 1153 (S)							MTU 1153 (S)								
V9		US 314 (Hybrid)							-								
V10		Local Check (Karjat3)							Local Check (GNU 1906)								
V11		-							369:62:259								
Available N:P:K soil																	

Table 4.1(d): Contd.

F-levels	Varieties	NAGINA						NAWAGAM							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	2.80	11	229	3.47	24.32	96		5.46	14	207	5.23	20.67	91	
	V2	3.00	10	231	3.52	24.37	95		4.51	18	203	4.48	21.00	81	
	V3	2.75	12	226	3.41	24.27	97		6.08	7	198	4.76	22.00	87	
	V4	2.30	18	198	2.92	23.71	86		5.58	12	254	3.45	19.00	82	
	V5	-	-	-	-	-	-		-	-	-	-	-	-	
	V6	2.73	13	218	3.40	24.21	77		3.33	20	246	2.51	20.67	84	
	V7	2.50	17	209	2.97	24.18	83		4.96	17	205	3.71	25.00	82	
	V8	2.66	14	218	3.32	24.23	91		5.41	15	258	3.75	22.00	92	
	V9	2.52	16	213	3.15	24.17	95		6.12	6	206	4.44	23.00	92	
	V10	2.59	15	218	3.36	24.19	91		6.31	5	226	5.21	22.67	87	
	V11	-	-	-	-	-	-	-	6.06	9	205	3.91	19.33	86	8.96
F2: Optimum input (100% NPK)	V1	4.87	2	321	3.52	25.46	97	18.82	6.02	10	223	5.97	19.67	92	16.00
	V2	5.00	1	333	3.60	25.57	96	18.18	5.51	13	239	5.58	23.00	82	13.76
	V3	4.83	3	317	3.48	25.42	98	18.91	6.94	2	247	5.22	21.67	87	8.00
	V4	4.05	9	290	2.98	24.94	88	15.91	6.08	7	272	3.74	18.67	81	-
	V5	-	-	-	-	-	-	-	-	-	-	-	-	-	2.56
	V6	4.67	4	312	3.40	25.40	78	17.64	3.49	19	267	2.43	21.00	84	5.60
	V7	4.29	8	297	3.02	25.30	85	16.27	5.31	16	273	3.70	25.33	83	3.04
	V8	4.52	6	316	3.40	25.34	93	16.91	5.60	11	263	4.24	22.67	93	15.20
	V9	4.38	7	293	3.18	25.33	96	16.91	7.07	1	235	4.90	23.00	92	9.28
	V10	4.55	5	312	3.39	25.38	92	17.82	6.89	3	258	5.83	21.33	89	8.48
	V11	-	-	-	-	-	-	-	6.59	4	241	5.23	18.67	89	
Interaction F at same V V at same F		NS		NS	NS	0.03	NS		NS		NS	0.42	NS	NS	
		NS		NS	NS	0.03	NS		NS		NS	0.34	NS	NS	
	F1	2.65	2	218	3.28	24.18	90	17.48	5.38	2	221	4.15	21.53	86	9.09
	F2	4.57	1	310	3.33	25.35	91		5.95	1	252	4.68	21.50	87	
	C.D.(0.05) C.V.(%)	0.15 3.64		7.64 2.47	NS 2.35	0.02 0.06	NS 2.78		0.47 7.48		NS 12.21	0.34 6.92	NS 4.2	NS 1.51	

Table 4.1(d): Contd.

N-levels		Varieties	NAGINA						NAWAGAM							
			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:			3.84	2	275	3.50	24.89	97	18.82	5.74	6	215	5.60	20.17	91	8.96
	V1		4.00	1	282	3.56	24.97	95	18.18	5.01	9	221	5.03	22.00	81	16.00
	V2		3.79	3	272	3.45	24.85	97	18.91	6.51	3	223	4.99	21.84	87	13.76
	V3		3.18	9	244	2.95	24.33	87	15.91	5.83	5	263	3.60	18.84	81	8.00
	V4		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	V5		3.70	4	265	3.40	24.81	77	17.64	3.41	10	257	2.47	20.84	84	2.56
	V6		3.40	8	253	3.00	24.74	84	16.27	5.14	8	239	3.71	25.17	82	5.60
	V7		3.59	5	267	3.36	24.79	92	16.91	5.51	7	261	4.00	22.34	93	3.04
	V8		3.45	7	253	3.17	24.75	95	16.91	6.60	2	221	4.67	23.00	92	15.20
	V9		3.57	6	265	3.38	24.79	92	17.82	6.60	1	242	5.52	22.00	88	9.28
	V10		-	-	-	-	-	-	-	6.33	4	223	4.57	19.00	88	8.48
	V11															
C.D.(0.05)			0.23		13.99	0.06	0.02	0.62		0.33		22.46	0.24	1.05	1.27	
C.V. (%)			5.31		4.51	1.5	0.08	0.58		4.99		8.11	4.62	4.18	1.25	
Expt. Mean			3.61		264	3.31	24.77	91		5.67		236	4.41	21.52	87	
Soil type			-							Clay loam						
pH			7.70							7.98						
N - levels (kg/ha)			60:30:20							40:12:5:0						
F1			120:60:40							80:25:0						
F2			120:60:40							80:25:0						
Recomnd N:P:K (kg/ha)			120:60:40							80:25:0						
Varieties																
	V1		IET 30637							IET 30637						
	V2		IET 31436(H)							IET 31436(H)						
	V3		IET 31501							IET 31501						
	V4		CO-51 (NC)							CO-51 (NC)						
	V5															
	V6		Narendra 97(E)							Narendra 97(E)						
	V7		Luit (NE)							Luit (NE)						
	V8		Sahbhagidhan (C&W)							Sahbhagidhan (C&W)						
	V9		MTU 1153 (S)							MTU 1153 (S)						
	V10		US 314 (Hybrid)							US 314 (Hybrid)						
	V11		-							Local Check - Mahisagar(115 days)						
Available N:P:K soil			21:18.33:209							329:83:226						

Table 4.1(d): Contd.

F-levels	Varieties	MARUTERU						PUDUCHERRY						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.91	6	310	2.85	86		5.61	11	229	3.30	18.54	84.00	
	V2	5.05	5	281	3.12	77		5.76	10	247	3.06	27.61	80.00	
	V3	4.64	9	292	2.96	78		5.54	12	218	2.17	28.86	79.00	
	V4	4.79	7	300	2.40	78		5.05	18	168	2.06	18.92	84.00	
	V5	-	-	-	-	-		-	-	-	-	-	-	
	V6	4.50	13	224	2.25	75		5.15	15	175	2.07	24.30	81.00	
	V7	4.24	16	229	2.74	75		5.13	16	181	2.20	27.20	85.00	
	V8	4.15	18	248	2.66	77		5.30	13	210	4.05	24.74	80.00	
	V9	4.70	8	292	4.13	77		5.12	17	194	2.83	27.02	81.00	
	V10	4.18	17	265	2.72	85		-	-	-	-	-	-	
	V11	-	-	-	-	-		5.22	14	201	3.36	25.45	84.00	
F2: Optimum input (100% NPK)	V1	5.22	4	321	2.98	75	2.95	6.86	2	335	3.78	19.23	81.00	12.50
	V2	5.25	3	289	3.28	81	1.90	7.02	1	354	3.39	28.30	78.00	12.60
	V3	5.39	1	303	3.05	83	7.14	6.84	3	323	2.61	29.29	78.00	13.00
	V4	5.34	2	310	2.63	84	5.24	5.97	9	261	2.24	19.70	82.00	9.20
	V5	-	-	-	-	-	-	-	-	-	-	-	-	-
	V6	4.62	10	241	2.51	75	1.14	6.15	7	272	1.79	25.07	79.00	10.00
	V7	4.42	15	243	2.85	76	1.71	6.11	8	280	2.35	27.60	84.00	9.80
	V8	4.43	14	255	2.85	81	2.67	6.66	4	314	4.40	25.02	79.00	13.60
	V9	4.59	11	297	4.22	79	-1.05	6.31	6	291	3.09	27.60	78.00	11.90
	V10	4.51	12	274	2.84	82	3.14	-	-	-	-	-	-	-
	V11	-	-	-	-	-	-	6.58	5	304	3.50	26.27	82.00	13.60
Interaction F at same V V at same F		NS		NS	NS	3		0.13		2	NS	NS	0.00	
		NS		NS	NS	3		0.16		7	NS	NS	0.00	
	F1	4.57	2	271	2.87	79		5.32	2	203	2.79	24.74	82	
	F2	4.86	1	281	3.02	80	2.76	6.50	1	304	3.02	25.34	80	11.80
	C.D.(0.05) C.V.(%)	0.25 4.60		2 0.5	0.15 4.33	NS 1		0.12 1.80		9 3	0.10 2.89	0.44 1.49	0.00 0.00	

Table 4.1(d): Contd.

N-levels		Varieties	MARUTERU						PUDUCHERRY						
Mean of varieties:			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
V1			5.07	2	316	2.92	80	2.95	6.24	2	282	3.54	18.89	83	12.50
V2			5.15	1	285	3.20	79	1.90	6.39	1	300	3.23	27.96	79	12.60
V3			5.02	4	298	3.01	81	7.14	6.19	3	271	2.39	29.08	79	13.00
V4			5.07	2	305	2.52	81	5.24	5.51	9	215	2.15	19.31	83	9.20
V5			-	-	-	-	-	-	-	-	-	-	-	-	-
V6			4.56	6	232	2.38	75	1.14	5.65	7	224	1.93	24.69	80	10.00
V7			4.33	8	236	2.80	76	1.71	5.62	8	231	2.28	27.40	85	9.80
V8			4.29	9	251	2.76	79	2.67	5.98	4	262	4.23	24.88	80	13.60
V9			4.65	5	295	4.18	78	-1.05	5.72	6	243	2.96	27.31	80	11.90
V10			4.35	7	270	2.78	84	3.14	-	-	-	-	-	-	-
V11			-	-	-	-	-	-	5.90	5	253	3.43	25.86	83	13.60
C.D.(0.05)			0.32		22	0.21	2		0.10		1	0.19	0.45	0.00	
C.V.(%)			5.84		7	5.98	2		1.38		0.4	5.52	1.56	0.00	
Expt. Mean			4.72		276	2.95	79		5.91		253	2.90	25.04	81	
Soil type			Clay Loam						Clay loam						
pH			6.90						7.98						
N - levels (kg/ha)															
F1			45:30:30						60:20:20						
F2			90:60:60						120:40:40						
Recomnd N:P:K (kg/ha)			90:60:60						120:40:40						
Varieties															
V1			IET 30637						IET 30637						
V2			IET 31436(H)						IET 31436(H)						
V3			IET 31501						IET 31501						
V4			CO-51 (NC)						CO-51 (NC)						
V5															
V6			Narendra 97(E)						Narendra 97(E)						
V7			Luit (NE)						Luit (NE)						
V8			Sahbhagidhan (C&W)						Sahbhagidhan (C&W)						
V9			MTU 1153 (S)						MTU 1153 (S)						
V10			US 314 (Hybrid)						-						
V11			-						Local Check - ADT 37(105 days)						
Available N:P:K soil			163:23:336						123:29:111						

Table 4.1(d): Contd.

F-levels	Varieties	RANCHI					VARANASI								
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test weight (g)	No of Grains/panicle	Days 50% flowerin g	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test weight (g)	Days 50% flowerin g	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	
F1: Low input (50% NPK)	V1	3.65	17	224	23.6	84	80		5.75	10	228	35.33	23.06	83	
	V2	3.75	15	194	23.4	86	83		5.47	12	257	37.46	23.81	84	
	V3	3.85	11	231	23.9	89	85		7.63	2	231	41.27	24.55	84	
	V4	3.78	13	242	23.9	87	83		7.82	1	201	37.50	26.72	85	
	V5	3.78	13	198	21.5	87	87		-	-	-	-	-	-	
	V6	-	-	-	-	-	-		6.52	5	244	30.26	27.33	77	
	V7	3.68	16	216	23.3	82	78		7.28	3	212	35.40	25.96	79	
	V8	3.97	9	229	24.8	108	90		6.17	8	262	22.36	25.66	78	
	V9	3.59	18	213	21.7	82	86		6.78	4	246	26.53	23.21	76	
	V10	3.79	12	197	19.5	102	86		4.71	17	233	22.27	26.26	67	
	V11	2.80	20	146	23.8	84	68		4.28	20	277	20.03	28.24	66	
F2: Optimum input (100% NPK)	V1	3.97	9	242	26.3	90	85	4.57	4.70	18	196	25.73	22.33	87	-10.00
	V2	4.03	7	213	26.5	92	87	4.00	5.14	15	196	34.07	24.41	86	-3.14
	V3	4.18	3	250	26.8	96	88	4.71	6.32	7	218	38.98	26.09	85	-12.48
	V4	4.13	4	260	26.4	93	87	5.00	5.57	11	214	33.13	25.67	85	-21.43
	V5	4.32	2	212	24.6	93	92	7.71	-	-	-	-	-	-	-
	V6	-	-	-	-	-	-	-	6.34	6	223	41.18	25.57	80	-1.71
	V7	4.12	5	235	26.2	86	81	6.29	6.03	9	217	30.76	25.90	80	-11.90
	V8	4.33	1	248	26.9	112	93	5.14	5.16	14	237	30.26	24.42	78	-9.62
	V9	3.99	8	234	24.7	85	90	5.71	5.37	13	229	22.47	24.49	78	-13.43
	V10	4.09	6	217	22.6	108	88	4.29	4.67	19	211	20.29	27.18	72	-0.38
	V11	3.08	19	203	25.0	87	72	4.00	4.75	16	210	20.43	26.68	73	4.48
Interaction F at same V V at same F		NS		NS	NS	NS	1		NS		NS	NS	NS	NS	
		NS		NS	NS	NS	1		NS		NS	NS	NS	NS	
	F1	3.66	2	209	22.95	89	83	5.14	6.24	1	239	30.84	25.48	78	
	F2	4.02	1	231	25.58	94	86		5.41	2	215	29.73	25.27	80	-7.96
C.D.(0.05) C.V.(%)		0.15	4	0.7	2	2	0.1		NS		19	NS	NS	NS	
		3.54	1	1	2.5	2	0.2		24.23		7	7.08	3.06	11	

Table 4.1(d): Contd.

N-levels		Varieties	RANCHI						VARANASI							
Mean of varieties:			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test weight (g)	No of Grains/panicle	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
V1			3.81	8	233	24.94	87	83	4.57	5.23	8	212	30.53	22.70	85	-10.00
V2			3.89	7	204	24.95	89	85	4.00	5.31	7	227	35.77	24.11	85	-3.14
V3			4.02	3	240	25.35	92	87	4.71	6.98	1	224	40.13	25.32	85	-12.48
V4			3.96	4	251	25.15	90	85	5.00	6.70	2	208	35.32	26.20	85	-21.43
V5			4.05	2	205	23.02	90	90	7.71	-	-	-	-	-	-	-
V6			-	-	-	-	-	-	-	6.43	4	234	35.72	26.45	79	-1.71
V7			3.90	6	226	24.74	84	80	6.29	6.66	3	214	33.08	25.93	80	-11.90
V8			4.15	1	238	25.88	110	91	5.14	5.67	6	250	26.31	25.04	78	-9.62
V9			3.79	9	223	23.19	84	88	5.71	6.08	5	238	24.50	23.85	77	-13.43
V10			3.94	5	207	21.07	105	87	4.29	4.69	9	222	21.28	26.72	70	-0.38
V11			2.94	10	175	24.39	86	70	4.00	4.52	10	244	20.23	27.46	70	4.48
C.D.(0.05)			0.43		23	2.0	8	1		0.77		NS	5.72	2.83	3	
C.V. (%)			9.67		9	7.0	7	1		11.35		11	16.20	9.56	3	
Expt. Mean			3.84		220	24.27	92	85		5.82		227	30.29	25.38	79	
Soil type			Clay Loam							Clay loam						
pH			6.90							7.30						
N - levels (kg/ha)																
F1			40:20:10							60:25:20						
F2			80:40:20							120:50:40						
Recomnd N:P:K (kg/ha)			80:40:20							120:50:40						
Varieties																
V1			IET 30637							IET 30637						
V2			IET 31436(H)							IET 31436(H)						
V3			IET 31501							IET 31501						
V4			CO-51 (NC)							CO-51 (NC)						
V5			PR 124 (N)							-						
V6			-							Narendra 97(E)						
V7			Luit (NE)							Luit (NE)						
V8			Sahbhagidhan (C&W)							Sahbhagidhan (C&W)						
V9			MTU 1153 (S)							MTU 1153 (S)						
V10			US 314 (Hybrid)							US 314 (Hybrid)						
V11			Local Check							Local Check (HUR 3022)						
Available N:P:K soil			238:32:155							-						

Table 4.1(d): Contd.

F-levels	Varieties	WARANGAL						SABOUR						Over all mean	Rank		
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test weight (g)	No of Grains/panicle	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test weight (g)	No of Grains/panicle			Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.27	13	249	5.45	19.78	95		3.86	13	269	19.17	133	85		4.28	16
	V2	6.30	3	296	5.48	23.6	92		4.10	9	248	22.76	141	87		4.73	10
	V3	4.83	9	296	5.38	22.24	94		3.22	18	247	21.85	120	83		4.82	8
	V4	5.20	8	319	3.05	16.99	86		4.05	11	203	21.17	113	83		4.67	11
	V5	-	-	-	-	-	-		-	-	-	-	-	-		3.78	22
	V6	4.83	9	347	2.29	22.9	78		3.14	20	231	23.17	105	85		3.90	21
	V7	2.77	18	316	3.53	20.2	82		3.18	19	224	22.50	116	83		3.94	20
	V8	2.80	17	302	4.96	25.31	89		3.80	14	242	22.65	122	86		4.14	19
	V9	4.77	11	297	5.07	25.17	92		4.03	12	203	22.00	119	83		4.52	13
	V10	3.50	16	305	7.19	21.6	80		4.20	8	256	21.24	145	86		4.22	18
	V11	-	-	-	-	-	-		4.08	10	188	23.33	110	83		4.27	17
F2: Optimum input (100% NPK)	V1	5.27	7	289	6.84	21.17	95	9.09	4.39	6	295	19.44	141	86	6.63	4.95	7
	V2	7.17	1	313	6.2	24.18	92	7.91	4.61	2	267	22.93	150	88	6.38	5.51	1
	V3	5.50	6	319	5.43	23.08	93	6.09	3.78	15	282	21.90	127	84	7.00	5.45	2
	V4	6.33	2	320	4.03	20.45	86	10.27	4.34	7	240	21.91	118	85	3.63	5.07	5
	V5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.32	15
	V6	5.53	5	374	3.07	22.35	78	6.36	3.53	17	264	23.74	111	86	4.88	4.51	14
	V7	3.53	15	319	3.98	24.32	80	6.91	3.78	15	250	23.33	120	84	7.50	4.56	12
	V8	3.63	14	306	5.83	23.06	89	7.55	4.47	4	260	22.78	127	86	8.38	4.77	9
	V9	5.73	4	307	5.59	23.83	91	8.73	4.44	5	240	23.08	125	84	5.13	5.26	3
	V10	4.60	12	315	7.38	25.13	87	10.00	4.73	1	274	21.39	154	87	6.63	4.97	6
	V11	-	-	-	-	-	-	-	4.57	3	201	24.17	115	84	6.13	5.08	4
Interaction F at same V V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS			
		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS			
	F1	4.36	2	303	4.71	22	87		3.77	2	231	21.98	123	84		4.33	2
	F2	5.25	1	318	5.37	23	88	8.10	4.26	1	257	22.47	129	85	6.22	5.00	1
	C.D.(0.05) C.V.(%)	NS 30.03	6 2	6 2	NS 15.83	NS 8.38	NS 3		0.25 5.55	18 7	18 7	NS 2.61	NS 16	NS 2			

Table 4.1(d): Contd.

N-levels	Varieties	WARANGAL						SABOUR						Over all mean	Rank		
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test weight (g)	No of Grains/panicle	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	R an k	Panicle/m ² (No.)	Test weight (g)	No of Grains/panicle			Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:																	
V1		4.77	6	269	6.15	20	95	9.09	4.13	7	282	19.31	137	86	6.63	4.61	6
V2		6.74	1	305	5.84	24	92	7.91	4.36	2	258	22.85	146	87	6.38	5.12	2
V3		5.17	5	308	5.41	23	94	6.09	3.50	8	265	21.88	124	84	7.00	5.13	1
V4		5.77	2	320	3.54	19	86	10.27	4.20	5	222	21.54	116	84	3.63	4.87	4
V5		-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.05	11
V6		5.18	4	361	2.68	23	78	6.36	3.34	10	248	23.46	108	85	4.88	4.21	10
V7		3.15	9	318	3.76	22	81	6.91	3.48	9	237	22.92	118	83	7.50	4.25	9
V8		3.22	8	304	5.40	24	89	7.55	4.14	6	251	22.72	125	86	8.38	4.46	8
V9		5.25	3	302	5.33	25	92	8.73	4.24	4	221	22.54	122	83	5.13	4.89	3
V10		4.05	7	310	7.29	23	83	10.00	4.47	1	265	21.32	150	86	6.63	4.60	7
V11		-	-	-	-	-	-	-	4.33	3	195	23.75	112	84	6.13	4.67	5
C.D.(0.05)		0.92		19	1.15	2.81	3		0.30		39	0.83	11	1			
C.V. (%)		16.42		5	19.48	10.69	3		6.35		14	3.21	8	1			
Expt. Mean		4.81		311	5.04	23	88		4.02		244	22.23	126	85		4.67	
Soil type		Clay							Clay loam								
pH		8.60							7.50								
N - levels (kg/ha)																	
F1		60:30:20							50:20:10								
F2		120:60:40							100:40:20								
Recomnd N:P:K (kg/ha)		120:60:40							100:40:20								
Varieties																	
V1		IET 30637							IET 30637								
V2		IET 31436(H)							IET 31436(H)								
V3		IET 31501							IET 31501								
V4		CO-51 (NC)							CO-51 (NC)								
V5		-							-								
V6		Narendra 97(E)							Narendra 97(E)								
V7		Luit (NE)							Luit (NE)								
V8		Sahbhagidhan (C&W)							Sahbhagidhan (C&W)								
V9		MTU 1153 (S)							MTU 1153 (S)								
V10		US 314 (Hybrid)							US 314 (Hybrid)								
V11		-							Local Check (Sabour Harshit)								
Available N:P:K soil		130:53:412							177:28:195								

4.1(e) AVT 2 - Irrigated Medium Early

AVT-2 IME cultures (IET 30692, IET 30713, IET 31448-H, IET 31452-H, IET 31456-H, IET 31461-H, IET 31466-H, IET 31589, IET 31603, IET 31608, a total of ten cultures were evaluated at 17 locations viz., **Aduthurai (150-50-50), Chinsurah (80-40-40), Dhangain (110-50-40), Gangavathi (150:75:75), (120:60:40), Ghaghraghat (120:60:60), Karjat (100:50:50), Kota (120:60:40), Ludhiana (105:30:30), Mandya (125:62:62), Maruteru (90:60:60), Masodha (120-60-40), Nagina (120-60-40), Navsari (100-30-0), Nawagam (100-25-0), Puducherry (120-40-40), Rajendranagar (120-60-40) and Varanasi (120:60:40)** in comparison to high yielding standard checks (US-312, Krishnahamsa and Local checks respective local checks) under two recommended dose of fertilizers (50% and 100% RDF). The details and data received from these locations are summarized and presented in **Table 4.1(e)**.

Interaction effect among RDF x cultures/varieties was found to be significant at **Aduthurai, Ghaghraghat, Mandya, Maruteru, Masodha, Navsari, Puducherry, and Varanasi**.

Application of different nutrient levels significantly influenced the grain yield at all the locations except at **Navasari** and **Varanasi** only. Application of 100% RDF recorded significantly higher grain yield at **Aduthurai (5.00 t/ha), Chinsurah (5.46 t/ha), Dhangain (5.81 t/ha), Masodha (5.69 t/ha), Gangavathi (4.91 t/ha), Ghaghraghat (3.85 t/ha), Karjat (4.72 t/ha), Kota (7.68 t/ha), Ludhiana (5.35 t/ha), Mandya (5.51 t/ha), Maruteru (5.39 t/ha), Nagina (4.51 t/ha), Nawagam (5.13 t/ha), Puducherry (6.36 t/ha) and Rajendranagar (5.45 t/ha)** with mean grain yield increase of 16.2% over 50% of RDF application. Nutrient response (kg grain/kg nutrient) was found to be higher (>5 kg grain / kg Nutrient) with the application of 100% RDF (10 out of 17 locations at **Aduthurai (5.53), Chinsurah (17.76), Dhangain (6.36), Karjat (10.48), Masodha (18.93), Kota (6.50), Nagina (16.47), Nawagam (10.59), Puducherry (16.06) and Rajendranagar (9.57)** as compared to other locations.

Grain yield differences among the tested varieties were found to be significant at all the locations having average yield of 4.88 t/ha. IET 31448 recorded the highest grain yield at **Chinsurah (5.32 t/ha), Karjat (5.70 t/ha), Kota (9.17 t/ha), Nawagam (6.26 t/ha)**. Similarly, IET 31452 recorded the highest grain yield at **Masodha (5.65 t/ha), Rajendranagar (5.82 t/ha)**. Overall mean grain yield across the location revealed that IET 31448 recorded the highest grain yield (5.48 t/ha) followed by IET 31452 (5.21 t/ha).

In this trial, mean over the locations, nutrient management with 100% RDF application recorded better yield over 50% RDF at all the locations with 19.3% higher grain yield. Among the cultures, IET 31448 (5.48 t/ha), IET 31452 (5.21 t/ha), IET 31456 (5.16 t/ha) performed better and recorded higher mean grain yield across the locations as compared to other test entries and checks.

Table 4.1(e): Summary of data on grain yield and ancillary characters of selected AVT -2 IME cultures grown under transplanted conditions at low and optimum levels level of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	ADUTHURAI						CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	4.60	18	316	2.54	18.63		3.89	25	252	2.28	101	
	V2	4.93	14	320	2.37	17.20		4.08	23	264	2.54	101	
	V3	4.67	17	308	2.23	16.30		4.65	16	303	2.82	98	
	V4	4.87	15	286	3.25	18.57		4.47	18	290	2.71	100	
	V5	5.50	4	339	4.48	20.50		4.34	20	279	2.63	99	
	V6	4.20	23	324	3.22	18.37		4.54	17	293	2.75	99	
	V7	4.95	13	285	2.15	16.23		3.91	24	253	2.37	94	
	V8	3.07	28	274	3.73	18.47		4.25	21	275	2.58	104	
	V9	4.27	21	246	2.52	16.40		3.58	28	232	2.17	93	
	V10	4.07	24	236	2.41	15.63		3.75	26	243	2.28	101	
	V11	2.67	30	222	3.62	19.00		3.43	29	223	2.08	95	
	V12	3.00	29	214	4.44	20.47		3.39	30	219	2.06	95	
	V13	5.07	11	206	4.47	20.83		3.70	27	238	2.24	88	
	V14	4.50	19	209	4.52	21.43		4.39	19	285	2.66	87	
	V15	4.27	21	211	4.46	23.00		4.19	22	272	2.54	98	
F2: Optimum input (100% NPK)	V1	5.10	9	328	2.68	19.27	4.00	5.33	10	343	3.23	104	18.00
	V2	5.36	5	332	2.45	18.40	3.44	5.47	8	355	3.32	104	17.38
	V3	5.69	2	322	2.35	17.33	8.16	5.98	1	387	3.62	100	16.63
	V4	5.61	3	299	3.39	19.43	5.92	5.83	3	377	3.53	104	17.00
	V5	6.65	1	361	4.62	21.10	9.20	5.68	5	367	3.44	101	16.75
	V6	5.31	7	341	3.36	19.33	8.88	5.94	2	385	3.60	101	17.50
	V7	5.09	10	298	2.26	17.47	1.12	5.35	9	346	3.24	98	18.00
	V8	3.81	26	280	3.90	19.57	5.92	5.61	6	363	3.40	107	17.00
	V9	4.96	12	258	2.78	17.33	5.52	5.16	13	332	3.12	95	19.75
	V10	4.40	20	249	2.60	16.67	2.64	5.28	11	341	3.20	104	19.13
	V11	3.86	25	233	3.85	20.77	9.52	4.95	14	321	3.00	98	19.00
	V12	3.69	27	227	4.73	21.53	5.52	4.78	15	309	2.90	95	17.38
	V13	5.33	6	215	4.63	21.30	2.08	5.24	12	337	3.17	90	19.25
	V14	5.27	8	220	4.75	22.47	6.16	5.71	4	370	3.46	88	16.50
	V15	4.87	15	225	4.71	23.73	4.80	5.56	7	361	3.37	100	17.13
Interaction													
F at same V		0.38		NS	0.09	0.34		NS		NS	NS	NS	
V at same F		0.36		NS	0.08	0.33		NS		NS	NS	NS	
Means of F levels:													
F1		4.31	2	266	3.36	18.74		4.04	2	261	2.45	97	
F2		5.00	1	279	3.54	19.71	5.53	5.46	1	353	3.31	99	17.76
C.D.(0.05)		0.18		5.1	0.04	0.15		0.14		30.66	0.07	NS	
C.V.(%)		4.23		2.06	1.19	0.86		3.2		11.01	2.53	3.12	

Table 4.1(e): Contd.

F- levels	Varieties	ADUTHURAI						CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/ m² (No.)	Panicle Weight (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/ m² (No.)	Panicle Weight (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties													
	V1	4.85	8	322	2.61	18.95	4.00	4.61	10	298	2.76	102	18.00
	V2	5.15	5	326	2.41	17.80	3.44	4.78	8	309	2.93	102	17.38
	V3	5.18	4	315	2.29	16.82	8.16	5.32	1	345	3.22	99	16.63
	V4	5.24	2	293	3.32	19.00	5.92	5.15	3	334	3.12	102	17.00
	V5	6.08	1	350	4.55	20.80	9.20	5.01	5	323	3.04	100	16.75
	V6	4.76	9	333	3.29	18.85	8.88	5.24	2	339	3.18	100	17.50
	V7	5.02	6	291	2.21	16.85	1.12	4.63	9	300	2.81	96	18.00
	V8	3.44	13	277	3.82	19.02	5.92	4.93	6	319	2.99	106	17.00
	V9	4.62	10	252	2.65	16.87	5.52	4.37	13	282	2.65	94	19.75
	V10	4.24	12	242	2.51	16.15	2.64	4.52	11	292	2.74	102	19.13
	V11	3.27	15	227	3.74	19.89	9.52	4.19	14	272	2.54	97	19.00
	V12	3.35	14	221	4.59	21.00	5.52	4.09	15	264	2.48	95	17.38
	V13	5.20	3	211	4.55	21.07	2.08	4.47	12	288	2.71	89	19.25
	V14	4.89	7	214	4.64	21.95	6.16	5.05	4	327	3.06	87	16.50
	V15	4.57	11	218	4.59	23.37	4.80	4.88	7	316	2.96	99	17.13
C.D.(0.05)		0.26		8.1	0.06	0.23		0.39		24.67	0.24	2.07	
C.V.(%)		4.74		2.57	1.47	1.03		7.07		6.95	7.07	1.82	
Expt. Mean		4.65		273	3.45	19.22		4.75		307	2.88	98	
Soil type		Clay soil						Clay loam					
pH		7.22						7.10					
F - levels (kg/ha)													
F1		75:25:25						40:20:20					
F2		150:50:50						80:40:40					
Recmnd N:P:K (kg/ha)		150:50:50						80:40:40					
Varieties													
V1		IET 30692						IET 30692					
V2		IET 30713						IET 30713					
V3		IET 31448						IET 31448					
V4		IET 31452						IET 31452					
V5		IET 31456						IET 31456					
V6		IET 31466						IET 31466					
V7		IET 31589						IET 31589					
V8		IET 31603						IET 31603					
V9		Gondhra Bidhan-3						Gondhra Bidhan-3					
V10		PR 113						PR 113					
V11		Lalat						Lalat					
V12		Karjat - 7						Karjat - 7					
V13		MTU 1010						MTU 1010					
V14		US 312						US 312					
V15		Local Check - ADT 59, 115 days						Local Check - Mukdashree, 125-130 days					
Available N:P:K of soil (kg/ha)		282;46:532						-					

Table 4.1(e): Contd.

F-levels	Varieties	DHANGAIN							GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle /m ² (No.)	Panicle Weight (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	5.17	17	268	2.75	22.00	111		5.33	6	167	3.04	18.10	
	V2	4.70	23	251	2.87	19.53	119		4.28	17	139	2.67	18.20	
	V3	5.96	9	293	4.12	28.47	101		3.64	26	154	2.63	22.03	
	V4	5.83	10	277	3.86	24.13	100		3.56	27	150	2.78	17.97	
	V5	5.15	18	268	3.16	22.23	99		3.65	25	157	3.08	21.93	
	V6	6.44	5	308	4.72	29.40	98		3.75	24	157	3.20	26.47	
	V7	6.03	8	303	4.26	21.97	108		5.06	9	171	2.94	20.60	
	V8	5.53	15	272	3.71	23.40	102		5.24	7	160	3.85	22.17	
	V9	5.73	13	292	3.87	20.60	99		-	-	-	-	-	
	V10	4.90	21	255	2.92	29.43	101		3.52	28	149	3.55	25.37	
	V11	4.61	24	251	2.59	26.33	105		3.79	22	156	2.95	24.43	
	V12	3.62	28	204	1.93	19.80	106		3.77	23	140	2.33	17.67	
	V13	3.97	27	243	2.21	19.50	105		4.62	11	147	3.34	21.27	
	V14	-	-	-	-	-	-		4.31	15	151	2.13	18.77	
	V15	4.84	22	251	2.62	20.87	103		4.42	13	165	3.27	17.40	
F2: Optimum input (100% NPK)	V1	5.80	11	284	3.44	22.57	112	6.30	6.03	2	193	3.73	20.00	4.67
	V2	5.26	16	307	3.53	20.53	120	5.60	4.54	12	173	3.29	22.27	1.73
	V3	6.79	3	307	3.80	28.47	102	8.30	4.16	20	161	3.71	25.73	3.47
	V4	6.39	6	291	3.90	24.60	101	5.60	4.24	18	164	3.97	23.53	4.53
	V5	5.80	11	270	3.61	24.00	100	6.50	4.22	19	172	4.09	26.13	3.80
	V6	7.20	1	313	5.49	29.47	100	7.60	4.02	21	170	4.21	27.13	1.80
	V7	6.93	2	307	4.36	22.27	109	9.00	5.85	3	189	4.05	24.67	5.27
	V8	5.09	19	285	3.83	24.57	102	-4.40	6.11	1	177	4.61	23.07	5.80
	V9	6.14	7	299	3.98	22.20	100	4.10	-	-	-	-	-	
	V10	5.54	14	276	3.55	29.53	102	6.40	4.33	14	167	4.01	29.13	5.40
	V11	5.05	20	267	3.24	26.93	105	4.40	4.29	16	180	3.17	26.00	3.33
	V12	4.36	26	224	2.33	21.20	107	7.40	5.38	5	147	3.26	22.73	10.73
	V13	4.55	25	257	2.41	22.77	106	5.80	5.42	4	170	3.73	26.07	5.33
	V14	-	-	-	-	-	-		5.01	10	160	4.15	23.00	4.67
	V15	6.49	4	268	3.31	21.20	105	16.50	5.15	8	181	3.55	20.47	4.87
Interaction F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	
Means of F levels:														
F1		5.18	2	267	3.26	23.40	104		4.21	2	154	2.98	20.88	
F2		5.81	1	282	3.63	24.31	105	6.36	4.91	1	172	3.82	24.28	4.67
C.D.(0.05)		0.37		14.62	NS	0.46	0.31		0.67		14.12	NS	2.81	
C.V.(%)		7.18		5.67	27.08	2.04	0.31		15.54		9.22	32.38	13.27	

Table 4.1(e): Contd.

F- levels	Varieties	DHANGAIN							GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panic le/m ² (No.)	Panic le Wei ght (g)	Test wt(g)	Days for 50% Flowe ring	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/ m ² (No.)	Panicl e Weig ht (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties														
V1		5.49	7	276	3.10	22.29	112	6.30	5.68	1	180	3.39	19.05	4.67
V2		4.98	11	279	3.20	20.03	119	5.60	4.41	8	156	2.98	20.24	1.73
V3		6.38	3	300	3.96	28.47	101	8.30	3.90	12	157	3.17	23.88	3.47
V4		6.11	4	284	3.88	24.37	100	5.60	3.90	12	157	3.38	20.75	4.53
V5		5.48	8	269	3.39	23.12	99	6.50	3.94	10	164	3.59	24.03	3.80
V6		6.82	1	311	5.11	29.44	99	7.60	3.89	14	164	3.71	26.80	1.80
V7		6.48	2	305	4.31	22.12	109	9.00	5.46	3	180	3.50	22.64	5.27
V8		5.31	9	279	3.77	23.99	102	-4.40	5.68	2	168	4.23	22.62	5.80
V9		5.94	5	295	3.93	21.40	99	4.10	-	-	-	-	-	-
V10		5.22	10	266	3.24	29.48	101	6.40	3.93	11	158	3.78	27.25	5.40
V11		4.83	12	259	2.92	26.63	105	4.40	4.04	9	168	3.06	25.22	3.33
V12		3.99	14	214	2.13	20.50	107	7.40	4.58	7	143	2.80	20.20	10.73
V13		4.26	13	250	2.31	21.14	105	5.80	5.02	4	158	3.54	23.67	5.33
V14		-	-	-	-	-	-	0.00	4.66	6	156	3.14	20.89	4.67
V15		5.67	6	260	2.97	21.04	104	16.50	4.79	5	173	3.41	18.94	4.87
C.D.(0.05)		0.67		25.71	0.71	1.03	0.48		0.98		13.85	NS	4.31	
C.V.(%)		10.53		8.08	17.89	3.73	0.39		18.64		7.33	22.54	16.48	
Expt. Mean		5.50		275	3.44	23.86	104		4.56		163	3.40	22.58	
Soil type		Clay loam							Black clay					
pH		6.58							8.00					
F - levels (kg/ha)														
F1		55:25:20							75:37.5:37.5					
F2		110:50:40							150:75:75					
Recmnd N:P:K (kg/ha)		110:50:40							150:75:75					
Varieties														
V1		IET 30692							IET 30692					
V2		IET 30713							IET 30713					
V3		IET 31448							IET 31448					
V4		IET 31452							IET 31452					
V5		IET 31456							IET 31456					
V6		IET 31466							IET 31466					
V7		IET 31589							IET 31589					
V8		IET 31603							IET 31603					
V9		Gondhra Bidhan-3							-					
V10		PR 113							PR 113					
V11		Lalat							Lalat					
V12		Karjat - 7							Karjat - 7					
V13		MTU 1010							MTU 1010					
V14		-							US 312					
V15		Local Check - Sabour Vijay, 130 - 135 days							Local Check - Gangavathi sona, 130 - 135 days					
Available N:P:K of soil (kg/ha)		329.6:44.1:240.3							-					

Table 4.1(e): Contd.

F-levels	Varieties	GHAGHRAGHAT							KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	2.79	22	133	3.23	21.30	91		4.43	10	353	3.06	20.16	104	
	V2	3.87	6	163	3.93	22.80	92		5.04	6	363	3.89	19.64	105	
	V3	3.63	18	136	3.63	21.80	98		5.05	5	391	4.26	22.09	103	
	V4	3.58	19	135	3.53	21.83	93		5.03	7	356	3.46	22.20	102	
	V5	3.72	15	145	3.83	22.33	93		3.28	18	352	2.88	23.54	95	
	V6	3.75	12	148	3.80	22.87	92		3.27	19	345	2.63	23.88	97	
	V7	3.84	8	159	3.80	22.40	91		3.21	21	352	2.69	18.47	106	
	V8	3.78	10	152	3.83	21.70	95		3.27	19	339	2.62	26.34	105	
	V9	2.93	21	134	3.47	21.93	95		-	-	-	-	-	-	
	V10	-	-	-	-	-	-		3.16	22	326	2.39	18.62	98	
	V11	3.69	16	137	3.67	21.57	91		2.85	26	295	1.63	25.58	100	
	V12	-	-	-	-	-	-		3.13	23	299	1.94	26.54	91	
	V13	-	-	-	-	-	-		2.87	25	299	1.85	24.30	92	
	V14	-	-	-	-	-	-		-	-	-	-	-	-	
	V15	3.85	7	161	3.90	22.33	91		3.13	23	318	2.17	22.72	100	
F2: Optimum input (100% NPK)	V1	3.48	20	136	3.50	22.97	94	6.27	5.36	4	395	4.09	26.44	108	9.30
	V2	4.11	1	165	4.03	23.73	95	2.18	6.27	2	399	4.54	28.97	107	12.30
	V3	3.75	12	140	3.57	23.33	92	1.09	6.34	1	403	4.84	31.82	105	12.90
	V4	3.73	14	139	3.53	22.27	94	1.36	6.24	3	398	4.19	28.44	106	12.10
	V5	3.81	9	147	3.67	21.97	97	0.82	4.57	8	390	3.97	28.76	99	12.90
	V6	3.95	5	152	3.83	22.60	92	1.82	4.39	11	374	3.53	27.58	99	11.20
	V7	4.01	3	156	3.97	22.97	95	1.55	4.10	13	361	2.76	24.38	108	8.90
	V8	3.97	4	153	3.83	22.53	96	1.73	4.48	9	376	3.56	30.69	108	12.10
	V9	3.67	17	138	3.53	22.63	95	6.73	-	-	-	-	-	-	
	V10	-	-	-	-	-	-		4.34	12	370	3.21	22.12	100	11.80
	V11	3.76	11	142	3.60	21.63	93	0.64	3.62	17	328	2.32	29.16	103	7.70
	V12	-	-	-	-	-	-		3.94	15	348	2.64	28.57	94	8.10
	V13	-	-	-	-	-	-		3.65	16	334	2.56	31.44	95	7.80
	V14	-	-	-	-	-	-		-	-	-	-	-	-	
	V15	4.09	2	157	3.40	22.30	97	2.18	4.04	14	360	2.69	26.53	103	9.10
Interaction															
F at same V		0.31		NS	NS	NS	NS		NS		NS	0.26	6.04	NS	
V at same F		0.3		NS	NS	NS	NS		NS		NS	0.24	3.23	NS	
Means of F levels:															
F1		3.58	2	146	3.69	22.08	93		3.67	2	338	2.73	22.62	100	
F2		3.85	1	148	3.68	22.63	94	2.40	4.72	1	372	3.45	28.07	103	10.48
C.D.(0.05)		0.14		NS	NS	NS	NS		0.37		4.01	0.17	NS	1.81	
C.V.(%)		3.43		21.56	6.13	5.41	6.29		9.16		1.16	5.52	27.41	1.83	

Table 4.1(e): Contd.

F- levels	Varieties	GHAGHRAGHAT							KARJAT						
		Grai n Yiel d (t/ha)	R a n k	Panicle/m ² (No.)	Panicle Weigh t (g)	Test wt(g)	Days for 50% Flow ering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/ m ² (No.)	Panicle Wei ght (g)	Test wt(g)	Days for 50% Flow ering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties															
V1		3.14	1	134	3.37	22.14	93	6.27	4.90	4	374	3.58	23.30	106	9.30
V2		3.99	1	164	3.98	23.27	93	2.18	5.66	2	381	4.22	24.31	106	12.30
V3		3.69	8	138	3.60	22.57	95	1.09	5.70	1	397	4.55	26.96	104	12.90
V4		3.66	9	137	3.53	22.05	93	1.36	5.64	3	377	3.83	25.32	104	12.10
V5		3.77	6	146	3.75	22.15	95	0.82	3.93	5	371	3.43	26.15	97	12.90
V6		3.85	5	150	3.82	22.74	92	1.82	3.83	7	359	3.08	25.73	98	11.20
V7		3.93	3	158	3.89	22.69	93	1.55	3.66	9	356	2.73	21.43	107	8.90
V8		3.88	4	152	3.83	22.12	96	1.73	3.88	6	357	3.09	28.52	107	12.10
V9		3.30	0	136	3.50	22.28	95	6.73	-	-	-	-	-	-	-
V10		-	-	-	-	-	-	-	3.75	8	348	2.80	20.37	99	11.80
V11		3.73	7	140	3.64	21.60	92	0.64	3.24	13	312	1.98	27.37	102	7.70
V12		-	-	-	-	-	-	-	3.54	11	323	2.29	27.56	93	8.10
V13		-	-	-	-	-	-	-	3.26	12	317	2.21	27.87	94	7.80
V14		-	-	-	-	-	-	-	-	-	-	-	-	-	-
V15		3.97	2	159	3.65	22.32	94	2.18	3.59	10	339	2.43	24.63	102	9.10
C.D.(0.05)		0.21		18.46	0.26	NS	NS		0.45		29.95	0.17	2.28	1.76	
C.V.(%)		4.93		10.78	5.99	5.32	4.64		9.14		7.27	4.74	7.75	1.5	
Expt. Mean		3.72		147	3.69	22.35	94		4.19		355	3.09	25.35	101	
Soil type		Sandy Loam							Medium black						
pH		7.40							-						
F - levels (kg/ha)															
F1		60:30:20							50:25:25						
F2		120:60:40							100:50:50						
Recmnd N:P:K (kg/ha)		120:60:40							100:50:50						
Varieties															
V1		IET 30692							IET 30692						
V2		IET 30713							IET 30713						
V3		IET 31448							IET 31448						
V4		IET 31452							IET 31452						
V5		IET 31456							IET 31456						
V6		IET 31466							IET 31466						
V7		IET 31589							IET 31589						
V8		IET 31603							IET 31603						
V9		Gondhra Bidhan-3							-						
V10		-							PR 113						
V11		Lalat							Lalat						
V12		-							Karjat - 7						
V13		-							MTU 1010						
V14		-							-						
V15		Local Check - NDR 2065							Local Check - Karjat 3, 115-120 days						
Available N:P:K of soil (kg/ha)		-							-						

Table 4.1(e): Contd.

F-levels	Varieties	KOTA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	6.15	21	195	4.71	21.29	98	
	V2	5.52	24	189	4.35	19.24	100	
	V3	8.66	3	255	6.51	30.26	88	
	V4	7.16	12	228	6.14	28.67	88	
	V5	7.64	8	233	6.17	29.21	85	
	V6	6.86	15	212	6.02	28.46	82	
	V7	6.25	20	221	4.98	24.81	96	
	V8	5.62	23	180	6.61	30.81	93	
	V9	7.87	7	234	5.75	27.53	86	
	V10	6.70	16	226	5.65	29.18	87	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	5.74	22	225	3.73	24.24	82	
	V14	6.89	14	220	5.75	22.41	87	
	V15	-		-	-	-	-	
F2: Optimum input (100% NPK)	V1	6.96	13	218	5.12	22.32	99	5.68
	V2	6.28	19	215	4.72	19.54	101	5.33
	V3	9.67	1	275	6.77	30.69	89	7.09
	V4	8.96	2	258	7.05	29.59	89	12.63
	V5	8.32	5	261	6.93	29.60	86	4.77
	V6	7.61	9	232	6.39	28.66	82	5.26
	V7	7.21	11	235	5.69	25.45	97	6.74
	V8	6.70	16	201	7.18	31.45	95	7.58
	V9	8.58	4	254	6.59	28.19	87	4.98
	V10	7.56	10	248	5.99	29.49	88	6.04
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	6.43	18	242	4.04	24.49	82	4.84
	V14	7.90	6	238	6.03	22.84	88	7.09
	V15	-		-	-	-	-	
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Means of F levels:								
F1		6.76	2	218	5.53	26.34	89	
F2		7.68	1	240	6.04	26.86	90	6.50
C.D.(0.05)		0.54		20.27	0.23	NS	NS	
C.V.(%)		7.42		8.73	3.88	2.26	0.82	

Table 4.1(e): Contd.

F-levels	Varieties	KOTA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties								
	V1	6.56	9	207	4.92	21.81	99	5.68
	V2	5.90	12	202	4.54	19.39	101	5.33
	V3	9.17	1	265	6.64	30.48	88	7.09
	V4	8.06	3	243	6.60	29.13	89	12.63
	V5	7.98	4	247	6.55	29.41	86	4.77
	V6	7.24	6	222	6.21	28.56	82	5.26
	V7	6.73	8	228	5.34	25.13	97	6.74
	V8	6.16	10	191	6.90	31.13	94	7.58
	V9	8.23	2	244	6.17	27.86	87	4.98
	V10	7.13	7	237	5.82	29.34	87	6.04
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	6.09	11	234	3.89	24.37	82	4.84
	V14	7.40	5	229	5.89	22.63	87	7.09
	V15	-		-	-	-	-	
C.D.(0.05)		0.58		15.77	0.5	0.88	0.73	
C.V.(%)		6.91		5.92	7.39	2.84	0.7	
Expt. Mean		7.22		229	5.79	26.60	90	
Soil type		Clay						
pH		7.46						
F - levels (kg/ha)								
F1		75:37.5:30						
F2		150:75:60						
Recmnd N:P:K (kg/ha)		150:75:60						
Varieties								
	V1	IET 30692						
	V2	IET 30713						
	V3	IET 31448						
	V4	IET 31452						
	V5	IET 31456						
	V6	IET 31466						
	V7	IET 31589						
	V8	IET 31603						
	V9	Gondhra Bidhan-3						
	V10	PR 113						
	V11	-						
	V12	-						
	V13	MTU 1010						
	V14	US 312						
	V15	-						
Available N:P:K of soil (kg/ha)		-						

Table 4.1(e): Contd.

F-levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	4.55	19	209	3.35	19.43	104	
	V2	2.57	26	189	1.86	22.35	116	
	V3	5.18	13	176	4.39	22.90	97	
	V4	5.16	14	163	4.20	20.95	96	
	V5	6.00	6	200	4.64	22.03	93	
	V6	-		-	-	-	-	
	V7	5.25	12	202	3.63	20.38	106	
	V8	4.97	15	180	3.94	20.61	103	
	V9	-		-	-	-	-	
	V10	4.60	18	166	3.89	25.27	94	
	V11	4.08	24	205	2.98	21.10	101	
	V12	4.41	22	205	2.90	20.67	91	
	V13	4.26	23	206	2.88	21.60	90	
	V14	6.13	5	190	4.46	22.62	97	
	V15	5.90	7	240	3.38	23.73	109	
F2: Optimum input (100% NPK)	V1	4.90	16	187	3.36	19.50	103	4.24
	V2	2.68	25	209	1.98	22.17	116	1.33
	V3	6.45	3	205	4.60	22.89	96	15.39
	V4	5.62	9	190	4.50	20.65	97	5.58
	V5	6.83	1	174	4.82	22.03	92	10.06
	V6	-		-	-	-	-	
	V7	5.41	10	229	3.77	20.43	105	1.94
	V8	4.73	17	158	4.00	20.45	103	-2.91
	V9	-		-	-	-	-	
	V10	5.74	8	218	4.03	25.42	93	13.82
	V11	4.49	20	207	3.19	21.07	99	4.97
	V12	5.29	11	244	2.96	20.74	91	10.67
	V13	4.45	21	217	3.01	21.72	90	2.30
	V14	6.51	2	221	4.53	22.57	97	4.61
	V15	6.45	3	244	3.74	23.73	107	6.67
Interaction								
N at same V		NS		29.32	NS	NS	NS	
V at same N		NS		36.31	NS	NS	NS	
Means of F levels:								
F1		4.85	2	195	3.58	21.82	100	
F2		5.35	1	208	3.73	21.80	99	6.05
C.D.(0.05)		0.27		NS	0.12	NS	NS	
C.V.(%)		5.35		14.97	3.31	2.37	0.82	

Table 4.1(e): Contd.

F- levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties								
	V1	4.73	10	198	3.36	19.47	104	4.24
	V2	2.63	13	199	1.92	22.26	116	1.33
	V3	5.82	4	190	4.50	22.90	96	15.39
	V4	5.39	5	177	4.35	20.80	96	5.58
	V5	6.42	1	187	4.73	22.03	93	10.06
	V6	-		-	-	-	-	
	V7	5.33	6	216	3.70	20.41	106	1.94
	V8	4.85	8	169	3.97	20.53	103	-2.91
	V9	-		-	-	-	-	
	V10	5.17	7	192	3.96	25.35	94	13.82
	V11	4.29	12	206	3.09	21.09	100	4.97
	V12	4.85	8	224	2.93	20.71	91	10.67
	V13	4.36	11	211	2.95	21.66	90	2.30
	V14	6.32	2	206	4.50	22.60	97	4.61
	V15	6.18	3	242	3.56	23.73	108	6.67
C.D.(0.05)		0.52		20.73	0.26	0.78	1.52	
C.V.(%)		8.74		8.87	6.13	3.08	1.32	
Expt. Mean		5.10		201	3.65	21.81	99	
Soil type		Sandy loam						
pH		7.80						
F - levels (kg/ha)								
F1		52.5:15:15						
F2		105:30:30						
Recmnd N:P:K (kg/ha)		105:30:30						
Varieties								
	V1	IET 30692						
	V2	IET 30713						
	V3	IET 31448						
	V4	IET 31452						
	V5	IET 31456						
	V6	-						
	V7	IET 31589						
	V8	IET 31603						
	V9	-						
	V10	PR 113						
	V11	Lalat						
	V12	Karjat - 7						
	V13	MTU 1010						
	V14	US 312						
	V15	Local Check - PR 131						
Available N:P:K of soil (kg/ha)		270:22.6:190						

Table 4.1(e): Contd.

F-levels	Varieties	MANDYA							MARUTERU					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	5.46	10	289	3.8	22.45	114		5.40	8	374	18.43	102	
	V2	4.48	20	277	2.75	20.47	98		4.82	13	348	15.50	102	
	V3	5.26	13	306	4.63	29.09	98.67		5.81	6	260	24.73	105	
	V4	5.25	14	293	3.86	23.33	98		5.46	7	244	17.40	103	
	V5	5.33	12	325	4.21	25.64	98		4.53	20	251	21.40	103	
	V6	5.1	15	299	4.12	19.72	98		6.43	4	287	22.87	108	
	V7	5.65	8	289	3.64	27.45	110		4.92	11	256	17.37	106	
	V8	5.57	9	267	5.7	24.66	101		4.28	24	249	21.53	103	
	V9	-	-	-	-	-	-		-	-	-	-	-	
	V10	4.92	16	293.67	4.31	29.34	103		4.24	25	281	24.05	97	
	V11	4.03	22	319	2.02	25.82	92		4.61	18	316	19.87	101	
	V12	3.61	24	303.67	2.44	23.21	92		4.53	20	245	18.50	100	
	V13	4.06	21	319	1.49	23.63	90		4.19	26	260	19.70	104	
	V14	-	-	-	-	-	-		4.49	22	252	17.40	109	
	V15	-	-	-	-	-	-		-	-	-	-	-	
F2: Optimum input (100% NPK)	V1	5.44	11	301	4.32	22.99	114	-0.16	7.50	1	385	18.90	98	20.00
	V2	6.41	2	312	3.1	20.66	98	15.50	6.91	2	365	15.83	99	19.90
	V3	4.72	19	319	5.04	29.39	99	-4.34	5.98	5	289	25.60	102	1.62
	V4	5.85	6	317.67	4.79	24.71	98	4.82	4.93	10	274	18.10	100	-5.05
	V5	5.79	7	340.33	4.78	25.87	98	3.69	4.76	16	289	22.63	99	2.19
	V6	6.01	3	337.33	4.67	31.98	98	7.31	5.08	9	310	24.40	104	-12.86
	V7	5.98	4	343.33	3.83	19.41	110	2.65	6.57	3	277	18.00	102	15.71
	V8	6.51	1	328.67	6.2	27.73	101	7.55	4.49	22	275	23.10	100	2.00
	V9	-	-	-	-	-	-		-	-	-	-	-	
	V10	4.85	17	343	4.4	31.21	103	-0.56	4.56	19	290	24.05	92	3.05
	V11	5.91	5	361.33	2.25	25.45	92	15.10	4.92	11	326	20.27	92	2.95
	V12	4.75	18	326	2.57	24.35	92	9.16	4.75	17	263	19.07	96	2.10
	V13	3.89	23	351.33	1.88	23.92	90	-1.37	4.81	14	285	20.07	99	5.90
	V14	-	-	-	-	-	-		4.80	15	270	18.20	103	2.95
	V15	-	-	-	-	-	-		-	-	-	-	-	
Interaction														
F at same V		0.76		NS	NS	1.8	NS		0.43		NS	NS	NS	
V at same F		0.66		NS	NS	1.57	NS		0.43		NS	NS	NS	
Means of F levels:														
F1		4.89	2	298	3.58	24.57	99		4.90	2	279	19.90	103	
F2		5.51	1	332	3.99	25.64	99	4.95	5.39	1	300	20.63	99	4.65
C.D.(0.05)		0.55		28.47	NS	NS	NS		0.16		5.83	0.52	0.98	
C.V.(%)		10.51		8.91	15.3	5.05	0.12		3.24		2.07	2.62	1	

Table 4.1(e): Contd.

F- levels	Varieties	MANDYA							MARUTERU					
		Grain Yield (t/ha)	Ra nk	Panicle /m ² (No.)	Panicl e Weig ht (g)	Test wt(g)	Days for 50% Flowe ring	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicl e/m ² (No.)	Test wt(g)	Days for 50% Flowe ring	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties														
	V1	5.45	6	295	4.06	22.72	114	-0.16	6.45	1	380	18.67	100	20.00
	V2	5.45	7	295	2.93	20.57	98	15.50	5.87	3	356	15.67	100	19.90
	V3	4.99	8	313	4.84	29.24	99	-4.34	5.90	2	274	25.17	104	1.62
	V4	5.55	5	305	4.33	24.02	98	4.82	5.20	6	259	17.75	102	-5.05
	V5	5.56	3	333	4.50	25.76	98	3.69	4.65	8	270	22.02	101	2.19
	V6	5.56	4	318	4.40	25.85	98	7.31	5.76	4	298	23.64	106	-12.86
	V7	5.82	2	316	3.74	23.43	110	2.65	5.75	5	267	17.69	104	15.71
	V8	6.04	1	298	5.95	26.20	101	7.55	4.39	13	262	22.32	101	2.00
	V9	-		-	-	-	-	0.00	-		-	-	-	
	V10	4.89	10	318	4.36	30.28	103	-0.56	4.40	12	286	24.05	95	3.05
	V11	4.97	9	340	2.14	25.64	92	15.10	4.77	7	321	20.07	97	2.95
	V12	4.18	11	315	2.51	23.78	92	9.16	4.64	10	254	18.79	98	2.10
	V13	3.98	12	335	1.69	23.78	90	-1.37	4.50	11	273	19.89	101	5.90
	V14	-		-	-	-	-	0.00	4.65	8	261	17.80	106	2.95
	V15	-		-	-	-	-	0.00	-		-	-	-	
C.D.(0.05)		0.46		17.86	0.64	1.11	0.14		0.31		25.85	0.75	3.32	
C.V.(%)		7.65		4.87	14.52	3.79	0.12		5.15		7.74	3.19	2.84	
Expt. Mean		5.20		315	3.78	25.10	99		5.15		289	20.27	101	
Soil type		Red Sandy loam							-					
pH		7.65							6.90					
F - levels (kg/ha)														
F1		62.5:31:31							45:30:30					
F2		125:62:62							90:60:60					
Recmnd N:P:K (kg/ha)		125:62:62							90:60:60					
Varieties														
V1		IET 30692							IET 30692					
V2		IET 30713							IET 30713					
V3		IET 31448							IET 31448					
V4		IET 31452							IET 31452					
V5		IET 31456							IET 31456					
V6		IET 31466							IET 31466					
V7		IET 31589							IET 31589					
V8		IET 31603							IET 31603					
V9		-							-					
V10		PR 113							PR 113					
V11		Lalat							Lalat					
V12		Karjat - 7							Karjat - 7					
V13		MTU 1010							MTU 1010					
V14		-							US 312					
V15		-							-					
Available N:P:K of soil (kg/ha)		341.5:58:241							163:23.3:336					

Table 4.1(e): Contd.

F-levels	Varieties	MASODHA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	4.83	14	224	3.45	25.47	89	
	V2	4.84	13	230	3.31	30.57	91	
	V3	3.22	23	223	3.34	26.73	87	
	V4	5.15	12	257	3.50	26.60	84	
	V5	4.20	19	219	3.43	35.20	89	
	V6	4.37	17	255	3.31	30.90	82	
	V7	3.30	22	214	2.86	25.17	88	
	V8	3.33	21	204	3.02	19.77	94	
	V9	-		-	-	-	-	
	V10	2.87	25	223	3.29	19.17	82	
	V11	2.24	28	252	2.67	20.33	89	
	V12	3.16	24	182	2.85	25.37	87	
	V13	2.63	27	212	2.84	21.10	87	
	V14	3.65	20	211	3.19	20.33	86	
	V15	2.77	26	214	3.19	19.53	86	
F2: Optimum input (100% NPK)	V1	6.06	6	267	3.94	25.95	89	11.18
	V2	6.05	7	269	4.15	26.20	91	11.00
	V3	6.37	1	265	3.96	26.44	87	28.64
	V4	6.15	5	275	3.49	26.68	84	9.09
	V5	6.28	3	263	3.87	24.87	89	18.91
	V6	6.18	4	271	4.11	25.63	82	16.45
	V7	6.31	2	266	3.75	26.37	88	27.36
	V8	5.93	8	267	3.96	24.70	94	23.64
	V9	-		-	-	-	-	
	V10	5.30	11	262	4.75	24.53	82	22.09
	V11	5.39	10	248	3.54	24.23	89	28.64
	V12	5.86	9	268	3.45	24.40	87	24.55
	V13	4.70	16	253	3.42	24.27	87	18.82
	V14	4.79	15	252	3.94	21.70	86	10.36
	V15	4.34	18	235	3.71	22.57	86	14.27
Interaction								
F at same V		1.12		29.47	NS	0.69	NS	
V at same F		1.06		34.3	NS	0.51	NS	
Means of F levels:								
F1		3.61	2	223	3.16	24.73	87	
F2		5.69	1	262	3.86	24.90	87	18.93
C.D.(0.05)		0.59		24.66	NS	NS	NS	
C.V.(%)		13.43		10.85	29.67	2.63	0	

Table 4.1(e): Contd.

F- levels	Varieties	MASODHA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties								
	V1	5.45	2	245	3.70	25.71	89	11.18
	V2	5.45	2	250	3.73	28.39	91	11.00
	V3	4.80	7	244	3.65	26.59	87	28.64
	V4	5.65	1	266	3.50	26.64	84	9.09
	V5	5.24	5	241	3.65	30.04	89	18.91
	V6	5.28	4	263	3.71	28.27	82	16.45
	V7	4.81	6	240	3.31	25.77	88	27.36
	V8	4.63	8	236	3.49	22.24	94	23.64
	V9	-		-	-	-	-	0.00
	V10	4.09	11	243	4.02	21.85	82	22.09
	V11	3.82	12	250	3.11	22.28	89	28.64
	V12	4.51	9	225	3.15	24.89	87	24.55
	V13	3.67	13	233	3.13	22.69	87	18.82
	V14	4.22	10	231	3.57	21.02	86	10.36
	V15	3.56	14	224	3.45	21.05	86	14.27
C.D.(0.05)		0.75		20.84	NS	0.36	1.26	
C.V.(%)		13.97		7.43	28.63	1.26	1.25	
Expt. Mean		4.65		242	3.51	24.81	87	
Soil type		Sand 32.2,Silt 48.6 & Clay 16.2						
pH		7.40						
F - levels (kg/ha)								
	F1	60:30:20						
	F2	120:60:40						
Recmnd N:P:K (kg/ha)		120:60:40						
Varieties								
	V1	IET 30692						
	V2	IET 30713						
	V3	IET 31448						
	V4	IET 31452						
	V5	IET 31456						
	V6	IET 31466						
	V7	IET 31589						
	V8	IET 31603						
	V9	-						
	V10	PR 113						
	V11	Lalat						
	V12	Karjat - 7						
	V13	MTU 1010						
	V14	US 312						
	V15	Local Check - Muktashree, 125-130 days						
Available N:P:K of soil (kg/ha)		75.4:13.5:22.5						

Table 4.1(e): Contd.

F-levels	Varieties	NAGINA							NAVSARI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	2.90	17	233	3.52	24.89	112		2.44	26	185	3.82	21.54	93	
	V2	2.83	20	228	3.47	24.67	113		4.36	8	189	4.45	23.82	91	
	V3	2.86	19	226	3.35	24.65	95		4.25	10	182	4.85	25.13	94	
	V4	2.83	20	233	3.47	24.68	96		2.79	21	178	5.06	20.89	91	
	V5	3.14	15	255	3.57	25.07	91		4.23	12	191	4.92	24.75	92	
	V6	2.93	16	241	3.52	24.98	88		2.39	28	190	5.01	24.62	90	
	V7	2.79	22	233	3.45	24.94	112		2.53	25	182	4.03	25.59	92	
	V8	2.90	17	233	3.41	24.72	104		4.11	16	175	4.69	24.79	91	
	V9	2.51	25	221	3.15	24.52	97		4.30	9	249	4.77	20.06	89	
	V10	2.58	23	218	3.36	24.59	102		4.44	6	239	3.53	23.52	92	
	V11	2.58	23	212	2.96	24.52	99		4.20	13	240	4.21	28.07	91	
	V12	2.22	28	216	2.92	24.49	93		3.97	17	266	2.54	20.58	86	
	V13	2.46	26	206	3.10	24.61	92		2.30	29	229	2.56	20.93	87	
	V14	2.30	27	212	2.92	24.60	92		4.55	2	179	5.19	20.77	90	
	V15	-		-	-	-	-		2.26	30	249	3.06	29.48	82	
F2: Optimum input (100% NPK)	V1	4.68	3	322	3.76	25.70	112	16.18	2.66	24	209	3.85	22.25	92	3.38
	V2	4.65	4	312	3.66	25.49	115	16.55	4.69	1	206	4.48	24.72	90	5.08
	V3	4.63	5	312	3.55	25.45	96	16.09	4.51	3	202	4.90	25.60	93	4.00
	V4	4.61	6	322	3.68	25.47	96	16.18	3.27	19	198	5.09	22.02	90	7.38
	V5	4.95	1	329	3.79	25.89	92	16.45	4.51	3	208	4.95	25.65	91	4.31
	V6	4.73	2	327	3.72	25.82	89	16.36	2.41	27	210	5.03	25.52	89	0.31
	V7	4.50	8	311	3.53	25.41	112	15.55	3.24	20	206	4.09	25.90	90	10.92
	V8	4.53	7	304	3.56	25.53	105	14.82	4.48	5	194	4.83	25.57	90	5.69
	V9	4.25	14	292	3.25	25.37	98	15.82	4.42	7	267	4.84	21.97	90	1.85
	V10	4.43	9	296	3.47	25.40	102	16.82	4.12	15	251	3.59	23.99	90	-4.92
	V11	4.29	12	285	3.19	25.36	100	15.55	4.14	14	264	4.36	28.21	93	-0.92
	V12	4.31	11	279	2.50	25.29	95	19.00	2.67	23	279	2.64	21.78	85	-20.00
	V13	4.27	13	270	3.25	25.40	93	16.45	2.71	22	250	2.64	22.13	87	6.31
	V14	4.36	10	255	3.16	25.40	93	18.73	4.25	10	191	5.73	20.75	91	-4.62
	V15	-		-	-	-	-		3.89	18	280	3.18	29.04	82	25.08
Interaction															
F at same V		NS		NS	0.18	NS	NS		0.52		NS	NS	NS	1.16	
V at same F		NS		NS	0.18	NS	NS		0.48		NS	NS	NS	1.15	
Means of F levels:															
F1		2.70	2	226	3.30	24.71	99		3.54	2	208	4.18	23.64	90	
F2		4.51	1	301	3.43	25.50	100	16.47	3.73	1	228	4.28	24.34	90	2.92
C.D.(0.05)		0.11		19	0.08	0.11	NS		NS		14.79	NS	NS	0.42	
C.V.(%)		3.21		7.67	2.43	0.45	2.28		9.32		7.48	5.02	4.98	0.51	

Table 4.1(e): Contd.

F-levels	Varieties	NAGINA							NAVSARI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties															
	V1	3.79	3	278	3.64	25.30	112	16.18	2.55	13	197	3.84	21.90	93	3.38
	V2	3.74	5	270	3.57	25.08	114	16.55	4.53	1	198	4.47	24.27	91	5.08
	V3	3.75	4	269	3.45	25.05	96	16.09	4.38	3	192	4.88	25.37	94	4.00
	V4	3.72	6	278	3.58	25.08	96	16.18	3.03	11	188	5.08	21.46	90	7.38
	V5	4.05	1	292	3.68	25.48	91	16.45	4.37	4	199	4.94	25.20	92	4.31
	V6	3.83	2	284	3.62	25.40	89	16.36	2.40	15	200	5.02	25.07	90	0.31
	V7	3.65	8	272	3.49	25.18	112	15.55	2.89	12	194	4.06	25.75	91	10.92
	V8	3.72	7	269	3.49	25.13	105	14.82	4.30	6	184	4.76	25.18	90	5.69
	V9	3.38	11	256	3.20	24.95	98	15.82	4.36	5	258	4.81	21.02	90	1.85
	V10	3.51	9	257	3.42	25.00	102	16.82	4.28	7	245	3.56	23.76	91	-4.92
	V11	3.44	10	249	3.08	24.94	99	15.55	4.17	8	252	4.29	28.14	92	-0.92
	V12	3.27	14	247	2.71	24.89	94	19.00	3.32	9	273	2.59	21.18	86	-20.00
	V13	3.37	12	238	3.18	25.01	92	16.45	2.51	14	240	2.60	21.53	87	6.31
	V14	3.33	13	234	3.04	25.00	93	18.73	4.40	2	185	5.46	20.76	91	-4.62
	V15	-		-	-	-	-		3.08	10	264	3.12	29.26	82	25.08
C.D.(0.05)		0.21		15.49	0.12	0.12	1.02		0.34		23.4	0.41	0.73	0.82	
C.V.(%)		4.92		5.07	3.18	0.42	0.89		8.04		9.28	8.28	2.63	0.78	
Expt. Mean		3.61		264	3.37	25.10	99		3.64		218	4.23	23.99	90	
Soil type		Sandy loam							Clayey						
pH		7.70							7.88						
F - levels (kg/ha)															
F1		60:30:20							50:15:0						
F2		120:60:40							100:30:0						
Recmnd N:P:K (kg/ha)		120:60:40							100:30:0						
Varieties															
	V1	IET 30692							IET 30692						
	V2	IET 30713							IET 30713						
	V3	IET 31448							IET 31448						
	V4	IET 31452							IET 31452						
	V5	IET 31456							IET 31456						
	V6	IET 31466							IET 31466						
	V7	IET 31589							IET 31589						
	V8	IET 31603							IET 31603						
	V9	Gondhra Bidhan-3							Gondhra Bidhan-3						
	V10	PR 113							PR 113						
	V11	Lalat							Lalat						
	V12	Karjat - 7							Karjat - 7						
	V13	MTU 1010							MTU 1010						
	V14	US 312							US 312						
	V15	-							Local check - GR-17, 113-118 days						
Available N:P:K of soil (kg/ha)		21:18.33:209							262:35.2:742						

Table 4.1(e): Contd.

F-levels	Varieties	NAWAGAM							PUDUCHERRY					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	5.12	11	215	4.05	16.67	91		4.60	23	200	1.98	21.84	
	V2	4.55	18	246	3.36	18.07	113		5.26	15	269	3.21	28.79	
	V3	5.95	2	230	3.82	25.83	96		5.01	18	235	2.32	24.86	
	V4	4.31	21	220	4.11	19.03	96		5.07	17	242	2.42	25.67	
	V5	3.93	25	221	4.67	20.47	88		4.93	20	220	2.37	27.10	
	V6	5.13	10	254	4.24	21.90	113		4.60	23	276	3.48	18.92	
	V7	5.10	12	239	4.32	16.37	114		5.00	19	228	2.13	24.00	
	V8	4.57	17	195	4.48	23.27	113		5.15	16	258	3.10	21.13	
	V9	-	-	-	-	-	-		-	-	-	-	-	
	V10	3.82	26	248	3.43	24.07	110		4.47	25	193	2.08	24.35	
	V11	3.75	27	237	2.85	28.37	113		4.24	27	188	2.19	25.84	
	V12	3.71	28	236	2.22	17.20	82		4.47	25	173	1.55	21.38	
	V13	4.19	23	230	2.47	23.50	110		4.24	27	184	1.61	24.20	
	V14	4.27	22	238	4.48	22.27	108		4.87	21	212	3.34	20.93	
	V15	4.15	24	233	4.03	20.27	96		4.65	22	181	2.15	24.80	
F2: Optimum input (100% NPK)	V1	5.37	5	259	4.82	17.47	93	4.00	6.33	9	240	2.12	22.15	17.30
	V2	5.47	4	249	3.30	18.37	114	14.72	6.74	2	311	3.44	29.19	14.80
	V3	6.56	1	247	4.40	24.77	97	9.76	6.62	6	275	2.83	25.57	16.10
	V4	4.64	15	248	4.32	18.13	98	5.28	6.64	4	289	2.72	26.68	15.70
	V5	5.53	3	280	4.78	20.17	88	25.60	6.58	7	251	2.79	27.90	16.50
	V6	5.26	7	275	5.28	20.83	113	2.08	6.85	1	319	3.88	19.53	22.50
	V7	5.37	5	276	4.47	15.90	113	4.32	6.63	5	259	2.42	24.90	16.30
	V8	5.02	13	211	4.73	22.50	115	7.20	6.73	3	302	3.28	21.83	15.80
	V9	-	-	-	-	-	-		-	-	-	-	-	
	V10	4.64	15	254	3.91	23.60	111	13.12	6.14	10	239	2.29	25.25	16.70
	V11	4.53	19	286	3.28	28.27	113	12.48	6.03	11	235	2.28	26.73	17.90
	V12	4.35	20	267	3.19	17.30	83	10.24	5.54	14	221	1.87	21.98	10.70
	V13	5.24	8	246	4.44	23.13	109	16.80	5.89	12	228	1.91	24.76	16.50
	V14	4.68	14	264	4.86	21.47	107	6.56	6.58	7	251	3.50	21.68	17.10
	V15	5.16	9	239	4.06	20.50	96	16.16	5.75	13	222	2.59	25.74	11.00
Interaction														
F at same V		NS		NS	NS	NS	1.3		0.07		3.11	0.04	0.24	
V at same F		NS		NS	NS	NS	1.26		0.12		22.05	0.04	0.23	
Means of F levels:														
F1		4.47	2	232	3.75	21.24	103		4.75	2	218	2.42	23.84	
F2		5.13	1	257	4.27	20.89	104	10.59	6.36	1	260	2.71	24.56	16.06
C.D.(0.05)		0.33		NS	0.36	NS	NS		0.12		30.58	0.03	0.02	
C.V.(%)		7.43		20.48	9.44	5.01	2.06		2.26		13.61	1.05	0.1	

Table 4.1(e): Contd.

F- levels	Varieties	NAWAGAM							PUDUCHERRY						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flower ing	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	
Mean of varieties															
	V1	5.25	2	237	4.44	17.07	92	4.00	5.47	9	220	2.05	22.00	17.30	
	V2	5.01	5	248	3.33	18.22	114	14.72	6.00	1	290	3.33	28.99	14.80	
	V3	6.26	1	239	4.11	25.30	96	9.76	5.82	4	255	2.58	25.22	16.10	
	V4	4.48	10	234	4.22	18.58	97	5.28	5.86	3	265	2.57	26.18	15.70	
	V5	4.73	7	251	4.73	20.32	88	25.60	5.76	6	236	2.58	27.50	16.50	
	V6	5.20	4	264	4.76	21.37	113	2.08	5.73	7	297	3.68	19.23	22.50	
	V7	5.24	3	257	4.40	16.14	113	4.32	5.82	4	243	2.28	24.45	16.30	
	V8	4.80	6	203	4.61	22.89	114	7.20	5.94	2	280	3.19	21.48	15.80	
	V9	-	-	-	-	-	-	-	-	-	-	-	-	-	
	V10	4.23	12	251	3.67	23.84	111	13.12	5.31	10	216	2.19	24.80	16.70	
	V11	4.14	13	262	3.07	28.32	113	12.48	5.14	12	211	2.24	26.29	17.90	
	V12	4.03	14	252	2.71	17.25	82	10.24	5.01	14	197	1.71	21.68	10.70	
	V13	4.72	8	238	3.46	23.32	109	16.80	5.07	13	206	1.76	24.48	16.50	
	V14	4.48	10	251	4.67	21.87	108	6.56	5.73	7	232	3.42	21.31	17.10	
	V15	4.66	9	236	4.05	20.39	96	16.16	5.20	11	202	2.37	25.27	11.00	
C.D.(0.05)		0.43		34.3	0.56	0.79	0.98		0.05		2.2	0.03	0.17		
C.V.(%)		7.74		12.11	11.98	3.22	0.82		0.8		0.79	0.94	0.6		
Expt. Mean		4.80		244	4.01	21.06	103		5.56		239	2.57	24.20		
Soil type		Clay loam							Clayey loam						
pH		8.08							-						
F - levels (kg/ha)															
F1		50:12.5:0							60:20:20						
F2		100:25:0							120:40:40						
Recmnd N:P:K (kg/ha)		100:25:0							120:40:40						
Varieties															
V1		IET 30692							IET 30692						
V2		IET 30713							IET 30713						
V3		IET 31448							IET 31448						
V4		IET 31452							IET 31452						
V5		IET 31456							IET 31456						
V6		IET 31466							IET 31466						
V7		IET 31589							IET 31589						
V8		IET 31603							IET 31603						
V9		Gondhra Bidhan-3							-						
V10		PR 113							PR 113						
V11		Lalat							Lalat						
V12		Karjat - 7							Karjat - 7						
V13		MTU 1010							MTU 1010						
V14		US 312							US 312						
V15		Local check - GAR 14, 125-130 days							Local check - White Ponni, 135 days						
Available N:P:K of soil (kg/ha)		250:78.6:428							123.2:28.6:111						

Table 4.1(e): Contd.

F-levels	Varieties	RAJENDRANAGAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: low input (50% NPK)	V1	4.31	22	240	3.74	21.53	115	
	V2	3.67	27	297	3.51	20.63	108	
	V3	4.89	18	264	3.98	28.37	106	
	V4	5.31	11	253	4.37	25.00	105	
	V5	5.32	10	245	3.96	25.50	101	
	V6	5.14	14	238	4.74	28.47	99	
	V7	4.46	19	299	4.35	18.67	112	
	V8	5.19	13	242	4.24	28.30	107	
	V9	5.10	15	220	4.98	22.37	100	
	V10	3.31	29	240	3.73	29.30	106	
	V11	4.19	24	268	3.65	26.60	97	
	V12	2.94	30	277	2.81	22.27	95	
	V13	3.86	26	298	2.88	24.13	102	
	V14	4.90	17	240	3.90	21.57	106	
	V15	3.32	28	287	2.96	15.57	103	
F2: Optimum input (100% NPK)	V1	6.02	7	296	3.84	21.71	115	15.55
	V2	5.44	9	331	4.01	20.93	108	16.09
	V3	6.17	5	294	4.97	29.50	108	11.64
	V4	6.32	2	315	5.37	25.77	106	9.18
	V5	6.20	4	263	4.25	25.67	102	8.00
	V6	6.14	6	285	4.96	29.73	100	9.09
	V7	5.27	12	356	4.97	19.97	112	
	V8	6.36	1	259	5.09	28.47	107	10.64
	V9	6.23	3	264	4.74	22.00	99	10.27
	V10	4.97	16	263	4.55	29.43	106	15.09
	V11	4.35	21	280	3.81	26.60	97	1.45
	V12	3.99	25	370	3.96	22.43	94	9.55
	V13	4.26	23	358	3.46	26.97	102	3.64
	V14	5.56	8	291	4.45	22.00	106	6.00
	V15	4.42	20	325	3.25	15.93	103	10.00
Interaction								
F at same V		NS		NS	NS	0.86	0.79	
V at same F		NS		NS	NS	0.83	0.48	
Means of F levels:								
F1		4.39	2	261	3.85	23.89	104	
F2		5.45	1	303	4.38	24.47	104	9.57
C.D.(0.05)		0.14		36.27	0.3	0.4	NS	
C.V.(%)		3.04		14.19	8.08	1.81	0.86	

Table 4.1(e): Contd.

F- levels	Varieties	RAJENDRANAGAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties								
	V1	5.17	8	268	3.79	21.62	115	15.55
	V2	4.56	10	314	3.76	20.78	108	16.09
	V3	5.53	6	279	4.48	28.94	107	11.64
	V4	5.82	1	284	4.87	25.39	106	9.18
	V5	5.76	3	254	4.11	25.59	102	8.00
	V6	5.64	5	262	4.85	29.10	100	9.09
	V7	4.87	9	327	4.66	19.32	112	
	V8	5.78	2	250	4.67	28.39	107	10.64
	V9	5.67	4	242	4.86	22.19	99	10.27
	V10	4.14	12	252	4.14	29.37	106	15.09
	V11	4.27	11	274	3.73	26.60	97	1.45
	V12	3.47	15	323	3.39	22.35	95	9.55
	V13	4.06	13	328	3.17	25.55	102	3.64
	V14	5.23	7	266	4.18	21.79	106	6.00
	V15	3.87	14	306	3.11	15.75	103	10.00
C.D.(0.05)		0.58		34.16	0.78	0.58	0.34	
C.V.(%)		10.19		10.48	16.49	2.09	0.28	
Expt. Mean		4.92		282	4.12	24.18	104	
Soil type		-						
pH		-						
F - levels (kg/ha)								
	F1	60:30:20						
	F2	120:60:40						
Recmnd N:P:K (kg/ha)		120:60:40						
Varieties								
	V1	IET 30692						
	V2	IET 30713						
	V3	IET 31448						
	V4	IET 31452						
	V5	IET 31456						
	V6	IET 31466						
	V7	IET 31589						
	V8	IET 31603						
	V9	Gondhra Bidhan-3						
	V10	PR 113						
	V11	Lalat						
	V12	Karjat - 7						
	V13	MTU 1010						
	V14	US 312						
	V15	Local check - KNM-1638, 125 days						
Available N:P:K of soil (kg/ha)		-						

Table 4.1(e): Contd.

F-levels	Varieties	VARANASI							Over all Mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: low input (50% NPK)	V1	7.13	2	225	28.14	20.13	94		4.65	19
	V2	6.78	3	230	27.19	21.88	96		4.50	23
	V3	7.77	1	195	28.51	20.52	90		5.09	13
	V4	6.64	4	235	29.21	22.75	87		4.85	14
	V5	5.21	24	216	23.94	21.05	88		4.71	17
	V6	5.45	17	211	22.79	23.74	90		4.65	20
	V7	4.23	28	195	24.43	22.73	90		4.50	24
	V8	5.23	23	193	22.28	23.51	89		4.47	25
	V9	5.76	12	167	32.13	24.10	90		4.67	18
	V10	5.42	19	185	23.04	25.02	88		4.17	26
	V11	5.88	10	198	29.10	29.01	94		3.80	29
	V12	5.07	26	204	28.92	26.81	94		3.67	30
	V13	5.38	21	184	30.82	24.19	96		3.97	28
	V14	-		-	-	-	-		4.60	21
	V15	5.70	14	165	30.20	23.69	95		4.11	27
F2: Optimum input (100% NPK)	V1	6.32	8	238	30.39	28.16	99	-6.48	5.49	6
	V2	5.50	16	222	34.20	25.36	99	-10.24	5.40	8
	V3	5.44	18	202	32.83	28.18	90	-18.64	5.87	1
	V4	5.76	12	222	33.39	27.17	91	-7.04	5.58	3
	V5	4.84	27	205	37.26	27.64	91	-2.96	5.61	2
	V6	5.30	22	240	32.11	26.88	92	-1.20	5.40	9
	V7	5.63	15	215	28.74	30.39	90	11.20	5.50	5
	V8	5.16	25	220	37.13	27.65	91	-0.56	5.28	10
	V9	6.51	6	174	32.88	24.09	85	6.00	5.55	4
	V10	6.29	9	181	33.39	27.01	87	6.96	5.16	11
	V11	5.88	10	224	38.97	24.39	90	0.00	4.72	16
	V12	5.40	20	185	32.68	21.16	94	2.64	4.60	22
	V13	6.55	5	176	42.17	22.97	95	9.36	4.84	15
	V14	-		-	-	-	-		5.45	7
	V15	6.43	7	190	37.91	23.23	96	5.84	5.13	12
Interaction										
F at same V		1.22		NS	NS	5.36	NS			
V at same F		1.51		NS	NS	5.39	NS			
Means of F levels:										
F1		5.83	1	200	27.19	23.51	91		4.45	2
F2		5.79	2	207	34.58	26.02	92	-0.37	5.31	1
C.D.(0.05)		NS		NS	2.08	1.98	NS			
C.V.(%)		22.4		5.43	7.17	8.5	2.88			

Table 4.1(e): Contd.

F- levels	Varieties	VARANASI							Over all Mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
Mean of varieties										
	V1	6.73	1	231	29.27	24.15	97	-6.48	5.07	5
	V2	6.14	4	226	30.70	23.62	97	-10.24	4.95	9
	V3	6.61	2	199	30.67	24.35	90	-18.64	5.48	1
	V4	6.20	3	229	31.30	24.96	89	-7.04	5.21	2
	V5	5.03	13	210	30.60	24.35	90	-2.96	5.16	3
	V6	5.38	10	226	27.45	25.31	91	-1.20	5.02	7
	V7	4.93	14	205	26.59	26.56	90	11.20	5.00	8
	V8	5.20	12	207	29.71	25.58	90	-0.56	4.88	10
	V9	6.14	5	170	32.51	24.10	87	6.00	5.11	4
	V10	5.86	9	183	28.22	26.02	88	6.96	4.66	11
	V11	5.88	8	211	34.04	26.70	92	0.00	4.26	14
	V12	5.24	11	195	30.80	23.99	94	2.64	4.14	15
	V13	5.97	7	180	36.50	23.58	96	9.36	4.40	13
	V14	-	-	-	-	-	-	-	5.03	6
	V15	6.07	6	177	34.06	23.46	95	5.84	4.62	12
C.D.(0.05)		0.86		21.82	4.53	NS	5.54			
C.V.(%)		12.87		9.29	12.71	13.25	5.22			
Expt. Mean		5.81		203	30.88	24.76	92		4.88	
Soil type		-								
pH		7.20								
F - levels (kg/ha)										
F1		75:30:20								
F2		150:60:40								
Recmnd N:P:K (kg/ha)		150:60:40								
Varieties										
	V1	IET 30692								
	V2	IET 30713								
	V3	IET 31448								
	V4	IET 31452								
	V5	IET 31456								
	V6	IET 31466								
	V7	IET 31589								
	V8	IET 31603								
	V9	Gondhra Bidhan-3								
	V10	PR 113								
	V11	Lalat								
	V12	Karjat - 7								
	V13	MTU 1010								
	V14	-								
	V15	Local check - HUR 4-3								
Available N:P:K of soil (kg/ha)		-								

4.1(f) AVT 2 - Irrigated Medium

Sixteen AVT-2 entries IET 29860, IET 29877, IET 31478(H), IET 31479(H), IET 31480(H), IET 31481(H), IET 31492(H), IET 31618, IET 31633, IET 31637, IET 31638, IET 31639, IET 31640, IET 31641, IET 31643 and IET 31659 of medium duration were evaluated for their response to nutrients on yield attributes and grain yield at 17 different locations viz., **Aduthurai (150-50-50)**, **Chinsurah (80-40-40)**, **Coimbatore (150-50-50)**, **Dhangain (120-60-40)**, **Masodha (120-60-40)**, **Jagdarpur (100-50-30)**, **Karjat (100-50-50)**, **Maruteru (90-60-60)**, **Nagina (120-60-40)**, **Navsari (100-30-0)**, **Nawagam (100-25-0)**, **Pantnagar (120-60-40)**, **Puducherry (120-40-40)**, **ARI-Rajendranagar (120-60-40)**, **Titabar (60-20-40)**, **Varanasi (150-60-40)** and **Warangal (120-60-40)** under two different levels of nutrient input (50% and 100% RDF). The details and data received from these locations are summarized and presented in Table 4.1 (f).

Application of different nutrient levels (50 and 100% RDF) significantly influenced the grain yield at all the locations except **Varanasi and Warangal** indicating application of higher dose is not required at these locations. However, the overall yield improvement was to the tune of 25.5% with 100% RDF compared to 50% RDF (4.28 t/ha).

Grain yield differences among the tested cultures were found to be significant at all the locations except **Aduthurai**. Among the tested entries higher grain yield was recorded by IET 31641 (4.92 t/ha) and IET 31480 (H) (4.84 t/ha) at **Chinsurah**; IET 31640 (6.20 t/ha) and IET 29877 (6.12 t/ha) at **Coimbatore**; IET 31643 (6.81 t/ha) at **Dhangain**; IET 29877 (5.08 t/ha), IET 31478(H) (4.58 t/ha) and IET 31479(H) (4.39 t/ha) at **Masodha**; IET 31480(H) (6.30 t/ha) and IET 31478(H) (5.36 t/ha) at **Karjat**; IET 31659 (5.59 t/ha) and IET 31618 (5.28 t/ha) at **Maruteru**; IET 31640 (3.94 t/ha) and IET 31643 (3.82 t/ha) at **Nagina**; IET 31618 (4.49 t/ha) at **Navsari**; IET 31480(H) (6.15 t/ha) and IET 31639 (5.64 t/ha) at **Nawagam**; IET 31481(H) (4.84 t/ha) and IET 31478 (4.65 t/ha) at **Pantnagar**; IET 31480(H) (5.79 t/ha) and IET 31478 (5.72 t/ha) at **Puducherry**; IET 31480(H) (7.88 t/ha) and IET 31659 (6.98 t/ha) at **Rajendranagar**; IET 31639 (5.67 t/ha) at **Titabar**; IET 29860 (5.52 t/ha) and IET 31641 (5.13 t/ha) at **Varanasi** and IET 29877 (6.67 t/ha) and IET 31637 (6.39 t/ha) at **Warangal** were found promising with higher grain yields.

In this trial, among cultures IET 31480(H) (5.18 t/ha) followed by IET 29860 (4.95 t/ha), and IET 31638 (4.94 t/ha) were found promising on the basis of overall mean grain yield across the locations. Interaction effect of nutrients and cultures found significant at **Aduthurai, Coimbatore, Jagdarpur, Masodha, Nawagam, Pantnagar, Puducherry** and **Varanasi**. Application of 100% RFD resulted in better yields of cultivars at these locations.

Table 4.1 (f): Summary of data on grain yield and ancillary characters of selected Irrigated Medium (Transplanted) cultures grown under transplanted conditions at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	ADUTHURAI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.79	13	358	5.67	17.47	
	V2	4.62	17	343	4.74	16.60	
	V3	4.36	26	343	4.44	16.40	
	V4	4.34	28	298	3.52	14.53	
	V5	4.63	16	310	4.11	16.97	
	V6	4.41	23	276	3.54	15.23	
	V7	4.35	27	305	3.88	15.43	
	V8	4.33	30	291	3.60	15.60	
	V9	3.64	41	276	3.49	16.13	
	V10	4.21	34	270	3.42	16.60	
	V11	4.32	31	322	4.34	18.30	
	V12	4.00	38	269	3.31	16.57	
	V13	3.33	44	250	2.73	15.30	
	V14	3.55	43	247	2.53	14.47	
	V15	4.34	28	313	4.16	18.60	
	V16	-		-	-	-	
	V17	4.56	20	241	2.44	14.43	
	V18	3.87	39	257	2.38	14.27	
	V19	4.23	33	244	2.60	15.37	
	V20	4.17	35	238	2.45	14.67	
	V21	3.86	40	235	4.35	18.43	
	V22	-		-	-	-	
	V23	4.40	24	241	3.25	18.33	
	V24	3.62	42	219	4.56	21.60	
	V25	-		-	-	-	
F2: Optimum input 100% NPK	V1	6.88	1	376	5.88	18.17	16.72
	V2	6.49	2	358	4.92	18.77	14.96
	V3	5.53	4	352	4.62	17.53	9.36
	V4	4.91	11	316	3.80	15.40	4.56
	V5	5.09	7	320	4.20	17.83	3.68
	V6	4.85	12	291	3.79	16.50	3.52
	V7	4.97	9	321	4.01	16.77	4.96
	V8	4.77	14	303	3.71	16.40	3.52
	V9	4.37	25	287	3.70	17.23	5.84
	V10	4.60	18	284	3.55	17.83	3.12
	V11	5.87	3	331	4.49	19.30	12.40
	V12	4.57	19	283	3.43	18.27	4.56
	V13	4.17	35	261	2.84	16.63	6.72
	V14	4.67	15	263	2.66	17.43	8.96
	V15	5.51	5	324	4.21	19.63	9.36
	V16	-		-	-	-	
	V17	5.13	6	255	2.58	15.50	4.56
	V18	4.43	22	278	2.51	15.50	4.48
	V19	4.47	21	260	2.70	16.77	1.92
	V20	5.07	8	255	2.59	15.73	7.20
	V21	4.27	32	253	4.59	20.40	3.28
	V22	-		-	-	-	
	V23	4.97	9	264	3.44	19.53	4.56
	V24	4.03	37	237	4.77	22.57	3.28
	V25	-		-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	ADUTHURAI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction							
	<i>F at same V</i>	0.3		9.11	0.09	0.27	
	<i>V at same F</i>	0.28		9.12	0.09	0.25	
	F1	4.24	2	294	3.75	16.2	
	F2	5.15	1	308	3.90	17.4	7.30
	C.D.(0.05)	0.14		2.55	0.05	0.14	
	C.V.(%)	4.06		1.19	1.81	1.12	
Mean of varieties:							
	V1	5.84	1	367	5.78	17.8	16.72
	V2	5.56	2	350	4.83	17.7	14.96
	V3	4.95	4	348	4.53	17.0	9.36
	V4	4.63	11	307	3.66	15.0	4.56
	V5	4.86	6	315	4.16	17.4	3.68
	V6	4.63	10	284	3.67	15.9	3.52
	V7	4.66	9	313	3.95	16.1	4.96
	V8	4.55	13	297	3.66	16.0	3.52
	V9	4.01	20	281	3.60	16.7	5.84
	V10	4.41	14	277	3.49	17.2	3.12
	V11	5.10	3	326	4.42	18.8	12.40
	V12	4.29	16	276	3.37	17.4	4.56
	V13	3.75	22	256	2.79	16.0	6.72
	V14	4.11	18	255	2.60	16.0	8.96
	V15	4.93	5	318	4.19	19.1	9.36
	V16	-		-	-	-	
	V17	4.85	7	248	2.51	15.0	4.56
	V18	4.15	17	267	2.45	14.9	4.48
	V19	4.35	15	252	2.65	16.1	1.92
	V20	4.62	12	247	2.52	15.2	7.20
	V21	4.07	19	244	4.47	19.4	3.28
	V22	-		-	-	-	
	V23	4.69	8	252	3.35	18.9	4.56
	V24	3.83	21	228	4.67	22.1	3.28
	V25	-		-	-	-	
	C.D.(0.05)	NS		6.44	NS	NS	
	C.V. (%)	3.82		1.96	1.45	0.91	
	Expt. Mean	4.58		287	3.69	17.07	
	Soil type	Clay					
	pH	7.20					
F - levels (kg/ha)							
	F1	75:25:25					
	F2	150:50:50					
Recommended N:P:K (kg/ha)		150:50:50					

Table 4.1 (f): Contd.

F-levels	Varieties	ADUTHURAI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties						
	V1	IET 29860					
	V2	IET 29877					
	V3	IET 31478(H)					
	V4	IET 31479(H)					
	V5	IET 31480(H)					
	V6	IET 31481(H)					
	V7	IET 31492(H)					
	V8	IET 31618					
	V9	IET 31633					
	V10	IET 31637					
	V11	IET 31638					
	V12	IET 31639					
	V13	IET 31640					
	V14	IET 31641					
	V15	IET 31643					
	V16	-					
	V17	NC- NDR 359					
	V18	PR121 (N)					
	V19	CR Dhan 300 (E & NE)					
	V20	Karma Mahsuri (C)					
	V21	Akshaydhan (W)					
	V22	-					
	V23	HRI 174					
	V24	Local Check - ADT 59					
	V25	-					
Available N:P:K of soil (kg/ha)		278:42:465					

Table 4.1 (f): Contd.

F-levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	3.06	44	212	2.22	104	
	V2	3.39	39	232	2.42	98	
	V3	3.13	42	217	2.26	99	
	V4	3.66	28	248	2.59	97	
	V5	3.79	25	256	2.67	106	
	V6	3.25	41	224	2.34	98	
	V7	-	-	-	-	-	
	V8	3.46	34	236	2.46	106	
	V9	3.36	40	230	2.41	101	
	V10	3.60	31	245	2.55	106	
	V11	3.64	29	247	2.58	97	
	V12	3.46	34	236	2.47	98	
	V13	3.42	38	234	2.44	106	
	V14	3.89	24	262	2.73	106	
	V15	3.64	29	247	2.58	109	
	V16	3.48	33	238	2.48	109	
	V17	2.88	46	201	2.11	104	
	V18	2.92	45	205	2.14	102	
	V19	3.57	32	243	2.53	88	
	V20	3.46	34	236	2.47	107	
	V21	3.43	37	235	2.45	105	
	V22	3.13	42	217	2.26	99	
	V23	3.75	26	254	2.65	94	
	V24	3.67	27	249	2.59	106	
	V25	-	-	-	-	-	
F2: Optimum input 100% NPK	V1	4.57	21	272	2.79	106	18.88
	V2	5.03	16	300	3.08	101	20.50
	V3	4.59	20	274	2.81	101	18.25
	V4	5.79	4	346	3.54	99	26.63
	V5	5.88	2	351	3.60	109	26.13
	V6	4.77	18	285	2.92	101	19.00
	V7	-	-	-	-	-	
	V8	5.39	13	321	3.29	109	24.13
	V9	4.94	17	294	3.02	103	19.75
	V10	5.51	9	329	3.37	109	23.88
	V11	5.72	6	341	3.49	100	26.00
	V12	5.47	11	326	3.34	100	25.13
	V13	5.31	14	317	3.24	109	23.63
	V14	5.95	1	355	3.64	109	25.75
	V15	5.73	5	342	3.50	111	26.13
	V16	5.48	10	327	3.35	111	25.00
	V17	4.41	23	263	2.70	106	19.13
	V18	4.44	22	265	2.71	104	19.00
	V19	5.59	8	333	3.41	90	25.25
	V20	5.43	12	324	3.32	109	24.63
	V21	5.23	15	312	3.20	107	22.50
	V22	4.62	19	276	2.82	101	18.63
	V23	5.83	3	347	3.56	96	26.00
	V24	5.68	7	339	3.47	109	25.13
	V25	-	-	-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction <i>F at same V</i> <i>V at same F</i>		NS		NS	NS	NS	
		NS		NS	NS	NS	
F1		3.44	2	235	2.46	103	
F2		5.28	1	315	3.23	105	22.99
<i>C.D.(0.05)</i>		0.21		10.17	0.27	1.4	
<i>C.V.(%)</i>		6.67		5.05	12.75	1.86	
Mean of varieties:							
V1		3.82	21	242	2.51	105	18.88
V2		4.21	16	266	2.75	99	20.50
V3		3.86	20	245	2.54	100	18.25
V4		4.73	4	297	3.07	98	26.63
V5		4.84	2	304	3.14	108	26.13
V6		4.01	18	254	2.63	100	19.00
V7							
V8		4.43	13	279	2.88	108	24.13
V9		4.15	17	262	2.72	102	19.75
V10		4.56	9	287	2.96	107	23.88
V11		4.68	6	294	3.04	99	26.00
V12		4.47	11	281	2.91	99	25.13
V13		4.37	14	276	2.84	108	23.63
V14		4.92	1	309	3.19	108	25.75
V15		4.69	5	295	3.04	110	26.13
V16		4.48	10	283	2.92	110	25.00
V17		3.65	23	232	2.41	105	19.13
V18		3.68	22	235	2.43	103	19.00
V19		4.58	8	288	2.97	89	25.25
V20		4.45	12	280	2.90	108	24.63
V21		4.33	15	273	2.83	106	22.50
V22		3.88	19	247	2.54	100	18.63
V23		4.79	3	301	3.11	95	26.00
V24		4.68	7	294	3.03	108	25.13
V25							
<i>C.D.(0.05)</i>		0.35		21.14	0.22	2.08	
<i>C.V. (%)</i>		7.07		6.7	6.62	1.75	
Expt. Mean		4.36		275	2.84	103	
Soil type		Clay loam					
pH		7.10					
F - levels (kg/ha)							
F1		40:20:20					
F2		80:40:40					
Recommended N:P:K (kg/ha)		80:40:40					

Table 4.1 (f): Contd.

F-levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties						
	V1	IET 29860					
	V2	IET 29877					
	V3	IET 31478(H)					
	V4	IET 31479(H)					
	V5	IET 31480(H)					
	V6	IET 31481(H)					
	V7	IET 31492(H)					
	V8	IET 31618					
	V9	IET 31633					
	V10	IET 31637					
	V11	IET 31638					
	V12	IET 31639					
	V13	IET 31640					
	V14	IET 31641					
	V15	IET 31643					
	V16	IET 31659					
	V17	NC- NDR 359					
	V18	PR121 (N)					
	V19	CR Dhan 300 (E & NE)					
	V20	Karma Mahsuri (C)					
	V21	Akshaydhan (W)					
	V22	Jaya (S)					
	V23	HRI 174					
	V24	Local Check - Pratikshya					
	V25	-					
	Available N:P:K of soil (kg/ha)	-					

Table 4.1 (f): Contd.

F-levels	Varieties	COIMBATORE						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.41	41	218	3.78	20.05	96	
	V2	5.12	24	286	3.84	19.97	103	
	V3	4.45	40	223	4.02	23.60	96	
	V4	4.50	38	228	3.54	21.76	96	
	V5	4.64	35	242	3.56	22.83	97	
	V6	4.70	33	249	4.04	26.14	97	
	V7	-		-	-	-	-	
	V8	4.59	36	236	4.16	20.45	97	
	V9	4.55	37	231	4.23	20.63	96	
	V10	4.74	31	253	3.81	19.38	97	
	V11	4.88	28	266	3.47	21.74	98	
	V12	4.82	29	261	4.19	20.82	98	
	V13	5.21	23	292	3.48	19.07	105	
	V14	5.08	25	281	4.17	20.85	102	
	V15	4.94	27	272	4.19	23.07	99	
	V16	5.00	26	277	4.25	21.73	100	
	V17	4.11	45	201	4.44	26.75	96	
	V18	4.48	39	257	4.36	26.35	96	
	V19	3.25	47	134	4.07	26.27	96	
	V20	4.30	43	228	3.52	18.83	100	
	V21	4.26	44	214	3.66	22.04	99	
	V22	2.76	48	117	4.16	25.83	96	
	V23	4.72	32	276	3.79	23.05	101	
	V24	4.33	42	224	3.18	18.13	101	
	V25	4.78	30	281	3.31	20.24	103	
F2: Optimum input 100% NPK	V1	6.36	18	312	3.92	20.34	96	15.60
	V2	7.12	2	383	3.99	20.10	104	16.00
	V3	6.41	17	321	4.15	23.93	97	15.68
	V4	6.48	16	323	3.69	22.16	96	15.84
	V5	6.63	12	339	3.71	23.21	96	15.92
	V6	6.69	11	343	4.19	26.43	97	15.92
	V7	-		-	-	-	-	
	V8	6.55	13	331	4.28	20.84	98	15.68
	V9	6.51	14	327	4.37	20.89	96	15.68
	V10	6.73	10	347	3.96	19.59	97	15.92
	V11	6.87	7	358	3.62	21.96	98	15.92
	V12	6.82	9	354	4.32	21.09	99	16.00
	V13	7.19	1	386	3.64	19.35	106	15.84
	V14	7.08	3	374	4.31	21.01	102	16.00
	V15	6.94	5	368	4.34	23.27	100	16.00
	V16	7.00	4	371	4.39	22.01	100	16.00
	V17	5.90	22	296	4.57	26.86	96	14.32
	V18	6.49	15	350	4.48	26.52	96	16.08
	V19	4.66	34	230	4.21	26.34	97	11.28
	V20	6.27	20	322	3.67	19.22	101	15.76
	V21	6.17	21	310	3.79	22.23	99	15.28
	V22	3.91	46	203	4.29	25.94	96	9.20
	V23	6.83	8	369	3.93	23.26	102	16.88
	V24	6.29	19	318	3.35	18.58	103	15.68
	V25	6.91	6	373	3.45	20.36	104	17.04

Table 4.1 (f): Contd.

F- levels	Varieties	COIMBATORE						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction <i>F at same V</i> <i>V at same F</i>		0.19 0.18		NS NS	NS NS	NS NS	NS NS	
F1		4.73	2	251	3.95		98	
F2		6.71	1	346	4.09		99	15.77
<i>C.D.(0.05)</i> <i>C.V.(%)</i>		0.08 2.06		6.68 3.25	NS 7.74	NS 1.57	0.06 0.08	
Mean of varieties:								
V1		5.39	18	265	3.85	20.20	96	15.60
V2		6.12	2	335	3.92	20.04	104	16.00
V3		5.43	17	272	4.09	23.77	97	15.68
V4		5.49	15	276	3.62	21.96	96	15.84
V5		5.64	12	291	3.64	23.02	97	15.92
V6		5.70	11	296	4.12	26.29	97	15.92
V7		-		-	-	-	-	
V8		5.57	13	284	4.22	20.65	98	15.68
V9		5.53	14	279	4.30	20.76	96	15.68
V10		5.74	10	300	3.89	19.49	97	-
V11		5.88	6	312	3.55	21.85	98	15.92
V12		5.82	8	307	4.26	20.96	99	16.00
V13		6.20	1	339	3.56	19.21	106	-
V14		6.08	3	328	4.24	20.93	102	16.00
V15		5.94	5	320	4.27	23.17	99	16.00
V16		6.00	4	324	4.32	21.87	100	-
V17		5.01	22	249	4.51	26.81	96	14.32
V18		5.49	16	303	4.42	26.44	96	
V19		3.96	23	182	4.14	26.31	97	
V20		5.29	20	275	3.60	19.03	101	
V21		5.22	21	262	3.73	22.14	99	
V22		3.34	24	160	4.23	25.89	96	
V23		5.78	9	323	3.86	23.16	101	
V24		5.31	19	271	3.27	18.36	102	
V25		5.85	7	327	3.38	20.30	104	
<i>C.D.(0.05)</i>		0.13		6.11	0.12	1.26	1.19	
<i>C.V. (%)</i>		2.01		1.86	2.57	4.94	1.05	
Expt. Mean		5.49		287	3.96	22.19	99	
Soil type		Clay loam						
pH		8.10						
F - levels (kg/ha)								
F1		75:25:25						
F2		150:50:50						
Recommended N:P:K (kg/ha)		150:50:50						

Table 4.1 (f): Contd.

F-levels	Varieties	COIMBATORE						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check(CO 56)						
	V25	Hybrid Check - CO 56, 130 days						
	Available N:P:K of soil (kg/ha)	211:19:462						

Table 4.1 (f): Contd.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	5.16	24	276	4.75	22.20	108	
	V2	3.94	40	252	3.38	18.40	104	
	V3	5.17	22	281	4.79	25.07	92	
	V4	4.91	28	273	4.52	22.20	93	
	V5	5.59	15	285	4.93	24.33	104	
	V6	4.57	32	266	3.95	27.80	90	
	V7	-		-	-	-	-	
	V8	4.49	33	262	3.72	19.80	108	
	V9	4.33	37	263	3.74	21.20	102	
	V10	3.92	41	262	3.36	21.40	108	
	V11	5.39	19	274	4.88	23.47	100	
	V12	4.09	39	253	3.60	22.53	108	
	V13	2.15	46	231	2.37	12.67	115	
	V14	4.20	38	258	3.70	18.53	114	
	V15	5.92	10	289	5.61	21.80	110	
	V16	4.61	31	261	4.16	19.57	105	
	V17	4.71	30	268	4.21	26.93	93	
	V18	4.42	34	265	3.76	25.33	96	
	V19	3.85	42	243	3.19	23.53	114	
	V20	3.46	44	244	3.14	20.53	100	
	V21	3.51	43	238	2.81	21.40	103	
	V22	4.97	27	272	4.48	26.40	95	
	V23	5.88	11	288	4.94	23.63	93	
	V24	5.19	21	271	4.82	20.40	110	
	V25	-		-	-	-	-	
F2: Optimum input 100% NPK	V1	6.32	7	281	5.15	24.53	110	10.55
	V2	4.98	26	256	3.46	20.40	104	9.45
	V3	6.40	6	283	5.22	25.13	94	11.18
	V4	6.05	8	278	4.91	23.87	95	10.36
	V5	6.66	4	288	5.32	24.53	104	9.73
	V6	5.61	14	267	4.23	28.40	92	9.45
	V7	-		-	-	-	-	
	V8	5.45	18	266	4.06	22.07	109	8.73
	V9	5.46	17	265	4.06	21.87	102	10.27
	V10	5.23	20	264	3.61	20.93	108	11.91
	V11	6.44	5	284	5.24	27.00	100	9.55
	V12	5.03	25	258	3.66	22.80	109	8.55
	V13	3.06	45	238	3.05	13.20	117	8.27
	V14	5.17	22	260	3.89	19.87	115	8.82
	V15	7.69	1	309	6.34	22.87	111	16.09
	V16	5.82	13	268	4.30	21.73	106	11.00
	V17	5.88	11	270	4.67	28.53	93	10.64
	V18	5.52	16	267	4.11	28.27	97	10.00
	V19	4.80	29	249	3.30	25.33	115	8.64
	V20	4.34	36	246	3.30	22.07	101	8.00
	V21	4.38	35	242	3.11	21.70	104	7.91
	V22	6.04	9	272	4.73	26.40	95	9.73
	V23	7.02	3	297	5.42	25.60	93	10.36
	V24	7.10	2	315	5.53	21.87	111	17.36
	V25	-		-	-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction <i>F at same V</i> <i>V at same F</i>		NS		NS	NS	1.57	0.8	
		NS		NS	NS	1.57	0.8	
F1		4.57	2	266	4.10	21.7	103	
F2		5.70	1	271	4.45	23.0	104	10.28
<i>C.D.(0.05)</i>		0.31		NS	NS	0.42	0.22	
<i>C.V.(%)</i>		8.39		5.3	27.05	2.49	0.29	
Mean of varieties:								
V1		5.74	7	279	4.95	23.4	109	10.55
V2		4.46	19	254	3.42	19.4	104	9.45
V3		5.79	6	282	5.01	25.1	93	11.18
V4		5.48	9	276	4.72	23.0	94	10.36
V5		6.13	4	287	5.13	24.4	104	9.73
V6		5.09	12	267	4.09	28.1	91	9.45
V7		-		-	-	-	-	
V8		4.97	13	264	3.89	20.9	108	8.73
V9		4.90	15	264	3.90	21.5	102	10.27
V10		4.58	17	263	3.49	21.2	108	11.91
V11		5.92	5	279	5.06	25.2	100	9.55
V12		4.56	18	256	3.63	22.7	109	8.55
V13		2.61	23	235	2.71	12.9	116	8.27
V14		4.69	16	259	3.80	19.2	114	8.82
V15		6.81	1	299	5.98	22.3	111	16.09
V16		5.22	11	265	4.23	20.7	105	11.00
V17		5.30	10	269	4.44	27.7	93	10.64
V18		4.97	14	266	3.94	26.8	97	10.00
V19		4.33	20	246	3.25	24.4	114	8.64
V20		3.90	22	245	3.22	21.3	101	8.00
V21		3.95	21	240	2.96	21.6	104	7.91
V22		5.51	8	272	4.61	26.4	95	9.73
V23		6.45	2	293	5.18	24.6	93	10.36
V24		6.15	3	293	5.18	21.1	110	17.36
V25		-		-	-	-	-	
<i>C.D.(0.05)</i>		0.48		22.28	0.59	1.11	0.57	
<i>C.V. (%)</i>		8.17		7.26	12.32	4.25	0.48	
Expt. Mean		5.11		267	4.21	22.78	103	
Soil type		Clay loam						
pH		6.58						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						

Table 4.1 (f): Contd.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - Sabour Mahsuri, 140 - 145 Days						
	V25	-						
	Available N:P:K of soil (kg/ha)	329.6:44.1:240.3						

Table 4.1 (f): Contd.

F-levels	Varieties	JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.81	33	189	23.33	23.67	104	
	V2	5.21	17	179	20.00	21.67	105	
	V3	4.87	30	213	23.33	27.33	91	
	V4	4.77	37	160	21.67	26.67	98	
	V5	5.27	15	186	24.33	24.00	101	
	V6	4.78	36	163	21.33	30.33	103	
	V7	4.80	34	177	22.00	19.67	94	
	V8	3.90	48	220	20.67	23.00	105	
	V9	4.80	34	187	23.67	22.33	106	
	V10	5.29	14	175	22.00	25.00	105	
	V11	5.07	24	212	19.33	30.33	98	
	V12	4.50	43	212	25.67	24.67	105	
	V13	4.20	47	197	14.67	16.67	104	
	V14	4.82	32	189	18.67	25.00	111	
	V15	5.30	12	217	24.67	23.67	109	
	V16	4.63	40	196	23.00	24.00	112	
	V17	6.00	2	220	24.67	24.67	92	
	V18	4.73	38	208	20.33	16.67	90	
	V19	4.53	41	207	24.67	24.33	102	
	V20	4.50	43	192	21.33	23.67	96	
	V21	5.47	10	214	21.33	25.33	93	
	V22	4.47	45	173	24.33	24.00	102	
	V23	5.17	20	204	24.33	22.67	91	
	V24	5.02	27	205	21.67	25.33	97	
	V25	-	-	-	-	-	-	
F2: Optimum input 100% NPK	V1	5.06	26	198	24.00	24.33	106	2.78
	V2	5.50	9	187	21.67	22.67	107	3.22
	V3	4.51	42	217	24.33	27.67	93	-4.00
	V4	5.20	18	162	24.00	27.00	99	4.78
	V5	5.80	4	193	25.33	25.00	103	5.89
	V6	5.33	11	169	23.67	31.00	104	6.11
	V7	5.87	3	183	23.67	20.67	96	11.89
	V8	4.87	30	235	23.67	24.00	107	10.78
	V9	5.10	22	191	25.33	23.00	108	3.33
	V10	5.53	8	177	23.67	25.33	106	2.67
	V11	5.30	12	220	22.33	31.67	101	2.56
	V12	4.73	38	221	27.00	25.67	106	2.56
	V13	4.23	46	201	16.67	19.00	106	0.33
	V14	4.97	29	195	20.67	26.00	114	1.67
	V15	5.60	7	220	26.67	24.33	111	3.33
	V16	5.07	24	203	24.00	25.00	113	4.89
	V17	6.47	1	225	27.00	25.33	93	5.22
	V18	5.23	16	211	22.00	18.00	92	5.56
	V19	5.00	28	210	25.67	25.00	104	5.22
	V20	5.10	22	198	23.00	25.00	98	6.67
	V21	5.77	5	214	23.33	25.67	94	3.33
	V22	5.20	18	176	25.67	24.33	103	8.11
	V23	5.63	6	205	25.67	23.33	94	5.11
	V24	5.17	20	180	23.67	26.33	99	1.67
	V25	-	-	-	-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction <i>F at same V</i> <i>V at same F</i>		NS		NS	NS	NS	NS	
		NS		NS	NS	NS	NS	
F1		4.88	2	194	21.94	24.3	103	
F2		5.24	1	200	23.75	25.2	104	4.00
<i>C.D.(0.05)</i>		NS		NS	0.51	0.7	0.26	
<i>C.V.(%)</i>		11.2		6.9	3.1	4.03	0.36	
Mean of varieties:								
V1		4.94	15	194	23.67	24.0	105	2.78
V2		5.36	7	183	20.84	22.2	106	3.22
V3		4.69	21	215	23.83	27.5	92	-4.00
V4		4.99	12	161	22.84	26.8	98	4.78
V5		5.54	3	190	24.83	24.5	102	5.89
V6		5.06	11	166	22.50	30.7	104	6.11
V7		5.34	8	180	22.84	20.2	95	11.89
V8		4.39	23	228	22.17	23.5	106	10.78
V9		4.95	14	189	24.50	22.7	107	3.33
V10		5.41	5	176	22.84	25.2	106	2.67
V11		5.19	9	216	20.83	31.0	100	2.56
V12		4.62	22	217	26.34	25.2	106	2.56
V13		4.22	24	199	15.67	17.8	105	0.33
V14		4.90	16	192	19.67	25.5	112	1.67
V15		5.45	4	219	25.67	24.0	110	3.33
V16		4.85	17	200	23.50	24.5	113	4.89
V17		6.24	1	222	25.84	25.0	93	5.22
V18		4.98	13	210	21.17	17.3	91	5.56
V19		4.77	20	208	25.17	24.7	103	5.22
V20		4.80	19	195	22.17	24.3	97	6.67
V21		5.62	2	214	22.33	25.5	93	3.33
V22		4.84	18	175	25.00	24.2	103	8.11
V23		5.40	6	205	25.00	23.0	93	5.11
V24		5.10	10	193	22.67	25.8	98	1.67
V25		-		-	-	-	-	
<i>C.D.(0.05)</i>		0.35		15.22	1.26	0.86	0.91	
<i>C.V. (%)</i>		6.1		6.71	4.8	3.09	0.78	
Expt. Mean		5.07		198	22.99	24.38	102	
Soil type		Clay loam						
pH		5.80						
F - levels (kg/ha)								
F1		50:25:15						
F2		100:50:30						
Recommended N:P:K (kg/ha)		100:50:30						

Table 4.1 (f): Contd.

F-levels	Varieties	JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	IET 31492(H)						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - Sonagathi, 120-125 days						
	V25	-						
	Available N:P:K of soil (kg/ha)	-						

Table 4.1 (f): Contd.

F-levels	Varieties	KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	3.27	43	288	2.67	20.46	104	
	V2	3.85	36	313	2.86	17.13	103	
	V3	5.14	10	353	4.34	24.66	104	
	V4	4.80	15	350	4.10	22.86	103	
	V5	6.07	2	381	4.77	21.75	116	
	V6	4.62	17	348	4.08	23.51	99	
	V7	-		-	-	-	-	
	V8	3.27	43	276	2.19	17.39	117	
	V9	4.16	28	328	3.44	20.03	116	
	V10	4.58	19	339	4.04	20.90	117	
	V11	4.20	26	330	3.48	26.14	112	
	V12	3.96	31	321	3.12	22.61	114	
	V13	3.43	41	309	2.68	13.68	123	
	V14	4.54	21	340	3.82	20.87	121	
	V15	4.09	29	316	3.22	22.11	118	
	V16	3.86	35	307	2.89	19.66	110	
	V17	2.90	45	274	1.81	22.42	106	
	V18	2.56	48	240	1.43	14.05	105	
	V19	4.01	30	268	3.14	23.26	123	
	V20	3.89	32	319	3.08	15.28	107	
	V21	3.71	38	314	2.73	19.72	110	
	V22	3.85	36	302	2.86	26.45	105	
	V23	3.48	40	308	2.73	20.20	111	
	V24	4.19	27	324	2.14	18.70	117	
	V25	5.20	9	331	3.69	21.54	110	
F2: Optimum input 100% NPK	V1	3.67	39	313	3.05	22.93	105	4.00
	V2	4.52	22	329	3.24	19.64	104	6.70
	V3	5.57	3	372	4.62	26.65	106	4.30
	V4	5.52	4	368	4.44	25.34	104	7.20
	V5	6.53	1	399	5.11	24.18	115	4.60
	V6	5.37	6	367	4.41	26.03	101	7.50
	V7	-		-	-	-	-	
	V8	3.42	42	300	2.58	19.62	118	1.50
	V9	4.97	12	349	3.78	21.80	117	8.10
	V10	5.35	7	356	4.35	23.46	118	7.70
	V11	5.07	11	352	3.81	28.19	114	8.70
	V12	4.80	15	344	3.46	24.37	116	8.40
	V13	3.89	32	330	3.01	16.50	124	4.60
	V14	5.25	8	364	4.13	22.70	123	7.10
	V15	4.95	13	341	3.60	23.28	120	8.60
	V16	4.55	20	333	3.25	21.65	111	6.90
	V17	2.82	47	300	2.22	23.75	108	-0.80
	V18	2.83	46	265	1.83	17.25	107	2.70
	V19	4.93	14	308	3.52	23.42	125	9.20
	V20	4.59	18	340	3.52	17.87	109	7.00
	V21	4.41	25	334	3.12	20.94	112	7.00
	V22	4.42	24	326	3.31	27.47	107	5.70
	V23	3.89	32	334	3.12	21.77	112	4.10
	V24	4.46	23	333	2.59	21.59	118	2.70
	V25	5.44	5	354	4.07	22.79	113	2.40

Table 4.1 (f): Contd.

F- levels	Varieties	KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction <i>F at same V</i> <i>V at same F</i>		NS		NS	NS	NS	NS	
		NS		NS	NS	NS	NS	
F1		4.17	2	323	3.34	21.01	111	
F2		4.77	1	345	3.69	23.13	113	5.94
<i>C.D.(0.05)</i>		0.09		3.31	0.07	0.27	1.43	
<i>C.V.(%)</i>		2.8		1.41	2.76	1.72	1.78	
Mean of varieties:								
V1		3.47	21	301	2.86	21.70	104	4.00
V2		4.19	16	321	3.05	18.39	103	6.70
V3		5.36	2	363	4.48	25.66	105	4.30
V4		5.16	4	359	4.27	24.10	104	7.20
V5		6.30	1	390	4.94	22.97	115	4.60
V6		5.00	5	357	4.25	24.77	100	7.50
V7		-		-	-	-	-	
V8		3.35	22	288	2.39	18.51	118	1.50
V9		4.57	9	338	3.61	20.92	116	8.10
V10		4.97	6	347	4.20	22.18	118	7.70
V11		4.64	8	341	3.65	27.17	113	8.70
V12		4.38	12	333	3.29	23.49	115	8.40
V13		3.66	20	320	2.85	15.09	123	4.60
V14		4.90	7	352	3.98	21.79	122	7.10
V15		4.52	10	328	3.41	22.70	119	8.60
V16		4.21	15	320	3.07	20.66	110	6.90
V17		2.86	23	287	2.02	23.09	107	-0.80
V18		2.70	24	253	1.63	15.65	106	2.70
V19		4.47	11	288	3.33	23.34	124	9.20
V20		4.24	14	330	3.30	16.58	108	7.00
V21		4.06	18	324	2.93	20.33	111	7.00
V22		4.14	17	314	3.09	26.96	106	5.70
V23		3.69	19	321	2.93	20.99	111	4.10
V24		4.33	13	329	2.37	20.15	118	2.70
V25		5.32	3	343	3.88	22.17	112	2.40
<i>C.D.(0.05)</i>		0.33		11.37	0.2	1.68	1.89	
<i>C.V. (%)</i>		6.62		3.03	5.29	6.79	1.47	
Expt. Mean		4.35		327	3.32	21.64	112	
Soil type		Medium Black						
pH		-						
F - levels (kg/ha)								
F1		50:25:25					-	
F2		100:50:50						
Recommended N:P:K (kg/ha)		100:50:50						

Table 4.1 (f): Contd.

F-levels	Varieties	KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - Ratnagiri 8, 138 to 140 days						
	V25	Hybrid Check - Sahyadri 3, 125 -130 days						
	Available N:P:K of soil (kg/ha)	-						

Table 4.1 (f): Contd.

F-levels	Varieties	MARUTERU					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.93	18	231	4.25	99	
	V2	4.40	35	235	2.76	100	
	V3	4.51	32	250	2.38	89	
	V4	4.49	33	265	2.52	94	
	V5	4.19	39	270	2.31	99	
	V6	4.79	24	257	2.62	100	
	V7	-		-	-	-	
	V8	5.14	9	257	3.08	99	
	V9	4.25	38	231	3.09	100	
	V10	4.62	29	223	2.64	99	
	V11	5.10	10	248	2.43	98	
	V12	4.61	30	265	3.58	101	
	V13	4.93	18	354	2.35	84	
	V14	4.12	40	328	2.83	99	
	V15	4.57	31	277	2.85	100	
	V16	5.46	2	276	3.08	98	
	V17	4.45	34	262	2.68	98	
	V18	4.79	24	306	2.79	97	
	V19	-		-	-	-	
	V20	4.38	36	258	3.67	98	
	V21	4.89	21	269	3.58	97	
	V22	-		-	-	-	
	V23	4.96	16	229	4.71	97	
	V24	-		-	-	-	
	V25	-		-	-	-	
F2: Optimum input 100% NPK	V1	5.44	3	241	4.25	96	4.86
	V2	4.71	26	255	2.76	97	2.95
	V3	5.07	11	263	2.38	87	5.33
	V4	4.83	22	280	2.52	90	3.24
	V5	4.67	28	278	2.31	95	4.57
	V6	5.16	8	265	2.62	95	3.52
	V7	-		-	-	-	
	V8	5.42	4	252	3.15	96	2.67
	V9	4.68	27	247	3.09	96	4.10
	V10	5.22	7	242	2.64	95	5.71
	V11	5.35	6	266	2.43	91	2.38
	V12	5.06	12	280	3.58	96	4.29
	V13	5.39	5	364	2.35	81	4.38
	V14	4.27	37	342	2.83	96	1.43
	V15	4.96	16	293	2.85	96	3.71
	V16	5.71	1	280	3.28	94	2.38
	V17	4.93	18	282	2.68	94	4.57
	V18	4.98	14	325	2.79	94	1.81
	V19	-		-	-	-	
	V20	4.80	23	269	3.67	94	4.00
	V21	4.97	15	284	3.58	92	0.76
	V22	-		-	-	-	#VALUE!
	V23	5.03	13	242	4.71	92	0.67
	V24	-		-	-	-	
	V25	-		-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	MARUTERU					
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction F at same V V at same F		NS		NS	NS	NS	
		NS		NS	NS	NS	
F1		4.66	2	264	2.84	97	
F2		5.05	1	277	2.86	93	3.76
C.D.(0.05)		0.06		5.62	NS	0.64	
C.V.(%)		1.46		2.64	1.7	0.85	
Mean of varieties:							
V1		5.19	4	236	4.25	98	4.86
V2		4.56	17	245	2.76	98	2.95
V3		4.79	12	256	2.38	88	5.33
V4		4.66	15	273	2.52	92	3.24
V5		4.43	19	274	2.31	97	4.57
V6		4.98	7	261	2.62	97	3.52
V7							
V8		5.28	2	254	3.12	98	2.67
V9		4.47	18	239	3.09	98	4.10
V10		4.92	9	233	2.64	97	5.71
V11		5.23	3	257	2.43	94	2.38
V12		4.84	11	273	3.58	99	4.29
V13		5.16	5	359	2.35	82	4.38
V14		4.20	20	335	2.83	98	1.43
V15		4.77	13	285	2.85	98	3.71
V16		5.59	1	278	3.18	96	2.38
V17		4.69	14	272	2.68	96	4.57
V18		4.89	10	315	2.79	96	1.81
V19							
V20		4.59	16	264	3.67	96	4.00
V21		4.93	8	276	3.58	95	0.76
V22							#VALUE!
V23		5.00	6	235	4.71	95	0.67
V24							
V25							
C.D.(0.05)		0.34		29.78	0.4	3.12	
C.V. (%)		6.11		9.62	11.62	2.86	
Expt. Mean		4.86		271	3.02	95	
Soil type		-					
pH		6.90					
F - levels (kg/ha)							
F1		45:30:30					
F2		90:60:60					
Recommended N:P:K (kg/ha)		90:60:60					

Table 4.1 (f): Contd.

F-levels	Varieties	MARUTERU					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties						
	V1	IET 29860					
	V2	IET 29877					
	V3	IET 31478(H)					
	V4	IET 31479(H)					
	V5	IET 31480(H)					
	V6	IET 31481(H)					
	V7	-					
	V8	IET 31618					
	V9	IET 31633					
	V10	IET 31637					
	V11	IET 31638					
	V12	IET 31639					
	V13	IET 31640					
	V14	IET 31641					
	V15	IET 31643					
	V16	IET 31659					
	V17	NC- NDR 359					
	V18	PR121 (N)					
	V19	CR Dhan 300 (E & NE)					
	V20	Karma Mahsuri (C)					
	V21	Akshaydhan (W)					
	V22	Jaya (S)					
	V23	HRI 174					
	V24	-					
	V25	-					
Available N:P:K of soil (kg/ha)		163:23.3:336					

Table 4.1 (f): Contd.

F-levels	Varieties	MASODHA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	3.42	19	255	3.08	29.60	102	
	V2	4.32	8	251	3.16	22.13	105	
	V3	3.69	15	250	3.12	25.90	103	
	V4	3.73	14	259	2.97	23.67	106	
	V5	2.32	35	244	2.73	25.07	103	
	V6	3.18	21	223	2.93	21.97	103	
	V7	-	-	-	-	-	-	
	V8	2.40	34	230	2.82	25.33	101	
	V9	3.06	24	232	2.94	24.17	106	
	V10	2.24	40	253	2.81	20.40	108	
	V11	-	-	-	-	-	-	
	V12	3.09	22	230	2.71	23.27	102	
	V13	2.22	41	233	2.79	20.63	104	
	V14	3.06	24	241	2.73	21.60	90	
	V15	3.26	20	224	2.74	21.40	94	
	V16	-	-	-	-	-	-	
	V17	2.49	31	245	2.39	19.33	89	
	V18	2.41	32	233	2.53	19.13	85	
	V19	2.32	35	233	2.56	19.93	91	
	V20	2.25	38	246	2.72	20.47	82	
	V21	2.17	42	238	2.41	19.37	88	
	V22	2.41	32	224	2.59	19.97	92	
	V23	2.32	35	234	2.45	19.73	90	
	V24	2.25	38	236	2.71	21.37	95	
	V25	-	-	-	-	-	-	
F2: Optimum input 100% NPK	V1	4.85	5	275	4.50	26.70	102	13.00
	V2	5.83	1	266	4.79	32.77	105	13.73
	V3	5.46	3	263	4.25	26.93	103	16.09
	V4	5.05	4	262	3.81	23.43	106	12.00
	V5	4.17	9	266	4.50	24.63	103	16.82
	V6	5.52	2	271	4.01	26.97	103	21.27
	V7	-	-	-	-	-	-	
	V8	4.02	11	272	3.90	22.90	101	14.73
	V9	3.83	12	255	3.79	23.25	106	7.00
	V10	4.11	10	238	3.60	26.30	108	17.00
	V11	-	-	-	-	-	-	
	V12	4.84	6	251	4.09	24.53	102	15.91
	V13	4.64	7	236	3.18	23.40	104	22.00
	V14	3.81	13	225	3.22	25.83	90	6.82
	V15	2.94	26	273	3.70	22.90	94	-2.91
	V16	-	-	-	-	-	-	
	V17	3.50	17	252	3.24	22.67	96	9.18
	V18	3.44	18	255	3.52	20.80	92	9.36
	V19	3.53	16	254	2.94	20.83	97	11.00
	V20	3.07	23	271	3.05	22.47	95	7.45
	V21	2.87	28	255	3.08	21.57	94	6.36
	V22	2.77	29	261	3.33	20.17	94	3.27
	V23	2.77	29	260	3.20	22.03	97	4.09
	V24	2.90	27	246	3.55	20.07	99	5.91
	V25	-	-	-	-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	MASODHA						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction F at same V V at same F		0.75 0.72		17.81 26.22	1.09 0.91	4.31 4.03	10.96 10.35	
F1		3.03	2	241	2.85	23.18	101	
F2		4.47	1	257	3.90	25.23	102	13.05
C.D.(0.05) C.V.(%)		0.35 13.58		NS 13.3	0.8 32.43	NS 12.8	NS 7.25	
Mean of varieties:								
V1		4.14	5	265	3.79	28.15	102	13.00
V2		5.08	1	258	3.98	27.45	105	13.73
V3		4.58	2	257	3.69	26.42	103	16.09
V4		4.39	3	261	3.39	23.55	106	12.00
V5		3.25	10	255	3.62	24.85	103	16.82
V6		4.35	4	247	3.47	24.47	103	21.27
V7		-		-	-	-	-	
V8		3.21	11	251	3.36	24.12	101	14.73
V9		3.45	7	243	3.37	23.71	106	7.00
V10		3.18	12	246	3.21	23.35	108	17.00
V11		-		-	-	-	-	
V12		3.97	6	241	3.40	23.90	102	15.91
V13		3.43	9	234	2.99	22.02	104	22.00
V14		3.44	8	233	2.98	23.72	90	6.82
V15		3.10	13	249	3.22	22.15	94	-2.91
V16		-		-	-	-	-	
V17		3.00	14	249	2.82	21.00	93	9.18
V18		2.93	15	244	3.03	19.97	88	9.36
V19		2.93	15	243	2.75	20.38	94	11.00
V20		2.66	17	259	2.89	21.47	89	7.45
V21		2.52	21	247	2.75	20.47	91	6.36
V22		2.59	18	243	2.96	20.07	93	3.27
V23		2.55	20	247	2.83	20.88	93	4.09
V24		2.58	19	241	3.13	20.72	97	5.91
V25		-		-	-	-	-	
C.D.(0.05)		0.51		12.59	NS	NS	NS	
C.V. (%)		13.04		4.42	17.5	10.79	6.48	
Expt. Mean		3.39		248	3.22	22.99	98	
Soil type		Sand 32.2,Silt 48.6 & Clay 16.2						
pH		7.40						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						

Table 4.1 (f): Contd.

F-levels	Varieties	MASODHA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	-						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	-						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - NDR 2065, 125 days						
	V25	-						
	Available N:P:K of soil (kg/ha)	75.4:13.5:22.5						

Table 4.1 (f): Contd.

F-levels	Varieties	NAGINA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	2.49	38	216	3.41	25.91	117	
	V2	2.43	41	239	3.37	25.91	119	
	V3	2.57	34	239	3.32	25.98	105	
	V4	2.71	26	244	3.40	26.03	111	
	V5	2.58	33	244	3.39	25.92	114	
	V6	2.65	29	221	3.15	25.91	98	
	V7	-		-	-	-	-	
	V8	2.66	28	239	3.32	25.98	118	
	V9	2.59	31	244	3.40	26.03	115	
	V10	2.57	34	237	3.31	25.90	119	
	V11	2.27	43	233	3.36	25.91	113	
	V12	2.52	37	233	3.47	25.98	106	
	V13	3.00	23	244	3.18	25.91	109	
	V14	2.59	31	241	3.40	26.00	108	
	V15	2.80	24	236	3.38	25.94	33	
	V16	2.48	39	218	3.36	25.94	116	
	V17	2.73	25	255	2.74	26.06	121	
	V18	2.64	30	243	2.69	25.33	108	
	V19	2.17	44	217	3.30	25.18	108	
	V20	2.70	27	252	2.74	24.55	104	
	V21	2.54	36	238	2.61	24.44	117	
	V22	2.35	42	224	2.55	24.35	106	
	V23	2.45	40	237	2.62	25.17	108	
	V24	-		-	-	-	-	
	V25	-		-	-	-	-	
F2: Optimum input 100% NPK	V1	4.45	13	311	3.60	26.57	119	17.82
	V2	4.33	19	316	3.36	26.40	119	17.27
	V3	4.38	17	317	3.48	26.39	106	16.45
	V4	4.59	8	325	3.20	26.46	113	17.09
	V5	4.69	6	329	3.52	26.41	116	19.18
	V6	4.46	12	320	2.95	26.42	97	16.45
	V7	-		-	-	-	-	
	V8	4.67	7	321	3.16	26.34	119	18.27
	V9	4.39	16	312	3.36	26.38	117	16.36
	V10	4.57	9	310	3.48	26.39	119	18.18
	V11	4.44	14	325	3.20	26.46	111	19.73
	V12	4.52	11	317	3.35	26.33	105	18.18
	V13	4.87	1	297	3.36	26.39	110	17.00
	V14	4.54	10	306	3.48	26.42	110	17.73
	V15	4.83	2	299	3.20	26.36	100	18.45
	V16	4.29	21	310	2.98	26.40	115	16.45
	V17	4.77	3	357	3.13	26.77	123	18.55
	V18	4.73	5	305	3.05	26.19	110	19.00
	V19	4.06	22	279	2.50	26.32	107	17.18
	V20	4.76	4	355	3.13	25.34	105	18.73
	V21	4.43	15	280	2.94	25.27	119	17.18
	V22	4.32	20	279	2.83	25.16	106	17.91
	V23	4.38	17	270	2.91	26.19	107	17.55
	V24	-		-	-	-	-	
	V25	-		-	-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	NAGINA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction								
<i>F at same V</i>		NS		19.97	0.07	0.04	14.7	
<i>V at same F</i>		NS		20.47	0.06	0.04	13.97	
F1		2.60	2	236	3.31	25.96	108	
F2		4.55	1	317	3.30	26.43	112	17.70
<i>C.D.(0.05)</i>		0.1		7.94	NS	0	NS	
<i>C.V.(%)</i>		3.93		3.88	2.05	0.02	8.54	
Mean of varieties:								
V1		3.47	16	264	3.51	26.24	118	17.82
V2		3.38	19	278	3.37	26.16	119	17.27
V3		3.48	15	278	3.40	26.19	105	16.45
V4		3.65	7	285	3.30	26.25	112	17.09
V5		3.64	8	287	3.46	26.17	115	19.18
V6		3.56	11	270	3.05	26.17	97	16.45
V7		-		-	-	-	-	
V8		3.67	6	280	3.24	26.16	119	18.27
V9		3.49	13	278	3.38	26.21	116	16.36
V10		3.57	9	273	3.40	26.15	119	18.18
V11		3.36	20	279	3.28	26.19	112	19.73
V12		3.52	12	275	3.41	26.16	106	18.18
V13		3.94	1	271	3.27	26.15	110	17.00
V14		3.57	10	274	3.44	26.21	109	17.73
V15		3.82	2	268	3.29	26.15	66	18.45
V16		3.39	18	264	3.17	26.17	116	16.45
V17		3.75	3	306	2.94	26.42	122	18.55
V18		3.69	5	274	2.87	25.76	109	19.00
V19		3.12	22	248	2.90	25.75	107	17.18
V20		3.73	4	303	2.94	24.95	105	18.73
V21		3.49	14	259	2.78	24.86	118	17.18
V22		3.34	21	251	2.69	24.76	106	17.91
V23		3.42	17	253	2.77	25.68	108	17.55
V24		-		-	-	-	-	
V25		-		-	-	-	-	
<i>C.D.(0.05)</i>		0.17		14.12	0.05	0.03	9.88	
<i>C.V. (%)</i>		4.12		4.5	1.25	0.09	7.84	
Expt. Mean		3.54		273	3.17	25.95	110	
Soil type		-						
pH		7.70						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						

Table 4.1 (f): Contd.

F-levels	Varieties	NAGINA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - Sonagathi, 120-125 days						
	V25	-						
	Available N:P:K of soil (kg/ha)	21:18.33:209						

Table 4.1 (f): Contd.

F-levels	Varieties	NAVSARI					
		Grain Yield (t/ha)	Rank	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.32	14	2.98	22.46	90	
	V2	4.16	22	3.09	21.66	90	
	V3	4.21	20	3.09	22.30	88	
	V4	4.30	15	3.40	21.60	92	
	V5	3.95	31	3.36	23.55	88	
	V6	4.33	13	2.77	23.84	90	
	V7	-		-	-	-	
	V8	4.35	12	3.09	22.32	92	
	V9	4.13	24	3.17	21.94	97	
	V10	3.79	36	3.88	21.30	92	
	V11	3.56	41	3.64	23.47	93	
	V12	3.40	43	3.21	22.36	91	
	V13	3.58	40	3.29	23.57	96	
	V14	3.90	32	3.28	21.10	94	
	V15	3.76	38	3.54	20.07	95	
	V16	3.29	47	3.65	24.08	93	
	V17	2.98	48	2.90	21.20	91	
	V18	4.28	17	4.66	21.59	93	
	V19	4.00	29	2.55	24.94	97	
	V20	4.16	22	2.35	22.44	96	
	V21	3.53	42	2.52	23.77	98	
	V22	3.33	45	4.27	25.62	87	
	V23	3.37	44	3.07	20.87	99	
	V24	4.19	21	3.91	18.03	87	
	V25	3.87	35	3.86	29.24	88	
F2: Optimum input 100% NPK	V1	4.47	8	3.83	24.54	90	2.31
	V2	4.30	15	4.38	22.91	89	2.15
	V3	4.52	5	5.13	24.70	89	4.77
	V4	4.51	6	4.50	23.25	92	3.23
	V5	4.25	18	4.88	25.62	88	4.62
	V6	4.57	4	4.08	24.13	90	3.69
	V7	-		-	-	-	
	V8	4.62	3	4.16	24.53	93	4.15
	V9	4.48	7	4.30	24.37	95	5.38
	V10	4.10	25	4.76	22.61	91	4.77
	V11	3.97	30	4.69	23.93	93	6.31
	V12	3.89	33	4.56	23.86	91	7.54
	V13	4.09	27	4.11	23.87	95	7.85
	V14	4.22	19	4.95	22.62	94	4.92
	V15	4.10	25	4.61	21.48	93	5.23
	V16	3.78	37	4.84	24.96	93	7.54
	V17	3.31	46	3.17	23.67	91	5.08
	V18	4.63	1	4.37	29.61	91	5.38
	V19	4.45	9	2.93	24.52	96	6.92
	V20	4.42	11	2.86	15.56	95	4.00
	V21	4.07	28	2.79	24.50	98	8.31
	V22	3.72	39	3.96	27.04	88	6.00
	V23	3.89	33	3.13	23.22	98	8.00
	V24	4.63	1	3.73	18.50	87	6.77
	V25	4.45	9	4.19	30.84	88	8.92

Table 4.1 (f): Contd.

F- levels	Varieties	NAVSARI					
		Grain Yield (t/ha)	Rank	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction							
<i>F at same V</i>		NS		0.5	1.3	1.33	
<i>V at same F</i>		NS		0.51	1.31	1.32	
F1		3.88	2	3.27	22.3	92	
F2		4.20	1	4.43	23.8	92	4.97
<i>C.D.(0.05)</i>		0.18		0.21	0.29	NS	
<i>C.V.(%)</i>		6.27		7.92	1.72	0.63	
Mean of varieties:							
V1		4.40	6	3.41	23.5	90	2.31
V2		4.23	10	3.74	22.3	90	2.15
V3		4.37	7	4.11	23.5	88	4.77
V4		4.41	5	3.95	22.4	92	3.23
V5		4.10	13	4.12	24.6	88	4.62
V6		4.45	3	3.43	24.0	90	3.69
V7		-		-	-	-	
V8		4.49	1	3.63	23.4	92	4.15
V9		4.31	8	3.74	23.2	96	5.38
V10		3.95	15	4.32	22.0	92	4.77
V11		3.77	19	4.17	23.7	93	6.31
V12		3.65	20	3.89	23.1	91	7.54
V13		3.84	17	3.70	23.7	96	7.85
V14		4.06	14	4.12	21.9	94	4.92
V15		3.93	16	4.08	20.8	94	5.23
V16		3.54	22	4.25	24.5	93	7.54
V17		3.15	24	3.04	22.4	91	5.08
V18		4.46	2	4.52	25.6	92	5.38
V19		4.23	11	2.74	24.7	96	6.92
V20		4.29	9	2.61	19.0	96	4.00
V21		3.80	18	2.66	24.1	98	8.31
V22		3.53	23	4.12	26.3	87	6.00
V23		3.63	21	3.10	22.0	98	8.00
V24		4.41	4	3.82	18.3	87	6.77
V25		4.16	12	4.03	30.0	88	8.92
<i>C.D.(0.05)</i>		0.27		0.35	0.93	0.93	
<i>C.V. (%)</i>		5.88		8.25	3.46	0.88	
Expt. Mean		4.05		3.72	23.30	92	
Soil type		Clayey					
pH		7.88					
F - levels (kg/ha)							
F1		50:15:0					
F2		100:30:0					
Recommended N:P:K (kg/ha)		100:30:0					

Table 4.1 (f): Contd.

F-levels	Varieties	NAVSARI					
		Grain Yield (t/ha)	Rank	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties						
	V1	IET 29860					
	V2	IET 29877					
	V3	IET 31478(H)					
	V4	IET 31479(H)					
	V5	IET 31480(H)					
	V6	IET 31481(H)					
	V7	-					
	V8	IET 31618					
	V9	IET 31633					
	V10	IET 31637					
	V11	IET 31638					
	V12	IET 31639					
	V13	IET 31640					
	V14	IET 31641					
	V15	IET 31643					
	V16	IET 31659					
	V17	NC- NDR 359					
	V18	PR121 (N)					
	V19	CR Dhan 300 (E & NE)					
	V20	Karma Mahsuri (C)					
	V21	Akshaydhan (W)					
	V22	Jaya (S)					
	V23	HRI 174					
	V24	Local Check - GNR-3, 120-125 dayss					
	V25	Hybrid Check					
	Available N:P:K of soil (kg/ha)	255:36.6:708.3					

Table 4.1 (f): Contd.

F-levels	Varieties	NAWAGAM						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.32	24	209	4.60	22.43	102	
	V2	3.87	33	217	4.18	17.83	111	
	V3	3.91	32	238	4.30	24.90	96	
	V4	4.32	24	217	4.76	21.07	98	
	V5	5.25	19	184	4.62	22.80	113	
	V6	4.36	23	211	4.13	24.90	88	
	V7	-		-	-	-	-	
	V8	3.80	35	229	4.01	19.17	105	
	V9	4.13	29	213	5.23	20.07	112	
	V10	3.49	37	229	5.35	21.50	113	
	V11	4.27	26	238	3.86	24.13	97	
	V12	5.00	20	192	4.11	22.90	112	
	V13	3.06	44	209	1.47	11.47	112	
	V14	3.74	36	254	3.17	20.10	110	
	V15	3.07	43	209	3.29	21.07	105	
	V16	3.35		182	3.52	18.73	108	
	V17	3.15	42	221	3.08	24.77	98	
	V18	2.85	45	172	3.50	20.57	97	
	V19	3.31	40	151	3.98	24.07	117	
	V20	2.72	46	198	3.24	16.53	114	
	V21	3.18	41	258	3.55	18.00	109	
	V22	4.24		236	4.20	22.73	97	
	V23	4.24	27	254	3.91	17.87	101	
	V24	4.07	31	265	3.99	15.07	100	
	V25	-		-	-	-	-	
F2: Optimum input 100% NPK	V1	6.60	5	238	5.17	22.30	102	36.48
	V2	5.66	14	260	4.20	17.90	111	28.64
	V3	5.94	11	254	4.74	24.73	97	32.48
	V4	6.88	2	225	5.35	21.20	99	40.96
	V5	7.05	1	231	4.85	22.67	114	28.80
	V6	6.76	4	258	5.32	24.70	89	38.40
	V7	-		-	-	-	-	
	V8	5.68	13	246	4.09	19.23	106	30.08
	V9	6.53	7	252	5.44	19.70	112	38.40
	V10	5.49	16	258	5.37	21.80	114	32.00
	V11	5.84	12	254	3.94	24.07	97	25.12
	V12	6.28	8	213	4.53	22.83	111	20.48
	V13	4.13	29	236	2.76	12.83	113	17.12
	V14	5.50	15	289	3.68	20.60	111	28.16
	V15	4.87	21	248	3.47	21.03	104	28.80
	V16	5.45		205	3.63	19.43	107	33.60
	V17	3.82	34	254	3.15	24.63	98	10.72
	V18	3.34	39	236	3.67	20.60	97	7.84
	V19	5.34	18	192	4.05	23.83	116	32.48
	V20	5.98	10	244	3.71	17.13	114	52.16
	V21	4.85	22	289	2.93	18.40	111	26.72
	V22	6.58		289	4.16	23.20	97	37.44
	V23	6.01	9	283	3.89	18.63	101	28.32
	V24	6.80	3	306	4.04	15.57	101	43.68
	V25	-		-	-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	NAWAGAM						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction <i>F at same V</i> <i>V at same F</i>		0.7 0.69		NS NS	NS NS	NS NS	NS NS	
F1		3.94	2	216	3.98	21.12	105	
F2		5.78	1	245	4.36	21.23	105	29.39
<i>C.D.(0.05)</i> <i>C.V.(%)</i>		0.23 6.54		15.74 9.2	NS 15.25	NS 4.73	NS 1.09	
Mean of varieties:								
V1		5.46	5	223	4.89	22.37	102	36.48
V2		4.77	12	239	4.19	17.87	111	28.64
V3		4.93	11	246	4.52	24.82	96	32.48
V4		5.60	3	221	5.06	21.14	99	40.96
V5		6.15	1	208	4.74	22.74	113	28.80
V6		5.56	4	234	4.73	24.80	89	38.40
V7		-		-	-	-	-	
V8		4.74	13	238	4.05	19.20	106	30.08
V9		5.33	8	233	5.34	19.89	112	38.40
V10		4.49	15	244	5.36	21.65	114	32.00
V11		5.06	10	246	3.90	24.10	97	25.12
V12		5.64	2	203	4.32	22.87	111	20.48
V13		3.60	21	222	2.12	12.15	112	17.12
V14		4.62	14	272	3.43	20.35	111	28.16
V15		3.97	20	228	3.38	21.05	104	28.80
V16		4.40	16	193	3.58	19.08	107	33.60
V17		3.49	22	238	3.12	24.70	98	10.72
V18		3.10	23	204	3.59	20.59	97	7.84
V19		4.33	18	172	4.02	23.95	116	32.48
V20		4.35	17	221	3.48	16.83	114	52.16
V21		4.02	19	274	3.24	18.20	110	26.72
V22		5.41	7	262	4.18	22.97	97	37.44
V23		5.13	9	269	3.90	18.25	101	28.32
V24		5.44	6	285	4.02	15.32	100	43.68
V25		-		-	-	-	-	
<i>C.D.(0.05)</i>		0.49		26.2	0.48	0.68	1.01	
<i>C.V. (%)</i>		8.97		9.78	10.29	2.86	0.84	
Expt. Mean		4.76		234	4.05	20.65	105	
Soil type		Clay loam						
pH		7.88						
F - levels (kg/ha)								
F1		50:12.5:0						
F2		100:25:0						
Recommended N:P:K (kg/ha)		100:25:0						

Table 4.1 (f): Contd.

F-levels	Varieties	NAWAGAM						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - GAR 13, 120-125 days						
	V25	-						
	Available N:P:K of soil (kg/ha)	250:78.6:428						

Table 4.1 (f): Contd.

F-levels	Varieties	PANTNAGAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	2.78	31	179	1.81	26.76	122	
	V2	3.61	23	192	2.14	26.91	111	
	V3	4.05	21	219	2.16	22.96	90	
	V4	4.38	15	222	2.21	23.05	97	
	V5	3.60	24	180	2.22	27.90	108	
	V6	4.38	15	216	2.39	26.21	81	
	V7	-		-	-	-	-	
	V8	3.51	26	200	2.08	26.91	118	
	V9	2.60	33	160	1.88	26.76	122	
	V10	3.58	25	191	2.17	25.47	122	
	V11	3.05	29	171	2.09	24.37	103	
	V12	-		-	-	-	-	
	V13	2.46	35	151	1.89	23.77	93	
	V14	3.06	27	190	1.88	27.90	121	
	V15	2.97	30	179	1.95	23.77	120	
	V16	3.06	27	181	1.96	21.72	112	
	V17	2.49	34	173	1.72	26.25	90	
	V18	2.46	35	160	1.85	24.37	102	
	V19	-		-	-	-	-	
	V20	-		-	-	-	-	
	V21	-		-	-	-	-	
	V22	-		-	-	-	-	
	V23	4.05	21	222	2.09	26.91	95	
	V24	2.63	32	164	2.01	26.25	87	
	V25	-		-	-	-	-	
F2: Optimum input 100% NPK	V1	4.53	11	230	2.25	26.76	122	15.91
	V2	4.46	13	225	2.28	26.91	111	7.73
	V3	5.24	2	262	2.27	22.96	90	10.82
	V4	4.88	4	244	2.19	23.05	97	4.55
	V5	4.40	14	222	2.27	27.90	108	7.27
	V6	5.29	1	261	2.26	26.21	81	8.27
	V7	-		-	-	-	-	
	V8	4.56	8	223	2.21	26.91	118	9.55
	V9	4.82	5	230	2.32	26.76	122	20.18
	V10	4.31	18	225	2.15	25.47	122	6.64
	V11	4.62	6	226	2.26	24.37	103	14.27
	V12	-		-	-	-	-	
	V13	4.22	20	216	2.17	23.77	93	16.00
	V14	4.53	11	226	2.31	27.90	121	13.36
	V15	4.54	10	225	2.35	23.77	120	14.27
	V16	4.35	17	217	2.28	21.72	112	11.73
	V17	4.99	3	232	2.34	26.25	90	22.73
	V18	4.61	7	228	2.23	24.37	102	19.55
	V19	-		-	-	-	-	
	V20	-		-	-	-	-	
	V21	-		-	-	-	-	
	V22	-		-	-	-	-	
	V23	4.56	8	228	2.31	26.91	95	4.64
	V24	4.30	19	224	2.22	26.53	90	15.18
	V25	-		-	-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	PANTNAGAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction <i>F at same V</i> <i>V at same F</i>		0.37 0.39		8.81 8.77	0.12 0.11	NS NS	NS NS	
F1		3.31	2	187	2.04	25.38	107	
F2		4.65	1	231	2.26	25.38	107	12.22
<i>C.D.(0.05)</i>		0.2		2.42	0.03	0.01	NS	
<i>C.V.(%)</i>		6.23		1.4	1.82	0.04	0.66	
Mean of varieties:								
V1		3.66	15	205	2.03	26.76	122	15.91
V2		4.04	5	209	2.21	26.91	111	7.73
V3		4.65	2	241	2.22	22.96	90	10.82
V4		4.63	3	233	2.20	23.05	97	4.55
V5		4.00	7	201	2.25	27.90	108	7.27
V6		4.84	1	238	2.33	26.21	81	8.27
V7		-		-	-	-	-	
V8		4.04	5	212	2.15	26.91	118	9.55
V9		3.71	13	195	2.10	26.76	122	20.18
V10		3.95	8	208	2.16	25.47	122	6.64
V11		3.84	9	198	2.18	24.37	103	14.27
V12		-		-	-	-	-	
V13		3.34	18	184	2.03	23.77	93	16.00
V14		3.80	10	208	2.10	27.90	121	13.36
V15		3.76	11	202	2.15	23.77	120	14.27
V16		3.71	14	199	2.12	21.72	112	11.73
V17		3.74	12	203	2.03	26.25	90	22.73
V18		3.54	16	194	2.04	24.37	102	19.55
V19		-		-	-	-	-	
V20		-		-	-	-	-	
V21		-		-	-	-	-	
V22		-		-	-	-	-	
V23		4.31	4	225	2.20	26.91	95	4.64
V24		3.47	17	194	2.12	26.39	88	15.18
V25		-		-	-	-	-	
<i>C.D.(0.05)</i>		0.26		6.23	0.08	0.2	0.7	
<i>C.V. (%)</i>		5.74		2.62	3.32	0.7	0.58	
Expt. Mean		3.94		208	2.14	25.47	105	
Soil type		Silt loam						
pH		7.50						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						

Table 4.1 (f): Contd.

F-levels	Varieties	PANTNAGAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	-						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	-						
	V20	-						
	V21	-						
	V22	-						
	V23	HRI 174						
	V24	Local Check - Pant Dhan 24, 130-135 days						
	V25	-						
Available	N:P:K of soil (kg/ha)	222.3:38.5:212.3						

Table 4.1 (f): Contd.

F-levels	Varieties	PUDUCHERRY					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.76	24	259	2.80	24.86	
	V2	3.95	42	155	1.81	18.96	
	V3	4.78	23	270	2.87	28.76	
	V4	4.68	28	217	2.67	25.78	
	V5	4.84	22	276	2.85	25.53	
	V6	4.69	27	222	2.72	28.04	
	V7	-		-	-	-	
	V8	4.07	39	162	2.04	26.59	
	V9	4.40	35	181	2.35	22.95	
	V10	4.64	30	204	2.79	21.77	
	V11	4.02	41	159	1.89	22.62	
	V12	4.06	40	161	2.00	28.90	
	V13	4.74	25	248	2.76	24.83	
	V14	4.65	29	210	2.65	13.35	
	V15	4.72	26	230	3.01	22.20	
	V16	-		-	-	-	
	V17	4.44	34	184	2.65	23.78	
	V18	4.61	31	196	2.65	21.65	
	V19	4.24	36	171	2.13	28.20	
	V20	4.16	37	164	1.93	26.69	
	V21	4.57	32	193	3.40	28.57	
	V22	-		-	-	-	
	V23	4.53	33	189	2.40	19.77	
	V24	4.11	38	167	3.20	21.07	
	V25	-		-	-	-	
F2: Optimum input 100% NPK	V1	6.68	2	301	3.46	25.77	19.20
	V2	5.57	21	181	1.90	19.73	16.20
	V3	6.66	4	314	3.66	29.60	18.80
	V4	6.53	7	253	2.93	27.08	18.50
	V5	6.73	1	321	3.12	26.00	18.90
	V6	6.61	5	259	3.05	28.10	19.20
	V7	-		-	-	-	
	V8	5.68	19	189	2.56	27.05	16.10
	V9	6.11	14	210	2.56	23.78	17.10
	V10	6.47	9	238	2.96	22.52	18.30
	V11	5.60	20	184	2.04	23.30	15.80
	V12	5.72	17	188	2.20	29.21	16.60
	V13	6.68	2	288	3.30	25.49	19.40
	V14	6.48	8	245	3.03	13.72	18.30
	V15	6.58	6	267	3.08	23.18	18.60
	V16	-		-	-	-	
	V17	6.21	13	214	3.07	24.72	17.70
	V18	6.45	10	229	3.43	22.73	18.40
	V19	5.92	15	199	2.86	29.04	16.80
	V20	5.80	16	191	2.26	27.41	16.40
	V21	6.37	11	225	4.93	28.94	18.00
	V22	-		-	-	-	
	V23	6.25	12	220	2.59	19.99	17.20
	V24	5.72	17	194	3.44	21.77	16.10
	V25	-		-	-	-	

Table 4.1 (f): Contd.

F- levels	Varieties	PUDUCHERRY					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction							
F at same V		0.06		2.88	0.04	0.27	
V at same F		0.29		21.44	0.05	0.27	
F1		4.50	2	209	2.52		
F2		6.29	1	244	2.86		17.91
C.D.(0.05)		0.39		29.76	0.03	0.07	
C.V.(%)		9.56		17.85	1.61	0.35	
Mean of varieties:							
V1		5.72	3	280	3.13	25.32	19.20
V2		4.76	21	168	1.86	19.35	16.20
V3		5.72	2	292	3.27	29.18	18.80
V4		5.61	7	235	2.80	26.43	18.50
V5		5.79	1	298	2.99	25.77	18.90
V6		5.65	5	241	2.89	28.07	19.20
V7		-		-	-	-	
V8		4.88	19	176	2.30	26.82	16.10
V9		5.26	14	196	2.46	23.37	17.10
V10		5.56	9	221	2.88	22.15	18.30
V11		4.81	20	171	1.97	22.96	15.80
V12		4.89	18	175	2.10	29.06	16.60
V13		5.71	4	268	3.03	25.16	19.40
V14		5.57	8	228	2.84	13.54	18.30
V15		5.65	5	248	3.05	22.69	18.60
V16		-		-	-	-	
V17		5.33	13	199	2.86	24.25	17.70
V18		5.53	10	213	3.04	22.19	18.40
V19		5.08	15	185	2.50	28.62	16.80
V20		4.98	16	178	2.10	27.05	16.40
V21		5.47	11	209	4.17	28.76	18.00
V22		-		-	-	-	
V23		5.39	12	204	2.50	19.88	17.20
V24		4.92	17	180	3.32	21.42	16.10
V25							
C.D.(0.05)		0.04		2.04	0.03	0.19	
C.V. (%)		0.67		0.82	0.93	0.68	
Expt. Mean		5.34		217	2.76	24.38	
Soil type		Clayey loam					
pH		-					
F - levels (kg/ha)							
F1		60:20:20					
F2		120:40:40					
Recommended N:P:K (kg/ha)		120:40:40					

Table 4.1 (f): Contd.

F-levels	Varieties	PUDUCHERRY					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties						
	V1	IET 29860					
	V2	IET 29877					
	V3	IET 31478(H)					
	V4	IET 31479(H)					
	V5	IET 31480(H)					
	V6	IET 31481(H)					
	V7	-					
	V8	IET 31618					
	V9	IET 31633					
	V10	IET 31637					
	V11	IET 31638					
	V12	IET 31639					
	V13	IET 31640					
	V14	IET 31641					
	V15	IET 31643					
	V16	-					
	V17	NC- NDR 359					
	V18	PR121 (N)					
	V19	CR Dhan 300 (E & NE)					
	V20	Karma Mahsuri (C)					
	V21	Akshaydhan (W)					
	V22	-					
	V23	HRI 174					
	V24	Local Check - BPT 5201, 135 days					
	V25	-					
	Available N:P:K of soil (kg/ha)	123.2:28.6:111					

Table 4.1 (f): Contd.

F-levels	Varieties	Rajendranga ARI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	6.20	21	209	6.14	22.49	108	
	V2	5.75	33	297	4.44	20.96	108	
	V3	5.76	32	245	6.03	26.53	100	
	V4	6.12	22	230	4.94	24.80	101	
	V5	7.04	8	235	5.14	26.30	105	
	V6	6.03	26	246	4.52	26.63	98	
	V7	-	-	-	-	-	-	
	V8	5.68	37	271	4.02	20.93	112	
	V9	5.32	43	301	4.26	21.23	106	
	V10	5.73	34	277	4.77	24.20	103	
	V11	5.78	30	289	4.23	28.50	107	
	V12	6.06	24	242	5.65	23.03	103	
	V13	4.08	48	274	3.20	13.40	113	
	V14	6.74	12	308	4.25	23.23	112	
	V15	6.39	18	330	4.97	24.70	111	
	V16	6.68	13	292	3.89	22.17	101	
	V17	5.50	39	277	5.55	28.53	100	
	V18	5.35	42	281	4.64	29.40	99	
	V19	6.05	25	244	4.76	28.97	113	
	V20	4.88	46	265	4.05	19.03	104	
	V21	4.89	45	256	4.30	23.50	98	
	V22	5.38	41	249	4.78	27.20	107	
	V23	6.38	19	231	4.42	25.03	101	
	V24	4.77	47	274	3.73	15.70	98	
	V25	7.17	5	261	4.36	27.97	99	
F2: Optimum input 100% NPK	V1	7.15	6	250	6.97	24.30	108	8.64
	V2	6.44	17	334	4.26	20.40	107	6.27
	V3	7.22	4	283	5.74	27.97	100	13.27
	V4	7.13	7	238	5.66	25.47	102	9.18
	V5	8.71	1	238	5.37	26.30	105	15.18
	V6	6.49	16	249	5.17	27.97	99	4.18
	V7	-	-	-	-	-	-	
	V8	5.83	29	283	3.93	21.27	113	1.36
	V9	5.97	27	284	5.13	21.23	107	5.91
	V10	6.35	20	285	4.35	25.00	104	5.64
	V11	5.93	28	258	4.57	27.80	106	1.36
	V12	6.76	11	276	6.40	24.43	103	6.36
	V13	5.31	44	278	3.60	12.97	113	11.18
	V14	6.83	9	312	4.14	23.13	112	0.82
	V15	6.78	10	251	4.61	23.10	111	3.55
	V16	7.27	3	275	4.54	20.93	101	5.36
	V17	5.71	36	271	5.55	28.33	102	1.91
	V18	5.72	35	345	4.85	27.37	100	3.36
	V19	6.68	13	274	5.36	29.87	113	5.73
	V20	5.78	30	324	4.56	17.87	105	8.18
	V21	6.09	23	330	4.22	21.37	98	10.91
	V22	5.58	38	318	5.19	25.37	108	1.82
	V23	6.50	15	309	4.76	24.58	101	1.09
	V24	5.47	40	297	3.51	15.87	99	6.36
	V25	8.00	2	292	5.34	27.60	100	7.55

Table 4.1 (f): Contd.

F- levels	Varieties	Rajendranga ARI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction F at same V V at same F F1 F2 C.D.(0.05) C.V.(%) Mean of varieties: V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 V15 V16 V17 V18 V19 V20 V21 V22 V23 V24 V25 C.D.(0.05) C.V. (%) Expt. Mean Soil type pH F - levels (kg/ha) F1 F2 Recommended N:P:K (kg/ha)	NS NS		NS NS	NS NS	1.08 0.93	0.57 0.48		
	5.93 6.62	2 1	270 273	4.75 5.00	23.60 23.79	105 106	6.26	
	0.61 13.85		NS 53.9	NS 25.21	NS 4.4	NS 0.57		
	6.68	5	230	6.56	23.40	108	8.64	
	6.10	13	315	4.35	20.68	108	6.27	
	6.49	8	264	5.89	27.25	100	13.27	
	6.63	6	234	5.30	25.14	101	9.18	
	7.88	1	236	5.26	26.30	105	15.18	
	6.26	12	247	4.85	27.30	98	4.18	
	-		-	-	-	-		
	5.76	16	277	3.98	21.10	113	1.36	
	5.65	17	292	4.70	21.23	107	5.91	
	6.04	14	281	4.56	24.60	103	5.64	
	5.86	15	273	4.40	28.15	106	1.36	
	6.41	10	259	6.03	23.73	103	6.36	
	4.70	24	276	3.40	13.19	113	11.18	
	6.79	4	310	4.20	23.18	112	0.82	
	6.59	7	291	4.79	23.90	111	3.55	
	6.98	3	284	4.22	21.55	101	5.36	
	5.61	18	274	5.55	28.43	101	1.91	
	5.54	19	313	4.75	28.39	99	3.36	
	6.37	11	259	5.06	29.42	113	5.73	
	5.33	22	295	4.31	18.45	104	8.18	
	5.49	20	293	4.26	22.44	98	10.91	
	5.48	21	283	4.99	26.29	107	1.82	
	6.44	9	270	4.59	24.81	101	1.09	
	5.12	23	285	3.62	15.79	98	6.36	
	7.59	2	276	4.85	27.79	99	7.55	
	0.67		50.57	0.6	0.66	0.34		
	9.49		15.99	10.94	2.4	0.28		
	6.15		276	4.77	23.85	105		
	-							
	-							
60:30:20								
120:60:40								
120:60:40								

Table 4.1 (f): Contd.

F-levels	Varieties	Rajendranga ARI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - KNM 1638						
	V25	Hybrid Check - MP 3030						
Available N:P:K of soil (kg/ha)		-						

Table 4.1 (f): Contd.

F-levels	Varieties	TITABAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	4.77	26	234	4.67	24.57	121	
	V2	4.23	34	274	3.33	19.57	119	
	V3	3.33	47	217	3.60	25.20	119	
	V4	4.00	40	253	4.07	22.97	120	
	V5	5.07	18	275	3.70	24.50	118	
	V6	3.77	43	241	2.77	26.83	122	
	V7	4.50	32	237	4.03	22.27	125	
	V8	4.80	24	255	3.63	21.20	129	
	V9	5.27	14	255	3.87	21.83	126	
	V10	4.80	24	247	3.30	23.53	130	
	V11	5.47	7	294	3.63	30.13	122	
	V12	5.40	11	240	4.70	24.07	130	
	V13	3.13	49	219	2.57	12.90	132	
	V14	4.63	31	234	3.33	21.97	132	
	V15	4.70	29	240	3.10	24.07	123	
	V16	5.47	7	257	3.50	21.90	124	
	V17	4.67	30	225	3.63	22.10	123	
	V18	3.03	50	258	2.73	26.63	124	
	V19	5.43	10	257	4.13	29.27	131	
	V20	3.50	45	281	3.47	19.70	121	
	V21	3.17	48	240	3.13	20.90	121	
	V22	4.77	26	233	3.47	25.17	123	
	V23	3.37	46	247	2.70	23.73	120	
	V24	4.23	34	240	4.03	22.97	104	
	V25	5.17	16	272	3.80	24.70	128	
F2: Optimum input 100% NPK	V1	5.40	11	239	5.20	24.23	123	10.50
	V2	4.83	23	286	3.87	20.23	120	10.00
	V3	3.77	43	242	4.83	25.30	116	7.33
	V4	4.27	33	257	4.70	22.97	116	4.50
	V5	5.47	7	283	4.37	24.73	121	6.67
	V6	4.10	37	256	3.63	23.13	116	5.50
	V7	4.97	20	246	4.87	23.40	123	7.83
	V8	5.27	14	262	3.20	22.03	126	7.83
	V9	5.63	4	259	3.90	23.13	124	6.00
	V10	5.17	16	255	3.67	29.70	128	6.17
	V11	5.70	3	311	3.80	24.07	121	3.83
	V12	5.93	1	249	5.73	12.97	129	8.83
	V13	4.07	39	262	2.90	22.97	131	15.67
	V14	5.03	19	247	3.73	23.83	132	6.67
	V15	4.97	20	248	4.13	22.37	122	4.50
	V16	5.77	2	267	3.77	21.37	121	5.00
	V17	4.90	22	246	4.37	26.30	121	3.83
	V18	3.90	42	264	3.13	25.93	121	14.50
	V19	5.40	11	272	4.27	30.47	129	-0.50
	V20	4.00	40	287	3.20	19.23	119	8.33
	V21	4.10	37	254	3.60	24.30	120	15.50
	V22	5.63	4	252	4.73	24.00	116	14.33
	V23	4.13	36	260	3.77	24.23	121	12.67
	V24	4.73	28	254	4.40	23.97	105	8.33
	V25	5.50	6	294	4.40	23.87	129	5.50

Table 4.1 (f): Contd.

F- levels	Varieties	TITABAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction								
<i>F at same V</i>		NS		NS	NS	1.14	1.55	
<i>V at same F</i>		NS		NS	NS	1.18	1.6	
F1		4.59	2	247	3.61	22.92	124	
F2		5.01	1	260	4.16	23.10	123	7.10
<i>C.D.(0.05)</i>		0.43		NS	0.36	NS	0.64	
<i>C.V.(%)</i>		13.08		8.61	13.29	2.96	0.74	
Mean of varieties:								
V1		5.09	9	236	4.94	24.40	122	10.50
V2		4.53	16	280	3.60	19.90	119	10.00
V3		3.55	24	229	4.22	25.25	118	7.33
V4		4.14	18	255	4.39	22.97	118	4.50
V5		5.27	7	279	4.04	24.62	120	6.67
V6		3.94	19	249	3.20	24.98	119	5.50
V7		4.74	15	242	4.45	22.84	124	7.83
V8		5.04	10	259	3.42	21.62	128	7.83
V9		5.45	4	257	3.89	22.48	125	6.00
V10		4.99	11	251	3.49	26.62	129	6.17
V11		5.59	3	303	3.72	27.10	121	3.83
V12		5.67	1	245	5.22	18.52	130	8.83
V13		3.60	23	241	2.74	17.94	132	15.67
V14		4.83	13	241	3.53	22.90	132	6.67
V15		4.84	12	244	3.62	23.22	122	4.50
V16		5.62	2	262	3.64	21.64	122	5.00
V17		4.79	14	236	4.00	24.20	122	3.83
V18		3.47	25	261	2.93	26.28	123	14.50
V19		5.42	5	265	4.20	29.87	130	-0.50
V20		3.75	20	284	3.34	19.47	120	8.33
V21		3.64	22	247	3.37	22.60	120	15.50
V22		5.20	8	243	4.10	24.59	120	14.33
V23		3.75	20	254	3.24	23.98	121	12.67
V24		4.48	17	247	4.22	23.47	105	8.33
V25		5.34	6	283	4.10	24.29	128	5.50
<i>C.D.(0.05)</i>		0.65		24.69	0.72	0.81	1.1	
<i>C.V. (%)</i>		12.22		8.45	16.43	3.01	0.78	
Expt. Mean		4.67		256	3.82	23.43	123	
Soil type		Clay loam						
pH		5.60						
F - levels (kg/ha)								
F1		30:10:20						
F2		60:20:40						
Recommended N:P:K (kg/ha)		60:20:40						

Table 4.1 (f): Contd.

F-levels	Varieties	TITABAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	IET 31492(H)						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - Numoli, 130-135 days						
	V25	Hybrid Check -						
Available N:P:K of soil (kg/ha)		-						

Table 4.1 (f): Contd.

F-levels	Varieties	VARANASI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input 50% NPK	V1	5.62	2	193	55.13	25.09	114	
	V2	4.46	19	193	35.84	17.26	100	
	V3	1.72	48	180	30.83	23.46	89	
	V4	3.29	42	196	37.35	20.30	93	
	V5	4.26	24	192	42.70	26.42	91	
	V6	3.47	38	195	27.31	25.84	89	
	V7	-		-	-	-	-	
	V8	3.70	33	185	29.27	26.99	105	
	V9	3.83	32	173	41.43	24.24	103	
	V10	4.31	22	171	49.95	26.41	103	
	V11	3.68	35	168	32.69	22.46	95	
	V12	4.30	23	161	30.11	20.41	107	
	V13	3.31	41	203	45.21	28.27	113	
	V14	4.91	14	208	29.71	18.60	110	
	V15	3.70	33	170	31.27	27.65	110	
	V16	4.10	28	192	35.92	22.37	103	
	V17	3.08	47	175	32.07	23.40	90	
	V18	3.26	44	189	31.86	25.52	94	
	V19	3.38	39	196	35.03	23.25	109	
	V20	3.97	30	197	34.72	25.72	94	
	V21	4.21	27	196	37.64	15.99	106	
	V22	4.22	26	192	30.54	24.66	94	
	V23	3.51	37	195	34.76	19.53	96	
	V24	5.28	7	198	37.02	17.02	104	
	V25	4.73	16	194	50.11	23.12	98	
F2: Optimum input 100% NPK	V1	5.42	3	171	37.86	22.57	114	-1.60
	V2	4.98	12	194	34.89	23.62	102	4.16
	V3	4.97	13	164	31.14	24.69	88	26.00
	V4	3.22	45	168	36.36	20.55	94	-0.56
	V5	4.38	20	178	45.75	23.98	98	0.96
	V6	4.37	21	179	32.92	28.61	88	7.20
	V7	-		-	-	-	-	
	V8	5.33	6	188	38.42	22.18	107	13.04
	V9	5.70	1	189	29.26	26.19	103	14.96
	V10	5.23	9	183	42.59	24.18	106	7.36
	V11	4.71	17	197	42.24	23.89	96	8.24
	V12	3.89	31	166	41.29	21.91	108	-3.28
	V13	3.99	29	197	30.42	19.73	116	5.44
	V14	5.34	5	209	36.58	24.81	110	3.44
	V15	5.26	8	175	29.59	19.47	110	12.48
	V16	4.79	15	178	39.00	26.16	104	5.52
	V17	4.24	25	151	45.94	23.62	91	9.28
	V18	4.52	18	199	39.16	22.06	97	10.08
	V19	3.62	36	183	28.47	26.19	113	1.92
	V20	3.38	39	200	38.10	22.92	94	-4.72
	V21	5.13	10	204	36.46	27.53	104	7.36
	V22	3.27	43	188	36.75	26.65	93	-7.60
	V23	3.13	46	193	35.48	22.28	93	-3.04
	V24	5.39	4	197	37.16	26.29	106	0.88
	V25	5.00	11	190	42.45	19.31	97	2.16

Table 4.1 (f): Contd.

F- levels	Varieties	VARANASI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Interaction F at same V V at same F		1.02 1.19		18.52 18.55	3.92 4.12	4.49 4.61	NS NS	
F1		3.86	2	185	36.67	23.70	101	
F2		4.74	1	180	37.14	23.51	102	7.04
C.D.(0.05) C.V.(%)		NS 27.09		NS 3.75	NS 7.37	NS 10.73	NS 2.95	
Mean of varieties:								
V1		5.52	1	182	46.50	23.83	114	-1.60
V2		4.72	7	194	35.37	20.44	101	4.16
V3		3.35	22	172	30.99	24.08	89	26.00
V4		3.26	24	182	36.86	20.43	94	-0.56
V5		4.32	12	185	44.23	25.20	95	0.96
V6		3.92	15	187	30.12	27.23	89	7.20
V7		-		-	-	-	-	
V8		4.52	9	186	33.85	24.59	106	13.04
V9		4.77	6	181	35.35	25.22	103	14.96
V10		4.77	5	177	46.27	25.30	105	7.36
V11		4.20	13	182	37.47	23.18	96	8.24
V12		4.10	14	164	35.70	21.16	107	-3.28
V13		3.65	20	200	37.82	24.00	115	5.44
V14		5.13	3	209	33.15	21.71	110	3.44
V15		4.48	10	173	30.43	23.56	110	12.48
V16		4.45	11	185	37.46	24.27	104	5.52
V17		3.66	19	163	39.01	23.51	90	9.28
V18		3.89	16	194	35.51	23.79	96	10.08
V19		3.50	21	190	31.75	24.72	111	1.92
V20		3.68	18	199	36.41	24.32	94	-4.72
V21		4.67	8	200	37.05	21.76	105	7.36
V22		3.75	17	190	33.65	25.66	94	-7.60
V23		3.32	23	194	35.12	20.91	95	-3.04
V24		5.34	2	198	37.09	21.66	105	0.88
V25		4.87	4	192	46.28	21.22	97	2.16
C.D.(0.05)		0.72		13.1	2.77	3.17	2.91	
C.V. (%)		14.92		6.14	6.58	11.86	2.52	
Expt. Mean		4.24		187	36.81	23.40	101	
Soil type		Clay loam						
pH		7.20						
F - levels (kg/ha)								
F1		75:30:20						
F2		150:60:40						
Recommended N:P:K (ka/ha)		150:60:40						

Table 4.1 (f): Contd.

F-levels	Varieties	VARANASI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Varieties							
	V1	IET 29860						
	V2	IET 29877						
	V3	IET 31478(H)						
	V4	IET 31479(H)						
	V5	IET 31480(H)						
	V6	IET 31481(H)						
	V7	-						
	V8	IET 31618						
	V9	IET 31633						
	V10	IET 31637						
	V11	IET 31638						
	V12	IET 31639						
	V13	IET 31640						
	V14	IET 31641						
	V15	IET 31643						
	V16	IET 31659						
	V17	NC- NDR 359						
	V18	PR121 (N)						
	V19	CR Dhan 300 (E & NE)						
	V20	Karma Mahsuri (C)						
	V21	Akshaydhan (W)						
	V22	Jaya (S)						
	V23	HRI 174						
	V24	Local Check - HUR 156						
	V25	Hybrid Check -						
	Available N:P:K of soil (kg/ha)	-						

Table 4.1 (f): Contd.

F-levels	Varieties	WARANGAL							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
F1: Low input 50% NPK	V1	5.41	15	290	4.43	21.49	104		4.38	29
	V2	6.37	5	304	3.75	16.70	105		4.33	32
	V3	5.07	20	293	5.13	25.18	93		4.16	40
	V4	3.85	37	303	3.71	22.11	92		4.29	36
	V5	6.00	7	299	3.82	24.49	90		4.65	24
	V6	6.00	7	307	4.18	21.64	87		4.35	31
	V7	-		-	-	-	-		4.55	28
	V8	5.81	11	315	2.99	15.48	110		4.12	41
	V9	5.07	20	313	3.23	18.46	104		4.09	43
	V10	6.26	6	319	3.37	21.43	101		4.26	37
	V11	5.41	15	296	2.79	25.79	105		4.38	30
	V12	4.56	29	307	3.69	20.67	107		4.24	38
	V13	2.44	44	313	2.54	12.43	115		3.45	50
	V14	5.56	14	316	3.49	18.68	108		4.30	34
	V15	5.00	24	313	4.01	21.83	109		4.30	33
	V16	4.59	28	308	3.90	19.97	100		4.29	35
	V17	4.48	31	318	4.83	22.09	97		3.86	46
	V18	3.67	40	312	3.05	22.52	95		3.67	49
	V19	3.74	39	315	2.97	26.21	111		3.87	45
	V20	5.00	24	329	3.05	16.50	99		3.84	48
	V21	5.22	18	324	3.05	18.39	100		3.91	44
	V22	4.19	36	306	2.91	18.52	98		3.85	47
	V23	4.22	35	314	3.40	21.78	102		4.16	39
	V24	-		-	-	-	-		4.11	42
	V25	-		-	-	-	-		5.15	17
F2: Optimum input 100% NPK	V1	5.85	10	326	5.51	23.63	104	4.00	5.51	3
	V2	6.96	1	324	3.65	18.62	103	5.36	5.39	6
	V3	6.56	2	321	5.70	24.69	94	13.55	5.46	5
	V4	3.63	41	322	3.84	24.24	92	-2.00	5.26	12
	V5	5.78	12	323	3.77	25.56	88	-2.00	5.70	2
	V6	5.04	22	316	4.99	23.25	87	-8.73	5.35	8
	V7	-		-	-	-	-		5.27	11
	V8	5.33	17	326	3.07	20.24	110	-4.36	5.11	18
	V9	4.41	32	325	3.87	21.64	103	-6.00	5.17	16
	V10	6.52	3	336	3.55	25.78	101	2.36	5.32	9
	V11	6.44	4	321	3.15	26.15	104	9.36	5.49	4
	V12	4.89	27	324	4.35	21.49	106	3.00	5.20	14
	V13	3.37	42	325	2.96	13.44	115	8.45	4.62	27
	V14	5.70	13	322	3.47	21.31	108	1.27	5.26	13
	V15	5.04	22	322	4.57	24.27	109	0.36	5.37	7
	V16	4.93	26	317	4.15	20.48	100	3.09	5.30	10
	V17	4.30	34	324	5.03	36.19	96	-1.64	4.78	22
	V18	3.78	38	327	3.31	27.14	96	1.00	4.65	25
	V19	2.52	43	317	3.01	28.27	111	-11.09	4.73	23
	V20	4.56	29	323	3.58	17.20	99	-4.00	4.83	21
	V21	5.93	9	331	3.16	20.09	99	6.45	4.94	20
	V22	4.33	33	312	2.85	25.81	97	1.27	4.65	26
	V23	5.22	18	327	3.71	23.60	101	9.09	5.06	19
	V24	-		-	-	-	-		5.19	15
	V25	-		-	-	-	-		5.88	1

Table 4.1 (f): Contd.

F- levels	Varieties	WARANGAL							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
Interaction <i>F at same V</i> <i>V at same F</i>		NS		NS	NS	NS	NS			
		NS		NS	NS	NS	NS			
F1		5.12	2	307	3.74	20.53	102		4.20	2
F2		5.30	1	323	4.10	23.19	101	1.63	5.27	1
<i>C.D.(0.05)</i>		NS		9.79	0.07	2.69	NS			
<i>C.V.(%)</i>		40.93		4.13	2.68	16.35	0.85			
Mean of varieties:										
V1		5.63	6	308	4.97	22.56	104	4.00	4.95	3
V2		6.67	1	314	3.70	17.66	104	5.36	4.86	6
V3		5.82	5	307	5.42	24.94	94	13.55	4.81	9
V4		3.74	19	313	3.78	23.18	92	-2.00	4.77	13
V5		5.89	4	311	3.80	25.03	89	-2.00	5.18	2
V6		5.52	10	312	4.59	22.45	87	-8.73	4.85	7
V7		-		-	-	-	-		4.91	5
V8		5.57	9	321	3.03	17.86	110	-4.36	4.61	18
V9		4.74	14	319	3.55	20.05	104	-6.00	4.63	16
V10		6.39	2	328	3.46	23.61	101	2.36	4.79	11
V11		5.93	3	309	2.97	25.97	105	9.36	4.94	4
V12		4.73	15	315	4.02	21.08	107	3.00	4.72	14
V13		2.91	22	319	2.75	12.94	115	8.45	4.04	25
V14		5.63	6	319	3.48	20.00	108	1.27	4.78	12
V15		5.02	11	318	4.29	23.05	109	0.36	4.84	8
V16		4.76	13	313	4.03	20.23	100	3.09	4.80	10
V17		4.39	17	321	4.93	29.14	96	-1.64	4.32	21
V18		3.73	20	320	3.18	24.83	96	1.00	4.16	24
V19		3.13	21	316	2.99	27.24	111	-11.09	4.30	22
V20		4.78	12	326	3.32	16.85	99	-4.00	4.34	20
V21		5.58	8	328	3.11	19.24	99	6.45	4.43	19
V22		4.26	18	309	2.88	22.17	98	1.27	4.25	23
V23		4.72	16	320	3.56	22.69	102	9.09	4.61	17
V24		-		-	-	-	-		4.65	15
V25		-		-	-	-	-		5.52	1
<i>C.D.(0.05)</i>		0.91		12.95	0.58	3.71	0.74			
<i>C.V. (%)</i>		15.99		3.58	13.58	14.78	0.64			
Expt. Mean		4.98		316	3.72	21.94	101		4.64	
Soil type		Clay								
pH		8.50								
F - levels (kg/ha)										
F1		60:30:20								
F2		120:60:40								
Recommended N:P:K (kg/ha)		120:60:40								

Table 4.1 (f): Contd.

F-levels	Varieties	WARANGAL							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
	Varieties									
	V1	IET 29860								
	V2	IET 29877								
	V3	IET 31478(H)								
	V4	IET 31479(H)								
	V5	IET 31480(H)								
	V6	IET 31481(H)								
	V7	-								
	V8	IET 31618								
	V9	IET 31633								
	V10	IET 31637								
	V11	IET 31638								
	V12	IET 31639								
	V13	IET 31640								
	V14	IET 31641								
	V15	IET 31643								
	V16	IET 31659								
	V17	NC- NDR 359								
	V18	PR121 (N)								
	V19	CR Dhan 300 (E & NE)								
	V20	Karma Mahsuri (C)								
	V21	Akshaydhan (W)								
	V22	Jaya (S)								
	V23	HRI 174								
	V24	-								
	V25	-								
	Available N:P:K of soil (kg/ha)	123-43-435								

4.1(g) AVT 2 – Late

Four AVT-2 late duration entries (IET 30882(H)(R), IET 31686(H), IET 31709(H), IET 31714(H)) were evaluated for its response to graded levels nutrients on grain yield and yield attributes at 7 locations i.e. **Aduthurai (150-50-50)**, **Chinsurah (80-40-40)**, **Chiplima (80-40-40)**, **Dhangain (120-60-40)**, **Karjat (100-50-50)**, **Mandya (125-62-62)** and **Nawagam (80-25-0)** under two levels of RDF (50% and 100% RDF). The details and data received from these locations are summarized and presented in Table 4.1(g).

Application of nutrients significantly influenced the grain yield at all locations except **Aduthurai** and **Mandya**. The maximum grain yield was recorded at all the locations with 100% RDF with average increase of 17.6% over 50% RDF. Application of 100% RDF recorded higher grain yields at **Chinsurah (5.24 t/ha)**, **Chiplima (4.72 t/ha)**, **Dhangain (5.68 t/ha)**, **Karjat (4.54 t/ha)**, **Mandya (5.55 t/ha)** and **Nawagam (6.80 t/ha)**. Higher nutrient response (kg grain/kg nutrient) was recorded with 100% RDF over 50% RDF at **Chinsurah (9.06)**, **Chiplima (9.66)**, **Dhangain (11.24)** **Mandya (10.46)**, **Nawagam (13.55)**.

Grain yield differences among the tested cultures were found to be significant at all the locations. Significantly higher mean maximum grain yield was recorded by IET 31686 (5.52 t/ha) at **Aduthurai**; IET 30882 at **Chiplima (5.12 t/ha)** and **Dhangain (5.83 t/ha)**; IET 31709 (4.94 t/ha) followed by IET 30882 (4.75 t/ha) at **Karjat**; IET 31714 (6.19 t/ha), IET 31709 (5.72 t/ha) at **Mandya**; IET 31714 (6.51 t/ha) and IET 31709 (6.30 t/ha) at **Nawagam** were found significant while at other locations performance of standard checks found promising. Interaction effects among RDF x varieties was found to be non-significant at all the location except **Chinsurah** and **Chiplima**. Mean over the locations the performance of IET 30882 (5.57 t/ha) was promising over other cultures at 100% RDF application.

In this trial, 100% RDF was found to be promising with 19 % increased grain yield and also exhibited higher nutrient recovery efficiency (8.53 kg grain/kg Nutrient). IET cultures were found to be promising in terms of higher grain yield at most of the locations however IET 28524 (5.36 t/ha) recorded better mean yields at higher RDF application.

Table 4.1(g): Summary of data on grain yield and ancillary characters of selected late cultures grown under transplanted conditions at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	ADUTHURAI					CHINSURAH						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1	V1	5.21	10	259	4.50	21.00		4.68	14	254	2.48	115	
	V2	5.23	9	241	4.25	20.43		4.99	11	300	2.64	111	
	V3	4.97	16	206	3.66	18.33		4.79	13	254	2.54	111	
	V4	5.07	14	203	3.46	17.53		5.06	10	248	2.69	118	
	V5	5.10	13	202	3.54	18.30		5.19	8	285	2.75	119	
	V6	4.97	16	224	4.13	19.60		3.26	21	232	1.73	118	
	V7	4.77	21	211	3.75	19.40		4.21	16	239	2.23	108	
	V8	4.93	18	190	3.27	16.47		3.97	18	229	2.11	122	
	V9	4.80	20	193	3.38	16.70		4.80	12	278	2.54	124	
	V10	4.44	22	177	3.23	15.97		3.56	20	214	1.89	113	
	V11	4.93	18	189	4.18	22.47		3.16	22	190	1.68	126	
F2	V1	5.53	6	279	6.84	22.27	2.42	5.50	6	330	3.00	117	10.25
	V2	5.80	1	259	4.58	21.67	4.32	5.53	5	332	3.02	113	6.75
	V3	5.13	11	218	3.81	19.63	1.21	5.49	7	330	2.99	113	8.75
	V4	5.00	15	217	3.64	18.40	-0.53	5.68	3	341	3.10	120	7.75
	V5	5.67	2	217	3.80	19.67	4.32	5.56	4	334	3.04	121	4.62
	V6	5.67	2	241	4.33	20.70	5.30	3.87	19	233	2.11	120	7.63
	V7	5.27	7	224	3.90	20.77	3.79	5.85	1	352	3.20	110	20.50
	V8	5.60	4	215	3.41	17.57	5.08	4.47	15	269	2.45	125	6.25
	V9	5.27	7	217	3.57	17.73	3.56	5.19	8	312	2.84	126	4.88
	V10	5.13	11	197	3.44	17.50	5.23	5.72	2	344	3.13	115	27.00
	V11	5.60	4	203	4.31	23.17	5.08	4.09	17	246	2.27	128	11.63
Interaction F at same V V at same F		NS		NS	0.71	0.29		0.48		27.61	0.22	NS	
		NS		NS	0.64	0.3		0.49		32.16	0.22	NS	
	F1	5.03	2	217	3.82	18.88		4.52	2	255	2.40	115	
	F2	5.46	1	234	4.29	20.09	3.42	5.24	1	315	2.86	117	9.06
	C.D.(0.05) C.V.(%)	NS 13.36		9.84 4.28	NS 11.03	0.09 0.45		0.12 2.47		23.65 7.99	0.09 3.33	1.47 1.18	

Table 4.1(g): Contd.

F-levels		Varieties	ADUTHURAI					CHINSURAH						
			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:														
V1			5.37	3	269	5.67	21.64	2.42	5.09	5	292	2.74	116	10.25
V2			5.52	1	250	4.42	21.05	4.32	5.26	3	316	2.83	112	6.75
V3			5.05	7	212	3.74	18.98	1.21	5.14	4	292	2.77	112	8.75
V4			5.04	8	210	3.55	17.97	-0.53	5.37	2	295	2.90	119	7.75
V5			5.39	2	210	3.67	18.99	4.32	5.38	1	310	2.90	120	4.62
V6			5.32	4	232	4.23	20.15	5.30	3.57	11	233	1.92	119	7.63
V7			5.02	10	218	3.83	20.09	3.79	5.03	6	296	2.72	109	20.50
V8			5.27	5	202	3.34	17.02	5.08	4.22	9	249	2.28	124	6.25
V9			5.04	8	205	3.48	17.22	3.56	5.00	7	295	2.69	125	4.88
V10			4.79	11	187	3.34	16.74	5.23	4.64	8	279	2.51	114	27.00
V11			5.27	5	196	4.25	22.82	5.08	3.63	10	218	1.98	127	11.63
C.D.(0.05)			0.32		5.39	0.45	0.21		0.35		19.52	0.15	1.27	
C.V. (%)			5.22		2.13	9.82	0.93		6.27		5.99	5.17	0.92	
Expt. Mean			5.19		217	3.95	19.33		4.76		279	2.57	118	
Soil type			Clay						Clay					
pH			7.20						7.20					
N - levels (kg/ha)			75:25:25						40:20:20					
F1			150:50:50						80:40:40					
F2			150:50:50						80:40:40					
Recomd N:P:K (kg/ha)														
Varieties														
V1			IET 30882						IET 30882					
V2			IET 31686						IET 31686					
V3			IET 31709						IET 31709					
V4			IET 31714						IET 31714					
V5			Swarna						Swarna					
V6			Pusa - 44						Pusa - 44					
V7			NDR 8002						NDR 8002					
V8			Ranjeet						Ranjeet					
V9			Salivahana						Salivahana					
V10			Pushyami						Pushyami					
V11			Local check - ADT 59						Local check - Rajdeep, 150-155 days					
Available N:P:K of soil			278:42:465						-					

Table 4.1(g): Contd.

F-levels	Varieties	CHIPLIMA						DHANGAIN							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1	V1	4.63	8	255	5.50	24.33	78		6.20	3	283	5.64	25.00	118	
	V2	4.33	10	246	4.57	21.67	73		5.20	9	282	5.23	21.80	114	
	V3	3.67	19	168	3.80	21.33	77		4.75	13	272	5.05	22.93	114	
	V4	3.57	20	165	3.07	19.33	82		4.34	14	272	5.03	20.87	121	
	V5	4.00	13	230	3.97	19.67	83		3.21	18	264	3.70	16.07	122	
	V6	3.37	22	195	4.77	21.33	72		3.11	19	269	4.26	23.00	113	
	V7	4.20	11	234	5.97	28.33	77		3.80	16	270	4.49	26.47	124	
	V8	3.80	18	189	2.77	16.33	86		4.91	11	282	5.06	17.20	124	
	V9	3.57	20	190	3.43	20.33	86		2.85	21	263	3.67	20.27	124	
	V10	4.00	13	232	3.07	17.33	84		2.60	22	254	2.65	17.10	486	
	V11	3.87	16	221	4.93	18.33	84		4.23	15	268	4.55	22.53	120	
F2	V1	5.60	1	281	5.97	27.33	79	12.13	7.66	1	304	6.80	28.13	119	13.27
	V2	5.37	2	270	5.37	23.33	72	13.00	5.95	5	290	6.56	23.33	114	6.82
	V3	4.07	12	217	4.37	21.33	78	5.00	5.45	6	281	5.22	23.43	115	6.36
	V4	4.00	13	216	4.17	21.00	85	5.38	4.96	10	276	5.24	21.13	122	5.64
	V5	5.20	4	255	3.27	19.00	82	15.00	5.25	8	267	4.79	18.13	123	18.55
	V6	3.87	16	213	4.20	22.00	72	6.25	5.28	7	271	4.86	23.47	114	19.73
	V7	5.27	3	262	6.33	29.33	77	13.38	4.84	12	274	4.94	27.93	125	9.45
	V8	4.37	9	228	3.47	19.00	87	7.13	6.02	4	283	6.53	18.10	125	10.09
	V9	4.83	7	236	4.27	22.00	85	15.75	3.38	17	267	4.46	22.00	124	4.82
	V10	5.07	5	249	3.63	19.33	83	13.38	3.04	20	259	3.53	17.40	123	4.00
	V11	5.00	6	240	5.30	21.33	84	14.13	6.77	2	270	5.38	23.80	120	23.09
Interaction F at same V V at same F		0.28		NS	0.41	1.49	1.82		0.79		NS	NS	NS	NS	
		0.28		NS	0.43	1.42	1.71		0.71		NS	NS	NS	NS	
	F1	3.95	2	210	4.30	21.54	79		4.44	2	274	4.81	21.67	119	
	F2	4.72	1	243	4.64	22.79	79	9.66	5.68	1	281	5.62	22.96	120	11.24
	C.D.(0.05) C.V.(%)	0.07 1.42		11.54 4.8	0.05 0.98	0.79 3.48	NS 1.22		0.54 10.77		NS 8.19	NS 18.48	NS 7.02	NS 98.25	

Table 4.1(g): Contd.

F-levels		Varieties	CHIPLIMA						DHANGAIN								
			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	
Mean of varieties:			V1	5.12	1	268	5.74	25.83	79	12.13	6.93	1	293	6.22	26.57	119	13.27
			V2	4.85	2	258	4.97	22.50	73	13.00	5.58	2	286	5.90	22.57	114	6.82
			V3	3.87	9	193	4.09	21.33	77	5.00	5.10	5	277	5.14	23.18	115	6.36
			V4	3.79	10	190	3.62	20.17	84	5.38	4.65	6	274	5.14	21.00	122	5.64
			V5	4.60	4	243	3.62	19.34	83	15.00	4.23	8	266	4.25	17.10	122	18.55
			V6	3.62	11	204	4.49	21.67	72	6.25	4.20	9	270	4.56	23.24	113	19.73
			V7	4.74	3	248	6.15	28.83	77	13.38	4.32	7	272	4.72	27.20	124	9.45
			V8	4.09	8	209	3.12	17.67	87	7.13	5.47	4	282	5.80	17.65	125	10.09
			V9	4.20	7	213	3.85	21.17	86	15.75	3.12	10	265	4.07	21.14	124	4.82
			V10	4.54	5	240	3.35	18.33	83	13.38	2.82	11	257	3.09	17.25	305	4.00
			V11	4.44	6	231	5.12	19.83	84	14.13	5.50	3	269	4.97	23.17	120	23.09
C.D.(0.05)				0.2		12.82	0.3	1.01	1.21		0.5		19.84	0.66	1.64	NS	
C.V.(%)				3.96		4.84	5.89	4.01	1.29		9.06		6.21	11.58	6.44	98.35	
Expt. Mean				4.35		227	4.37	21.51	80		4.72		274	4.89	21.82	137	
Soil type				-							Clay Loam						
pH				5.20							6.58						
N - levels (kg/ha)																	
F1				40:20:20							60:30:20						
F2				80:40:40							120:60:40						
Recomnd N:P:K (kg/ha)				80:40:40							120:60:40						
Varieties																	
V1				IET 30882							IET 30882						
V2				IET 31686							IET 31686						
V3				IET 31709							IET 31709						
V4				IET 31714							IET 31714						
V5				Swarna							Swarna						
V6				Pusa - 44							Pusa - 44						
V7				NDR 8002							NDR 8002						
V8				Ranjeet							Ranjeet						
V9				Salivahana							Salivahana						
V10				Pushyami							Pushyami						
V11				Local check - Hasanta, 145 days							Local check - Sabour SriRam, 150 - 155 Days						
Available N:P:K of soil				260:17:118 NPK kg/ha							329.6:44.1:240.3						

Table 4.1(g): Contd.

F- levels	Varieties	KARJAT						MANDYA							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1	V1	4.64	5	418	4.53	19.48	114		4.90	13	290	4.46	27.47	109	
	V2	4.28	10	408	4.10	19.93	108		4.14	18	290	3.70	25.63	93	
	V3	4.78	3	429	4.65	18.92	110		5.10	10	306	3.96	23.15	108	
	V4	4.23	11	404	3.78	16.90	116		5.38	8	323	4.00	20.93	113	
	V5	4.10	13	325	3.55	20.56	116		3.81	20	273	2.20	19.65	109	
	V6	4.20	12	343	3.76	20.47	103		3.72	21	299	3.55	24.01	96	
	V7	4.06	14	307	3.52	27.08	111		2.71	22	296	2.31	31.48	90	
	V8	3.28	18	296	3.15	20.80	120		4.20	17	316	3.21	20.05	117	
	V9	2.86	22	276	2.50	21.73	119		4.13	19	321	3.13	25.00	110	
	V10	2.91	21	282	3.03	18.07	119		4.33	15	325	4.46	18.94	103	
	V11	3.58	16	302	3.18	24.32	116		4.91	12	328	2.32	15.07	107	
F2	V1	4.86	2	445	4.80	20.65	115	2.20	5.96	4	331	4.53	27.81	109	8.51
	V2	4.68	4	440	4.32	19.94	109	4.00	5.74	6	314	4.43	25.08	93	12.85
	V3	5.09	1	448	5.18	19.96	112	3.10	6.33	2	334	4.48	23.35	108	9.88
	V4	4.64	5	438	3.99	17.81	118	4.10	6.99	1	352	4.91	21.72	113	12.93
	V5	4.47	8	348	3.67	20.89	119	3.70	4.68	14	320	2.98	19.83	109	6.99
	V6	4.55	7	358	4.11	21.09	105	3.50	4.95	11	326	4.37	24.28	96	9.88
	V7	4.46	9	327	3.63	27.30	113	4.00	4.21	16	311	2.99	33.51	90	12.05
	V8	3.56	17	316	3.34	21.01	124	2.80	5.52	7	334	4.19	20.26	117	10.60
	V9	3.14	20	287	2.78	22.57	121	2.80	5.37	9	331	3.77	25.07	110	9.96
	V10	3.18	19	299	3.16	19.17	120	2.70	6.10	3	350	4.49	19.43	105	14.22
	V11	3.94	15	317	3.35	24.54	118	3.60	5.91	5	353	2.56	15.16	107	8.03
Interaction F at same V V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS	
		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS	
	F1	4.20	2	366	3.88	20.52	112		4.25	2	299	3.42	24.05	104	
	F2	4.54	1	390	4.13	21.08	114	3.43	5.55	1	328	4.11	24.48	104	10.46
	C.D.(0.05) C.V.(%)	0.23 5.39	10.1 2.68	NS 7.03	NS 4.81	NS 4.81	0.69 0.57		NS 13.21		19.06 5.64	NS 46.11	0.24 0.99	NS 1	

Table 4.1(g): Contd.

F-levels	Varieties	NAWAGAM							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1	V1	5.22	16	208	4.91	25.17	112		5.07	7
	V2	5.44	14	231	4.60	23.67	112		4.80	13
	V3	5.85	7	238	4.80	22.27	114		4.84	11
	V4	6.03	5	223	4.18	21.10	115		4.81	12
	V5	5.37	15	250	3.78	20.33	114		4.40	16
	V6	3.55	22	236	3.64	19.67	96		3.74	22
	V7	4.57	19	240	3.40	29.77	113		4.05	19
	V8	4.66	18	247	4.06	15.20	119		4.25	17
	V9	5.07	17	248	4.48	24.50	118		4.01	20
	V10	5.45	13	244	3.74	18.10	117		3.90	21
	V11	4.53	20	251	3.00	19.40	110		4.17	18
F2	V1	5.91	6	219	5.02	26.67	113	13.14	5.86	1
	V2	5.58	9	260	4.63	23.37	113	2.67	5.52	2
	V3	6.75	2	285	4.65	22.71	115	17.14	5.47	3
	V4	6.98	1	250	5.38	19.43	114	18.10	5.46	4
	V5	6.13	4	293	3.36	21.80	113	14.48	5.28	6
	V6	3.97	21	265	3.49	18.40	97	8.00	4.59	15
	V7	5.53	11	278	3.50	29.47	113	18.29	5.06	8
	V8	5.53	11	273	4.10	16.67	119	16.57	5.01	9
	V9	5.54	10	268	4.27	22.87	120	8.95	4.67	14
	V10	6.49	3	269	3.89	17.57	117	19.81	4.96	10
	V11	5.79	8	276	3.61	20.67	110	24.00	5.30	5
Interaction F at same V V at same F		NS		NS	0.95	1.48	NS			
		NS		NS	0.57	1.06	NS			
	F1	5.09	2	234	4.17	22.15	112		4.49	2
	F2	5.80	1	266	4.27	22.32	112	13.55	5.28	1
	C.D.(0.05) C.V.(%)	0.19 3.22		11.77 4.4	NS 23.28	NS 6.04	NS 0.87			

Table 4.1(g): Contd.

F-levels	Varieties	NAWAGAM							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
Mean of varieties:	V1	5.57	5	213	4.97	25.92	112	13.14	5.46	1
	V2	5.51	6	246	4.62	23.52	113	2.67	5.16	2
	V3	6.30	2	261	4.73	22.49	115	17.14	5.16	3
	V4	6.51	1	237	4.78	20.27	114	18.10	5.14	4
	V5	5.75	4	272	3.57	21.07	113	14.48	4.84	5
	V6	3.76	11	250	3.57	19.04	96	8.00	4.17	11
	V7	5.05	10	259	3.45	29.62	113	18.29	4.55	8
	V8	5.10	9	260	4.08	15.94	119	16.57	4.63	7
	V9	5.31	7	258	4.38	23.69	119	8.95	4.34	10
	V10	5.97	3	256	3.82	17.84	117	19.81	4.43	9
	V11	5.16	8	264	3.31	20.04	110	24.00	4.74	6
C.D.(0.05) C.V. (%) Expt. Mean		0.33		24.23	0.4	0.75	1.11		4.78	
		5.12		8.23	8.4	2.94	0.84			
		5.45		252	4.11	21.76	113			
Soil type pH N - levels (kg/ha) F1 F2 Recomnd N:P:K (kg/ha) Varieties		Clay loam								
		7.55								
		40:12:5:0								
		80:25:0								
		80:25:0								
		IET 30882								
		IET 31686								
		IET 31709								
		IET 31714								
		Swarna								
		Pusa - 44								
Available N:P:K of soil	V7	NDR 8002								
	V8	Ranjeet								
	V9	Salivahana								
	V10	Pushyami								
	V11	Local check - GAR 101, 135-140 days								
		219:102:369								

4.1(h) AVT 2 – Aerobic

Aerobic rice cultivation is a system where rice is grown under aerated conditions without standing water as against the usual transplanted flooded rice which is grown just like wheat crop. Rice is grown on dry but irrigated as per the need of the crop same as other irrigated dry (ID) crops such as Wheat and Barley. The crop is provided with irrigation water depending upon the season, evapotranspiration and specific needs of the crop. It is characterized by the presence of air in the soil medium and its limited water requirement as compared to the flooded irrigated rice.

Eight AVT-2 entries (IET 30045, IET 30919, IET 31740, IET 31741, IET 31757, IET 31760, IET 31765 and IET 31775) were evaluated against CR Dhan 201, CR Dhan 202, AAUDR-1 (W), MAS 946-1(S), DRRH4 (Hybrid), DRR Dhan 54, Pusa 44 (RP) and local check) for their response to two fertilizer levels on grain yield at 8 locations viz., **Dhangain (100-50-40)**, **Jagdalpur (100-50-25)**, **Ludhiana (150-30-30)**, **Nawagam (80-25-0)**, **Pantnagar (120-60-40)**, **Raipur (120-60-40)**, **Sabour (120-60-40)** and **Varanasi (120-50-40)**. The data received from these locations are summarized and presented in Table 4.1(h).

Different doses of RDF exhibited significant differences on grain yield at all the locations. Application of 100% RDF recorded higher yield at **Dhangain** (4.15 t/ha), **Jagdalpur** (5.60 t/ha), **Ludhiana** (5.10 t/ha), **Nawagam** (4.85 t/ha), **Pantnagar** (4.81 t/ha) and **Raipur** (4.18 t/ha) **Sabour** (4.94 t/ha) and **Varanasi** (4.44 t/ha). Nutrient response (kg grain / kg N) was higher at 100 % RDF over 50% RDF at **Jagdalpur** (12.78) and **Nawagam** (19.31).

Grain yield of cultures differed significantly at all locations. Among the entries tested, IET 30045 recorded higher yield at **Dhangain** (5.27 t/ha) and **Varanasi** (5.19 t/ha). IET 31740 (5.64 t/ha) yielded better at Ludhiana. At Nawagam, IET 31740 (5.10 t/ha) followed by IET 30919 (5.08 t/ha) and IET 30045 (5.02 t/ha) recorded higher grain yield. The good performers are IET 31765 (5.60 t/ha) IET 31741 (5.10 t/ha) and IET 31760 (5.02 t/ha) at **Pantnagar**. IET 31765 (4.98 t/ha) followed by IET 30045 (4.37 t/ha) at **Raipur** (4.18 t/ha) over other entries. At **Varanasi**, IET 30045 followed by IET 31741 (5.03 t/ha) performed well. Interaction effects of RDF doses and varieties was found to be non-significant at all the locations except **Varanasi** and **Pantnagar** where, 100% RDF realised higher grain yield with test cultures.

Summarized over the locations, application of 100% RDF was found to be promising (18.4% higher grain yield) and also exhibited higher nutrient response. Across the locations, the performance of IET 31740 (4.80 t/ha) followed by IET 30045 (4.80 t/ha) were found to be promising.

Table 4.1(h): Summary of data on grain yield and ancillary characters of selected AET Aerobic cultures at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	DHANGAIN						Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	
F1- Lower Input (50% of RDF)	V1	4.56	5	332	4.28	23.00	90	
	V2	3.23	19	288	3.21	19.47	99	
	V3	3.72	16	303	3.55	27.80	92	
	V4	4.25	10	325	4.02	22.27	95	
	V5	-		-	-	-	-	
	V6	2.26	23	252	2.94	25.33	105	
	V7	4.09	13	311	3.82	24.00	91	
	V8	3.59	17	296	3.47	21.33	89	
	V9	2.25	24	241	2.78	27.40	95	
	V10	3.80	15	305	3.60	22.20	95	
	V11	1.39	26	205	2.56	26.40	97	
	V12	2.80	21	264	3.04	23.20	93	
	V13	3.90	14	308	3.63	26.13	101	
	V14	4.22	11	317	3.85	17.93	90	
F2 - Optimum Input (100% of RDF)	V1	5.97	1	341	4.58	24.60	92	14.84
	V2	4.12	12	295	3.64	20.73	105	9.37
	V3	4.35	8	304	3.82	28.93	92	6.63
	V4	5.30	3	332	4.15	22.87	94	11.05
	V5	-		-	-	-	-	
	V6	2.91	20	282	3.11	26.67	106	6.84
	V7	4.79	4	315	4.12	25.53	92	7.37
	V8	4.33	9	330	3.71	22.47	90	7.79
	V9	2.76	22	275	3.08	27.70	97	5.37
	V10	4.37	7	307	3.93	22.53	96	6.00
	V11	1.89	25	238	3.04	27.60	97	5.26
	V12	3.41	18	295	3.13	23.40	96	6.42
	V13	4.44	6	309	4.11	27.47	100	5.68
	V14	5.37	2	320	4.13	18.07	91	12.11
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Mean of F levels								
F1		3.39	2	288	3.44	23.57	95	
F2		4.15	1	303	3.73	24.51	96	8.06
C.D.(0.05)		0.33		NS	0.25	0.89	NS	
C.V.(%)		8.98		17.8	7.09	3.82	1.66	
Mean of varieties:								
V1		5.27	1	336	4.43	23.80	91	14.84
V2		3.68	9	292	3.43	20.10	102	9.37
V3		4.04	7	304	3.69	28.37	92	6.63
V4		4.78	3	329	4.09	22.57	95	11.05
V5		-		-	-	-	-	
V6		2.59	11	267	3.03	26.00	105	6.84
V7		4.44	4	313	3.97	24.77	92	7.37
V8		3.96	8	313	3.59	21.90	89	7.79
V9		2.51	12	258	2.93	27.55	96	5.37
V10		4.09	6	306	3.77	22.37	96	6.00
V11		1.64	13	222	2.80	27.00	97	5.26
V12		3.11	10	280	3.09	23.30	95	6.42
V13		4.17	5	309	3.87	26.80	101	5.68
V14		4.80	2	319	3.99	18.00	90	12.11
C.D.(0.05)		0.36		42.44	0.67	1	1.75	
C.V. (%)		8.16		12.36	16.11	3.57	1.58	
Expt. Mean		3.77		296	3.59	24.04	95	

Table 4.1(h): Contd.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Soil type		Clay loam						
pH		6.58						
N - levels (kg/ha)								
F1		50:25:20						
F2		100:50:40						
Recommended N:P:K (kg/ha)		100:50:40						
Varieties								
V1		IET 30045						
V2		IET 30919						
V3		IET 31740						
V4		IET 31741						
V5		-						
V6		IET 31760						
V7		IET 31765						
V8		IET 31775						
V9		CR Dhan 201(NC)						
V10		CR Dhan 202 (N, E, NE & C)						
V11		AAUDR-1 (W)						
V12		MAS 946-1 (S)						
V13		DRR Dhan 54						
V14		Local check - Sabour Narendra						
Available N:P:K of soil (kg/ha)		329.6:44.1:240.3						

Table 4.1(h): Contd.

F-levels	Varieties	JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1- Lower Input (50% of RDF)	V1	3.99	23	206	14.33	22.33	99	
	V2	4.89	14	270	18.33	22.00	97	
	V3	4.76	17	235	16.33	31.67	95	
	V4	4.39	20	281	14.67	25.00	92	
	V5	3.26	28	281	17.33	28.00	92	
	V6	5.09	13	184	15.67	22.00	91	
	V7	4.79	16	228	14.00	26.00	88	
	V8	4.36	21	215	18.67	27.67	99	
	V9	3.39	26	189	17.67	23.67	95	
	V10	3.37	27	267	16.67	27.00	90	
	V11	7.53	2	182	18.67	26.67	88	
	V12	3.58	24	252	15.00	30.67	93	
	V13	3.57	25	191	19.00	28.67	95	
	V14	5.83	6	180	20.00	26.33	88	
F2 - Optimum Input (100% of RDF)	V1	5.81	7	295	17.67	26.67	100	20.80
	V2	5.97	4	274	19.00	23.67	99	12.34
	V3	4.5	18	333	19.33	33.00	97	-2.97
	V4	5.31	11	323	15.33	27.33	93	10.51
	V5	5.87	5	372	19.33	27.00	93	29.83
	V6	5.51	10	213	18.33	24.00	93	4.80
	V7	5.64	9	372	15.00	26.33	94	9.71
	V8	5.72	8	297	18.67	28.33	101	15.54
	V9	4.44	19	208	22.33	26.33	96	12.00
	V10	5.18	12	283	18.00	27.00	91	20.69
	V11	8.8	1	272	17.00	28.67	89	14.51
	V12	4.85	15	283	16.00	32.33	93	14.51
	V13	4.33	22	203	17.67	32.67	97	8.69
	V14	6.53	3	187	22.33	31.67	90	8.00
Interaction								
F at same V		NS		32.65	NS	NS	1.87	
V at same F		NS		32.88	NS	NS	1.38	
Mean of F levels								
F1		4.49	2	226	16.88	26.26	93	
F2		5.60	1	280	18.29	28.21	95	12.78
C.D.(0.05)		0.76		12.26	NS	NS	NS	
C.V.(%)		15.99		5.16	16.66	8.62	1.92	
Mean of varieties:								
V1		4.90	7	251	16.00	24.50	100	20.80
V2		5.43	3	272	18.67	22.84	98	12.34
V3		4.63	9	284	17.83	32.34	96	-2.97
V4		4.85	8	302	15.00	26.17	93	10.51
V5		4.57	10	327	18.33	27.50	93	29.83
V6		5.30	4	199	17.00	23.00	92	4.80
V7		5.22	5	300	14.50	26.17	91	9.71
V8		5.04	6	256	18.67	28.00	100	15.54
V9		3.92	14	198	20.00	25.00	95	12.00
V10		4.28	11	275	17.34	27.00	91	20.69
V11		8.17	1	227	17.84	27.67	89	14.51
V12		4.22	12	268	15.50	31.50	93	14.51
V13		3.95	13	197	18.34	30.67	96	8.69
V14		6.18	2	184	21.17	29.00	89	8.00
C.D.(0.05)		0.76		23.09	2.39	2.06	0.97	
C.V. (%)		13.06		7.88	11.71	6.53	0.9	
Expt. Mean		5.05		253	17.58	27.24	94	

Table 4.1(h): Contd.

F-levels	Varieties	JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Soil type		Clay loam						
pH		6.30						
N - levels (kg/ha)								
F1		50:25:12.5						
F2		100:50:25						
Recommended N:P:K (kg/ha)		100:50:25						
Varieties								
V1		IET 30045						
V2		IET 30919						
V3		IET 31740						
V4		IET 31741						
V5		IET 31757						
V6		IET 31760						
V7		IET 31765						
V8		IET 31775						
V9		CR Dhan 201(NC)						
V10		CR Dhan 202 (N, E, NE & C)						
V11		AAUDR-1 (W)						
V12		MAS 946-1 (S)						
V13		DRR Dhan 54						
V14		Local check - CG Dhan, 120-25 days						
Available N:P:K of soil (kg/ha)		-						

Table 4.1(h): Contd.

F-levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1- Lower Input (50% of RDF)	V1	4.99	14	288	2.86	22.53	86	
	V2	-		-	-	-	-	
	V3	5.39	11	277	3.12	22.37	88	
	V4	4.63	16	275	2.59	20.27	94	
	V5	3.31	24	267	2.37	23.07	91	
	V6	4.63	16	275	2.93	20.73	103	
	V7	5.63	6	283	3.12	20.63	91	
	V8	5.08	12	251	3.21	20.80	86	
	V9	4.61	18	299	2.51	20.97	96	
	V10	5.47	10	235	3.60	22.00	86	
	V11	2.40	25	224	2.17	23.13	78	
	V12	3.76	22	285	2.06	20.77	83	
	V13	3.66	23	171	3.36	21.30	93	
	V14	4.95	15	283	2.89	21.13	83	
F2 - Optimum Input (100% of RDF)	V1	5.06	13	323	3.05	22.47	86	0.67
	V2	-		-	-	-	-	
	V3	5.88	4	309	3.21	22.30	89	4.67
	V4	5.61	8	312	3.34	20.42	97	9.33
	V5	3.99	21	341	2.59	23.23	93	6.48
	V6	5.90	3	357	2.94	20.69	103	12.10
	V7	6.12	1	307	3.25	20.50	92	4.67
	V8	5.49	9	272	3.35	20.78	87	3.90
	V9	5.63	6	320	3.11	21.06	101	9.71
	V10	5.78	5	301	3.40	21.86	87	2.95
	V11	2.11	26	245	2.30	23.36	79	-2.76
	V12	4.25	20	317	2.08	21.59	84	4.67
	V13	4.52	19	221	3.49	21.27	95	8.19
	V14	5.93	2	325	3.14	20.97	84	9.33
Interaction								
F at same V		NS		NS	0.38	NS	2.58	
V at same F		NS		NS	0.33	NS	1.78	
Mean of F levels								
F1		4.50	2	262	2.83	21.52	89	
F2		5.10	1	304	3.02	21.58	90	5.68
C.D.(0.05)		0.39		21.96	NS	NS	NS	
C.V.(%)		8.26		7.96	9.52	1.75	2.84	
Mean of varieties:								
V1		5.03	9	305	2.96	22.50	86	0.67
V2		-		-	-	-	-	
V3		5.64	2	293	3.17	22.34	88	4.67
V4		5.12	7	293	2.97	20.35	96	9.33
V5		3.65	12	304	2.48	23.15	92	6.48
V6		5.27	6	316	2.94	20.71	103	12.10
V7		5.88	1	295	3.19	20.57	91	4.67
V8		5.29	5	261	3.28	20.79	87	3.90
V9		5.12	7	309	2.81	21.02	99	9.71
V10		5.63	3	268	3.50	21.93	86	2.95
V11		2.26	13	235	2.24	23.25	78	-2.76
V12		4.01	11	301	2.07	21.18	84	4.67
V13		4.09	10	196	3.43	21.29	94	8.19
V14		5.44	4	304	3.02	21.05	84	9.33
C.D.(0.05)		0.62		25.57	0.23	0.72	1.26	
C.V. (%)		11.17		7.78	6.88	2.89	1.21	
Expt. Mean		4.80		283	2.92	21.55	90	

Table 4.1(h): Contd.

F-levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Soil type		Sandy Loam						
pH		7.80						
N - levels (kg/ha)								
F1		75:15:15						
F2		150:30:30						
Recommended N:P:K (kg/ha)		150:30:30						
Varieties								
V1		IET 30045						
V2		-						
V3		IET 31740						
V4		IET 31741						
V5		IET 31757						
V6		IET 31760						
V7		IET 31765						
V8		IET 31775						
V9		CR Dhan 201(NC)						
V10		CR Dhan 202 (N, E, NE & C)						
V11		AAUDR-1 (W)						
V12		MAS 946-1 (S)						
V13		DRR Dhan 54						
V14		Local check - PR 126 (118 days seed to seed)						
Available N:P:K of soil (kg/ha)		270:22.6:185						

Table 4.1(h): Contd.

F-levels	Varieties	NAWAGAM						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1- Lower Input (50% of RDF)	V1	4.83	8	193	3.68	21.63	78	
	V2	4.36	16	203	4.68	15.37	83	
	V3	4.65	11	210	4.56	28.57	85	
	V4	3.86	20	227	2.70	22.50	96	
	V5	3.04	27	217	3.09	25.07	98	
	V6	4.32	17	227	3.73	23.10	85	
	V7	3.80	23	207	3.88	21.33	84	
	V8	4.13	18	220	4.51	23.87	96	
	V9	3.78	24	173	3.74	27.80	78	
	V10	4.12	19	240	2.78	21.83	96	
	V11	3.33	25	157	3.63	27.47	72	
	V12	3.18	26	200	3.66	23.93	96	
	V13	2.49	28	163	3.29	26.77	85	
	V14	3.84	21	160	3.48	16.57	76	
F2 - Optimum Input (100% of RDF)	V1	5.20	3	233	4.12	22.57	79	7.05
	V2	5.79	1	208	5.00	16.83	82	27.24
	V3	5.54	2	225	4.18	28.50	84	16.95
	V4	4.88	7	263	3.17	19.33	95	19.43
	V5	4.43	14	240	3.22	24.13	97	26.48
	V6	5.13	4	267	3.81	24.33	86	15.43
	V7	4.62	12	235	3.44	22.73	85	15.62
	V8	5.06	5	247	4.59	24.83	96	17.71
	V9	4.58	13	212	3.56	26.73	80	15.24
	V10	4.74	9	279	2.84	21.97	96	11.81
	V11	3.81	22	204	3.29	25.13	73	9.14
	V12	4.66	10	243	3.91	23.77	96	28.19
	V13	4.43	14	209	3.39	25.47	85	36.95
	V14	5.05	6	207	3.20	17.60	77	23.05
Interaction								
F at same V		NS		NS	NS	0.99	NS	
V at same F		NS		NS	NS	1.02	NS	
Mean of F levels								
F1		3.84	2	200	3.67	23.27	86	
F2		4.85	1	234	3.69	23.14	87	19.31
C.D.(0.05)		0.26		13.77	NS	NS	NS	
C.V.(%)		6.36		6.77	10.21	0.75	0.55	
Mean of varieties:								
V1		5.02	3	213	3.90	22.10	79	7.05
V2		5.08	2	206	4.84	16.10	83	27.24
V3		5.10	1	217	4.37	28.54	85	16.95
V4		4.37	8	245	2.94	20.92	96	19.43
V5		3.74	12	228	3.16	24.60	98	26.48
V6		4.73	4	247	3.77	23.72	86	15.43
V7		4.21	9	221	3.66	22.03	84	15.62
V8		4.60	5	233	4.55	24.35	96	17.71
V9		4.18	10	193	3.65	27.27	79	15.24
V10		4.43	7	260	2.81	21.90	96	11.81
V11		3.57	13	180	3.46	26.30	73	9.14
V12		3.92	11	222	3.79	23.85	96	28.19
V13		3.46	14	186	3.34	26.12	85	36.95
V14		4.45	6	184	3.34	17.09	77	23.05
C.D.(0.05)		0.86		18.23	0.42	0.72	0.93	
C.V. (%)		17.1		7.26	9.84	2.67	0.92	
Expt. Mean		4.34		217	3.68	23.20	86	

Table 4.1(h): Contd.

F-levels	Varieties	NAWAGAM						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Soil type		Clay loam						
pH		8.12						
N - levels (kg/ha)								
F1		40:12.5:0						
F2		80:25:0						
Recommended N:P:K (kg/ha)		80:25:0						
Varieties								
V1		IET 30045						
V2		IET 30919						
V3		IET 31740						
V4		IET 31741						
V5		IET 31757						
V6		IET 31760						
V7		IET 31765						
V8		IET 31775						
V9		CR Dhan 201(NC)						
V10		CR Dhan 202 (N, E, NE & C)						
V11		AAUDR-1 (W)						
V12		MAS 946-1 (S)						
V13		DRR Dhan 54						
V14		Local check - Mahisagar, 115-120 days						
Available N:P:K of soil (kg/ha)		266.52:26:315						

Table 4.1(h): Contd.

F-levels	Varieties	PANTNAGAR					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1- Lower Input (50% of RDF)	V1	3.91	17	227	1.95	18.5	
	V2		#N/A				
	V3	4.73	11	252	2.08	16.7	
	V4	5.06	6	270	2.08	21.8	
	V5	4.30	14	235	2.08	24.2	
	V6	4.76	9	260	2.07	18.9	
	V7	5.09	5	289	1.98	17.7	
	V8	4.13	15	242	1.90	18.1	
	V9	3.39	21	217	1.81	16.5	
	V10	3.39	21	220	1.80	22.9	
	V11	-	-	-	-	-	
	V12	-	-	-	-	-	
	V13	3.52	19	239	1.72	18.2	
	V14	3.90	18	259	1.63	23.6	
F2 - Optimum Input (100% of RDF)	V1	4.81	8	256	2.09	18.2	8.18
	V2	-	-	-	-	-	-
	V3	5.30	2	284	2.05	18.7	5.18
	V4	5.13	4	270	2.09	20.2	0.64
	V5	4.97	7	267	2.02	14.4	6.09
	V6	5.28	3	282	2.06	13.2	4.73
	V7	6.11	1	292	2.31	23.0	9.27
	V8	4.76	9	252	2.06	23.1	5.73
	V9	3.97	16	238	1.86	21.5	5.27
	V10	3.50	20	237	1.69	19.0	1.00
	V11	-	-	-	-	-	-
	V12	-	-	-	-	-	-
	V13	4.59	12	247	2.09	22.0	9.73
	V14	4.49	13	245	2.03	22.1	5.36
Interaction							
F at same V		0.41		18	0.16	1.7	
V at same F		0.37		19	0.16	1.5	
Mean of F levels							
F1		4.20	2	246	1.92	19.71	
F2		4.81	1	261	2.03	19.57	5.56
C.D.(0.05)		0.26		11	0.08	NS	
C.V.(%)		5.45		4	3.99	5.2	
Mean of varieties:							
V1		4.36	7	242	2.02	18.32	8.18
V2		-	-	-	-	-	-
V3		5.02	4	268	2.07	17.73	5.18
V4		5.10	2	270	2.09	20.99	0.64
V5		4.64	5	251	2.05	19.26	6.09
V6		5.02	3	271	2.07	16.03	4.73
V7		5.60	1	290	2.15	20.34	9.27
V8		4.45	6	247	1.98	20.59	5.73
V9		3.68	10	228	1.84	18.95	5.27
V10		3.45	11	229	1.75	20.94	1.00
V11		-	-	-	-	-	-
V12		-	-	-	-	-	-
V13		4.06	9	243	1.91	20.08	9.73
V14		4.20	8	252	1.83	22.84	5.36
C.D.(0.05)		0.26		12	0.11	1.1	
C.V. (%)		5.01		4	4.78	4.8	
Expt. Mean		4.50		254	1.98	19.64	

Table 4.1(h): Contd.

F-levels	Varieties	PANTNAGAR					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Soil type		Silt Loam					
pH		7.50					
N - levels (kg/ha)							
F1		60:30:20					
F2		120:60:40					
Recommended N:P:K (kg/ha)		120:60:40					
Varieties							
V1		IET 30045					
V2		-					
V3		IET 31740					
V4		IET 31741					
V5		IET 31757					
V6		IET 31760					
V7		IET 31765					
V8		IET 31775					
V9		CR Dhan 201(NC)					
V10		CR Dhan 202 (N, E, NE & C)					
V11		AAUDR-1 (W)					
V12		MAS 946-1 (S)					
V13		DRR Dhan 54					
V14		Local check - Pant Dhan 24, 130-135 days					
Available N:P:K of soil (kg/ha)		222:39:212					

Table 4.1(h): Contd.

F-levels	Varieties	RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1- Lower Input (50% of RDF)	V1	4.27	7	227	3.26	24.4	73	
	V2	-	-	-	-	-	-	
	V3	3.57	16	203	2.47	32.8	74	
	V4	3.27	20	202	2.17	24.5	77	
	V5	-	-	-	-	-	-	
	V6	3.12	22	205	2.30	27.3	84	
	V7	4.89	2	290	2.95	25.4	75	
	V8	3.67	14	210	3.16	24.1	74	
	V9	3.06	23	231	3.28	22.2	81	
	V10	4.06	10	222	3.77	24.2	72	
	V11	3.03	24	188	1.84	27.0	60	
	V12	3.82	13	229	3.05	26.5	73	
	V13	3.55	18	175	3.40	26.9	74	
	V14	3.23	21	229	3.05	21.5	73	
F2 - Optimum Input (100% of RDF)	V1	4.47	4	254	3.76	24.8	73	1.82
	V2	-	-	-	-	-	-	-
	V3	4.74	3	220	2.63	32.9	75	10.64
	V4	3.48	19	249	3.05	24.8	77	1.91
	V5	-	-	-	-	-	-	-
	V6	4.05	11	233	2.48	27.4	84	8.45
	V7	5.07	1	307	3.46	25.6	75	1.64
	V8	3.92	12	222	3.63	24.3	74	2.27
	V9	4.19	8	247	3.39	23.0	81	10.27
	V10	4.46	5	245	3.85	24.3	73	3.64
	V11	3.56	17	232	2.26	27.8	61	4.82
	V12	4.39	6	252	3.49	26.7	74	5.18
	V13	4.18	9	203	3.60	27.2	74	5.73
	V14	3.63	15	254	3.53	21.7	73	3.64
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Mean of F levels								
F1		3.63	2	218	2.89	25.6	74	
F2		4.18	1	243	3.26	25.9	75	5.00
C.D.(0.05)		0.49		24	0.33	NS	NS	
C.V.(%)		12.29		10	10.45	3.6	1	
Mean of varieties:								
V1		4.37	2	241	3.51	24.57	73	1.82
V2		-	-	-	-	-	-	-
V3		4.16	4	212	2.55	32.83	75	10.64
V4		3.38	11	225	2.61	24.67	77	1.91
V5		-	-	-	-	-	-	-
V6		3.59	9	219	2.39	27.34	84	8.45
V7		4.98	1	299	3.21	25.48	75	1.64
V8		3.80	7	216	3.40	24.20	74	2.27
V9		3.63	8	239	3.34	22.57	81	10.27
V10		4.26	3	234	3.81	24.24	73	3.64
V11		3.30	12	210	2.05	27.37	61	4.82
V12		4.11	5	240	3.27	26.59	74	5.18
V13		3.87	6	189	3.50	27.05	74	5.73
V14		3.43	10	242	3.29	21.59	73	3.64
C.D.(0.05)		0.58		39	0.51	0.7	1	
C.V. (%)		12.79		15	14.23	2.3	1	
Expt. Mean		3.90		230	3.08	25.71	74	

Table 4.1(h): Contd.

F-levels	Varieties	RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Soil type		Vertisols						
pH		6.90						
N - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 30045						
V2		-						
V3		IET 31740						
V4		IET 31741						
V5		-						
V6		IET 31760						
V7		IET 31765						
V8		IET 31775						
V9		CR Dhan 201(NC)						
V10		CR Dhan 202 (N, E, NE & C)						
V11		AAUDR-1 (W)						
V12		MAS 946-1 (S)						
V13		DRR Dhan 54						
V14		Local check - Indira Aerobic 1, 115 days						
Available N:P:K of soil (kg/ha)		222:25:337						

Table 4.1(h): Contd.

F-levels	Varieties	SABOUR				
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1- Lower Input (50% of RDF)	V1	3.98	18	207	87	
	V2	3.79	21	200	93	
	V3	4.79	12	257	91	
	V4	3.51	24	197	92	
	V5	5.11	11	268	80	
	V6	3.14	26	195	96	
	V7	3.04	28	190	81	
	V8	3.10	27	193	82	
	V9	5.40	10	298	90	
	V10	5.55	7	327	87	
	V11	5.51	8	318	81	
	V12	3.86	20	199	80	
	V13	5.46	9	310	97	
	V14	3.88	19	204	95	
F2 - Optimum Input (100% of RDF)	V1	4.62	13	224	87	5.82
	V2	4.40	15	217	94	5.55
	V3	5.56	6	274	92	7.00
	V4	4.07	17	214	94	5.09
	V5	5.88	5	285	81	7.00
	V6	3.59	22	212	98	4.09
	V7	3.47	25	207	84	3.91
	V8	3.53	23	210	84	3.91
	V9	6.21	4	315	92	7.36
	V10	6.38	1	344	87	7.55
	V11	6.31	2	335	82	7.27
	V12	4.39	16	216	81	4.82
	V13	6.25	3	327	98	7.18
	V14	4.50	14	221	96	5.64
Interaction						
F at same V		NS		NS	NS	
V at same F		NS		NS	NS	
Mean of F levels						
F1		4.29	2	240	88	
F2		4.94	1	257	89	5.87
C.D.(0.05)		0.18		0.01	0.47	
C.V.(%)		4.07		0.01	0.56	
Mean of varieties:						
V1		4.30	7	216	87	5.82
V2		4.10	10	209	94	5.55
V3		5.18	6	266	91	7.00
V4		3.79	11	205	93	5.09
V5		5.50	5	276	81	7.00
V6		3.37	12	204	97	4.09
V7		3.26	14	199	83	3.91
V8		3.32	13	201	83	3.91
V9		5.81	4	307	91	7.36
V10		5.97	1	335	87	7.55
V11		5.91	2	326	82	7.27
V12		4.13	9	207	81	4.82
V13		5.86	3	319	97	7.18
V14		4.19	8	213	95	5.64
C.D.(0.05)		0.22		25	1	
C.V. (%)		4.10		9	1	
Expt. Mean		4.62		249	89	

Table 4.1(h): Contd.

F-levels	Varieties	SABOUR				
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Soil type		-				
pH		7.60				
N - levels (kg/ha)						
F1		60:30:20				
F2		120:60:40				
Recommended N:P:K (kg/ha)		120:60:40				
Varieties						
V1		IET 30045				
V2		-				
V3		IET 31740				
V4		IET 31741				
V5		IET 31757				
V6		IET 31760				
V7		IET 31765				
V8		IET 31775				
V9		CR Dhan 201(NC)				
V10		CR Dhan 202 (N, E, NE & C)				
V11		AAUDR-1 (W)				
V12		MAS 946-1 (S)				
V13		DRR Dhan 54				
V14		Local check - Sabour Shree				
Available N:P:K of soil (kg/ha)		176:27:196				

Table 4.1(h): Contd.

F-levels	Varieties	VARANASI						Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1- Lower Input (50% of RDF)	V1	5.10	3	224	19.6	81		4.45	14
	V2	-	-	-	-	-		4.07	20
	V3	4.63	11	238	26.2	91		4.53	12
	V4	4.95	4	243	21.3	83		4.24	18
	V5	4.72	9	231	25.5	93		3.96	23
	V6	3.03	22	191	16.4	94		3.79	24
	V7	4.15	14	261	18.0	100		4.44	15
	V8	4.35	13	265	15.7	78		4.05	22
	V9	3.13	20	245	18.1	76		3.63	27
	V10	3.49	19	246	32.1	92		4.16	19
	V11	3.06	21	229	27.6	77		3.75	25
	V12	1.53	24	174	31.1	64		3.22	28
	V13	-	-	-	-	-		3.74	26
	V14	4.13	15	238	24.5	103		4.25	17
F2 - Optimum Input (100% of RDF)	V1	5.27	1	217	27.0	82	1.62	5.15	1
	V2	-	-	-	-	-	-	5.07	3
	V3	4.76	7	259	23.5	90	1.24	5.08	2
	V4	5.11	2	234	24.5	84	1.52	4.86	8
	V5	4.73	8	249	23.4	93	0.10	4.98	6
	V6	4.10	16	176	26.3	95	10.19	4.56	11
	V7	4.62	12	238	27.4	100	4.48	5.06	4
	V8	4.68	10	266	22.1	77	3.14	4.69	9
	V9	3.89	18	252	23.0	75	7.24	4.46	13
	V10	4.78	6	248	22.6	92	12.29	4.90	7
	V11	4.01	17	231	22.6	78	9.05	4.36	16
	V12	2.47	23	176	22.3	64	8.95	4.06	21
	V13	-	-	-	-	-	-	4.68	10
	V14	4.89	5	228	23.5	102	7.24	5.05	5
Interaction									
F at same V		0.43		NS	1.82	NS			
V at same F		0.54		NS	1.95	NS			
Mean of F levels									
F1		3.86	2	232	23.01	86		4.02	2
F2		4.44	1	231	24.01	86	5.59	4.76	1
C.D.(0.05)		0.44		NS	NS	NS			
C.V.(%)		10.44		7	4.77	1			
Mean of varieties:									
V1		5.19	1	221	23.28	82	1.62	4.80	2
V2		-	-	-	-	-	-	4.57	5
V3		4.70	4	248	24.84	91	1.24	4.80	1
V4		5.03	2	239	22.89	84	1.52	4.55	6
V5		4.73	3	240	24.48	93	0.10	4.47	8
V6		3.57	9	184	21.35	95	10.19	4.18	11
V7		4.39	7	249	22.69	100	4.48	4.75	3
V8		4.52	5	266	18.86	77	3.14	4.37	9
V9		3.51	11	248	20.55	76	7.24	4.04	13
V10		4.14	8	247	27.33	92	12.29	4.53	7
V11		3.54	10	230	25.09	77	9.05	4.05	12
V12		2.00	12	175	26.72	64	8.95	3.64	14
V13		-	-	-	-	-	-	4.21	10
V14		4.51	6	233	24.03	102	7.24	4.65	4
C.D.(0.05)		0.30		16	1.29	1			
C.V. (%)		6.34		6	4.74	1			
Expt. Mean		4.15		232	23.51	86		4.49	

Table 4.1(h): Contd.

F-levels	Varieties	VARANASI						Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test wt (g)	Days for 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
Soil type		Loam							
pH		7.40							
N - levels (kg/ha)									
F1		60:25:20							
F2		120:50:40							
Recommended N:P:K (kg/ha)		120:50:40							
Varieties									
V1		IET 30045							
V2		-							
V3		IET 31740							
V4		IET 31741							
V5		IET 31757							
V6		IET 31760							
V7		IET 31765							
V8		IET 31775							
V9		CR Dhan 201(NC)							
V10		CR Dhan 202 (N, E, NE & C)							
V11		AAUDR-1 (W)							
V12		MAS 946-1 (S)							
V13		-							
V14		Local check - HUR 156, 130-135 days							
Available N:P:K of soil (kg/ha)		222:39:212							

4.1(i) AVT 2 - MS

One entry IET 31494(H) of medium slender group was evaluated for their response to two levels of nutrients (50% and 100% RDF) on grain yield at nine different locations i.e., **Dhangain (120-60-40)**, **Karjat (100-50-50)**, **Kaul (150-60-60)**, **Mandya (125-62-62)**, **Maruteru (90-60-60)**, **Masodha (120-60-40)**, **Nagina (120-60-40)**, **Nawagam (100-25-0)** and **Raipur (120-60-40)**. The details and data received from these locations are summarized and presented in Table 4.1 (i).

RDF doses significantly influenced the grain yield at all locations (except **Masodha**) and the significant increase in grain yield was observed with 100% RDF at all the locations. Application of 100% RDF recorded higher grain yield at **Dhangain (4.81)**, **Karjat (4.56 t/ha)**, **Kaul (5.62 t/ha)**, **Mandya (5.26 t/ha)**, **Maruteru (5.01 t/ha)**, **Masodha (4.78 t/ha)**, **Nagina (4.55 t/ha)**, **Nawagam (5.61 t/ha)** and **Raipur (4.79 t/ha)**. Average over the locations, higher mean grain yield of 5.01 t/ha was recorded with 100% RDF with 22.8% higher yield over 50% of RDF. Higher nutrient response was (kg grain/kg nutrient) recorded with 100% RDF at **Dhangain (6.61)**, **Karjat (8.33)**, **Kaul (10.22)**, **Nagina (17.65)**, **Nawagam (9.60)**, **Mandya (8.93)** and **Raipur (6.71)** over other centres.

Grain yield differences among the tested cultures were also found to be significant all locations. Significantly higher mean maximum grain yield was recorded by IET 31494(H) at **Karjat (4.84 t/ha)**, **Kaul (6.01 t/ha)**, **Mandya (6.10 t/ha)**, **Maruteru (5.06 t/ha)**, **Nagina (3.95 t/ha)**, **Nawagam (5.74 t/ha)** and **Raipur (5.45 t/ha)**

In this trial, application of 100% RDF was found to be promising (22.8% higher yield) and also exhibited higher nutrient response. Entry IET 31494(H) was found to be promising with better yields over other test entries and checks at 100% of RDF application at respective locations.

Table 4.1(i): Summary of data on grain yield and ancillary characters of selected AET MS cultures grown under transplanted conditions at low and optimum recommended fertilizer doses, Kharif 2025.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.18	9	264	3.89	15.87	110	
	V2	4.67	7	266	4.03	15.93	107	
	V3	3.30	12	258	3.51	14.13	105	
	V4	5.41	5	282	5.02	15.40	105	
	V5	4.10	10	261	2.70	24.60	99	
	V6	2.44	13	250	2.51	13.13	106	
	V7	5.04	6	279	4.51	18.33	104	
F2: Optimum input (100% NPK)	V1	5.72	4	266	3.93	15.87	111	14.00
	V2	5.85	3	271	4.36	16.03	108	10.73
	V3	4.10	10	262	2.55	14.73	106	7.27
	V4	5.95	2	288	5.29	16.73	106	4.91
	V5	4.67	7	267	2.83	25.60	100	5.18
	V6	1.67	14	250	2.69	13.20	108	-7.00
	V7	6.27	1	280	4.90	19.00	104	11.18
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
F1		4.16	2	266	3.74	16.77	105	
F2		4.89	1	269	3.79	17.31	106	6.61
C.D.(0.05)		0.52		NS	NS	NS	0.2	
C.V.(%)		8.57		7.18	9.07	5.93	0.15	
Mean of varieties:								
	V1	4.95	4	265	3.91	15.87	110	14.00
	V2	5.26	3	269	4.20	15.98	108	10.73
	V3	3.70	6	260	3.03	14.43	105	7.27
	V4	5.68	1	285	5.16	16.07	105	4.91
	V5	4.39	5	264	2.77	25.10	100	5.18
	V6	2.06	7	250	2.60	13.17	107	-7.00
	V7	5.66	2	280	4.71	18.67	104	11.18
C.D.(0.05)		0.76		18.18	0.46	0.93	0.59	
C.V. (%)		14.01		5.71	10.18	4.57	0.47	
Expt. Mean		4.53		267	3.77	17.04	106	
Soil type		Sandy loam						
pH		6.58						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 31494(H)						
V2		WGL 14 (NC 1)						
V3		BPT 5204 (NC 2)						
V4		Improved Samba Mahsuri (N, E & C)						
V5		Ketekejoha (NE)						
V6		Karjat-6 (W)						
V7		Local check - Sabour Pratap, 130 -140 days						
Available N:P:K of soil (kg/ha)		329.6:44.1:240.3						

Table 4.1(i): Contd.

F-levels	Varieties	KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.33	5	340	4.61	14.29	104	
	V2	3.59	10	262	3.52	15.30	104	
	V3	3.51	11	272	3.30	15.04	115	
	V4	-		-	-	-	-	
	V5	3.25	12	274	3.13	24.61	95	
	V6	3.65	9	285	3.55	13.72	112	
	V7	4.01	7	324	3.67	18.11	106	
F2: Optimum input (100% NPK)	V1	5.34	1	365	4.80	15.07	105	10.10
	V2	4.34	4	331	3.87	16.02	105	7.50
	V3	4.33	5	305	3.86	15.22	116	8.20
	V4	-		-	-	-	-	
	V5	3.99	8	274	3.27	25.91	97	7.40
	V6	4.39	3	334	3.90	14.28	114	7.40
	V7	4.95	2	358	3.97	19.01	108	9.40
Interaction								
F at same V		NS		12.39	NS	NS	NS	
V at same F		NS		13.61	NS	NS	NS	
F1		3.72	2	293	3.63	16.85	106	
F2		4.56	1	328	3.95	17.59	108	8.33
C.D.(0.05)		0.17		9.63	NS	0.41	0.63	
C.V.(%)		2.83		2.16	10.9	1.64	0.41	
Mean of varieties:								
	V1	4.84	1	352	4.71	14.68	104	10.10
	V2	3.97	4	297	3.70	15.66	105	7.50
	V3	3.92	5	288	3.58	15.13	116	8.20
	V4	-		-	-	-	-	
	V5	3.62	6	274	3.20	25.26	96	7.40
	V6	4.02	3	310	3.73	14.00	113	7.40
	V7	4.48	2	341	3.82	18.56	107	9.40
C.D.(0.05)		0.33		8.76	0.3	0.69	1.97	
C.V. (%)		6.62		2.35	6.56	3.32	1.53	
Expt. Mean		4.14		310	3.79	17.22	107	
Soil type		Medium black						
pH		-						
F - levels (kg/ha)								
F1		50:25:25						
F2		100:50:50						
Recommended N:P:K (kg/ha)		100:50:50						
Varieties								
V1		IET 31494(H)						
V2		WGL 14 (NC 1)						
V3		BPT 5204 (NC 2)						
V4		-						
V5		Ketekejoha (NE)						
V6		Karjat-6 (W)						
V7		Local check - Ratnagiri 8, 138 to 140 days						
Available N:P:K of soil (kg/ha)		-						

Table 4.1(i): Contd.

F-levels	Varieties	KAUL					Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	
F1: Low input (50% NPK)	V1	4.89	5	307	1.78	25.90	
	V2	4.18	9	294	1.57	24.43	
	V3	3.99	11	273	1.62	25.03	
	V4	-		-	-	-	
	V5	4.18	9	261	1.58	25.90	
	V6	3.82	12	274	1.65	26.23	
	V7	4.39	8	301	1.70	25.33	
F2: Optimum input (100% NPK)	V1	7.13	1	363	1.91	27.03	16.59
	V2	5.28	4	340	1.79	26.10	8.15
	V3	4.73	6	316	1.75	25.57	5.48
	V4	-		-	-	-	
	V5	5.47	3	307	1.69	26.07	9.56
	V6	4.69	7	316	1.77	25.47	6.44
	V7	6.43	2	351	1.83	26.87	15.11
Interaction							
F at same V		0.57		NS	NS	NS	
V at same F		0.62		NS	NS	NS	
F1		4.24	2	285	1.65	25.47	
F2		5.62	1	332	1.79	26.19	10.22
C.D.(0.05)		0.09		11.03	NS	NS	
C.V.(%)		1.32		2.49	5.82	5.32	
Mean of varieties:							
	V1	6.01	1	335	1.85	26.47	16.59
	V2	4.73	4	317	1.68	25.27	8.15
	V3	4.36	5	294	1.69	25.30	5.48
	V4	-		-	-	-	
	V5	4.83	3	284	1.64	25.99	9.56
	V6	4.26	6	295	1.71	25.85	6.44
	V7	5.41	2	326	1.77	26.10	15.11
C.D.(0.05)		0.44		21.3	0.13	NS	
C.V. (%)		7.43		5.73	6.24	3.81	
Expt. Mean		4.93		309	1.72	25.83	
Soil type		Clay loam					
pH		8.00					
F - levels (kg/ha)							
F1		75:30:30					
F2		150:60:60					
Recommended N:P:K (kg/ha)		150:60:60					
Varieties							
V1		IET 31494(H)					
V2		WGL 14 (NC 1)					
V3		BPT 5204 (NC 2)					
V4		-					
V5		Ketekejoha (NE)					
V6		Karjat-6 (W)					
V7		Local check - HKR 49, 125 days					
Available N:P:K of soil (kg/ha)		160:16:320					

Table 4.1(i): Contd.

F-levels	Varieties	MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	5.67	3	292	4.28	15.66	90	
	V2	2.85	12	297	3.04	15.43	102	
	V3	4.31	7	315	2.90	14.37	104	
	V4	-		-	-	-	-	
	V5	3.04	11	271	3.37	26.28	85	
	V6	3.69	10	305	2.52	13.23	96	
	V7	5.35	5	296	4.35	18.96	88	
F2: Optimum input (100% NPK)	V1	6.52	2	308	4.88	15.63	90	6.83
	V2	4.12	9	320	3.41	15.93	103	10.20
	V3	5.47	4	353	2.96	14.67	104	9.32
	V4	-		-	-	-	-	-
	V5	4.13	8	322	3.40	26.73	85	8.76
	V6	4.69	6	323	2.68	14.30	96	8.03
	V7	6.65	1	317	5.06	18.68	88	10.44
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
F1		4.15	2	296	3.41	17.32	94	
F2		5.26	1	324	3.73	17.66	94	8.93
C.D.(0.05)		0.26		NS	0.3	NS	NS	
C.V.(%)		3.88		17.53	5.9	3.31	0.47	
Mean of varieties:								
	V1	6.10	1	300	4.58	15.65	90	6.83
	V2	3.49	6	308	3.23	15.68	102	10.20
	V3	4.89	3	334	2.93	14.52	104	9.32
	V4	-		-	-	-	-	-
	V5	3.59	5	296	3.39	26.51	85	8.76
	V6	4.19	4	314	2.60	13.77	96	8.03
	V7	6.00	2	307	4.71	18.82	88	10.44
C.D.(0.05)		0.54		25.54	0.48	0.73	0.45	
C.V. (%)		9.58		6.85	11.27	3.48	0.4	
Expt. Mean		4.71		310	3.57	17.49	94	
Soil type		Red sandy loam						
pH		7.04						
F - levels (kg/ha)								
F1		62.5:31:31						
F2		125:62:62						
Recommended N:P:K (kg/ha)		125:62:62						
Varieties								
V1		IET 31494(H)						
V2		WGL 14 (NC 1)						
V3		BPT 5204 (NC 2)						
V4		-						
V5		Ketekejoha (NE)						
V6		Karjat-6 (W)						
V7		Local check - KRH 4, 130-135 days						
Available N:P:K of soil (kg/ha)		383.5:72.51:278.5						

Table 4.1(i): Contd.

F-levels	Varieties	MARUTERU						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.69	5	280	2.63	14.63	104	
	V2	4.53	9	284	3.48	17.57	101	
	V3	4.66	6	241	3.33	13.10	99	
	V4	4.32	11	292	3.03	13.17	98	
	V5	4.49	10	256	2.34	23.87	97	
	V6	4.29	12	283	2.56	13.27	97	
	V7	-	-	-	-	-	-	
F2: Optimum input (100% NPK)	V1	5.43	1	296	2.78	15.43	100	7.05
	V2	5.22	3	299	3.66	18.87	96	6.57
	V3	4.64	7	262	3.49	12.97	96	-0.19
	V4	4.57	8	306	3.09	13.77	94	2.38
	V5	5.29	2	283	2.55	24.77	93	7.62
	V6	4.89	4	291	2.79	13.77	93	5.71
	V7	-	-	-	-	-	-	
Interaction								
F at same V		0.49		NS	NS	NS	NS	
V at same F		0.39		NS	NS	NS	NS	
F1		4.50	2	273	2.90	15.94	99	
F2		5.01	1	290	3.06	16.60	95	4.86
C.D.(0.05)		0.42		11.5	0.06	NS	0.63	
C.V.(%)		6.23		2.85	1.43	6.13	0.45	
Mean of varieties:								
	V1	5.06	1	288	2.71	15.03	102	7.05
	V2	4.88	3	292	3.57	18.22	99	6.57
	V3	4.65	4	252	3.41	13.04	97	-0.19
	V4	4.45	6	299	3.06	13.47	96	2.38
	V5	4.89	2	270	2.45	24.32	95	7.62
	V6	4.59	5	287	2.68	13.52	95	5.71
	V7	-	-	-	-	-	-	
C.D.(0.05)		0.27		13.97	0.26	0.83	2.39	
C.V. (%)		4.78		4.12	7.19	4.24	2.04	
Expt. Mean		4.75		281	2.98	16.27	97	
Soil type		-						
pH		6.90						
F - levels (kg/ha)								
F1		45:30:30						
F2		90:60:60						
Recommended N:P:K (kg/ha)		90:60:60						
Varieties								
V1		IET 31494(H)						
V2		WGL 14 (NC 1)						
V3		BPT 5204 (NC 2)						
V4		Improved Samba Mahsuri (N, E & C)						
V5		Ketekejoha (NE)						
V6		Karjat-6 (W)						
V7		-						
Available N:P:K of soil (kg/ha)		163:23.3:336						

Table 4.1(i): Contd.

F-levels	Varieties	MASODHA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.24	10	226	3.10	15.77	107	
	V2	4.87	4	172	2.43	19.27	111	
	V3	4.19	6	240	3.43	17.77	111	
	V4	-	-	-	-	-	-	
	V5	4.97	3	203	4.23	12.20	108	
	V6	-	-	-	-	-	-	
	V7	4.01	7	277	2.27	16.37	109	
F2: Optimum input (100% NPK)	V1	5.87	2	268	4.31	18.53	113	23.91
	V2	6.23	1	265	4.32	19.80	113	12.36
	V3	3.48	9	264	3.20	17.93	115	-6.45
	V4	-	-	-	-	-	-	
	V5	3.66	8	249	3.20	18.13	108	-11.91
	V6	-	-	-	-	-	-	
	V7	4.65	5	268	3.50	16.70	118	5.82
Interaction								
F at same V		0.87		15.99	1	1.94	NS	
V at same F		0.82		41.82	1.1	1.64	NS	
F1		4.26	2	224	3.09	16.28	109	
F2		4.78	1	263	3.71	18.22	113	4.75
C.D.(0.05)		NS		NS	0.2	1.61	NS	
C.V.(%)		8.4		13.85	3.76	5.95	2.56	
Mean of varieties:								
	V1	4.56	2	247	3.71	17.15	110	23.91
	V2	5.55	1	219	3.38	19.54	112	12.36
	V3	3.84	5	252	3.32	17.85	113	-6.45
	V4	-	-	-	-	-	-	
	V5	4.32	4	226	3.72	15.17	108	-11.91
	V6	-	-	-	-	-	-	
	V7	4.33	3	273	2.89	16.54	113	5.82
C.D.(0.05)		0.58		11.31	NS	1.16	3.09	
C.V. (%)		10.46		3.8	18.76	5.5	2.27	
Expt. Mean		4.52		243	3.40	17.25	111	
Soil type		Sand 32.2,Silt 48.6 & Clay 16.2						
pH		7.40						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 31494(H)						
V2		WGL 14 (NC 1)						
V3		BPT 5204 (NC 2)						
V4		-						
V5		Ketekejoha (NE)						
V6		-						
V7		Local check - Sambha Sub-1, 140 days						
Available N:P:K of soil (kg/ha)		75.4:13.5:22.5						

Table 4.1(i): Contd.

F-levels	Varieties	NAGINA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.02	6	221	3.22	25.10	111	
	V2	2.73	8	212	3.12	25.05	111	
	V3	2.24	9	206	3.11	24.99	114	
	V4	-		-	-	-	-	
	V5	2.85	7	218	3.18	25.07	88	
	V6	2.21	10	205	3.10	24.96	118	
	V7	-		-	-	-	-	
F2: Optimum input (100% NPK)	V1	4.88	1	338	3.52	26.43	112	16.91
	V2	4.53	3	321	3.38	26.32	113	16.36
	V3	4.29	4	317	3.27	26.29	115	18.64
	V4	-		-	-	-	-	
	V5	4.82	2	330	3.42	26.38	88	17.91
	V6	4.24	5	311	3.20	26.27	119	18.45
	V7	-		-	-	-	-	
Interaction								
F at same V		NS		NS	0.03	NS	NS	
V at same F		NS		NS	0.03	NS	NS	
F1		2.61	2	212	3.15	25.03	108	
F2		4.55	1	324	3.36	26.34	109	17.65
C.D.(0.05)		0.07		26.06	0.03	0.05	NS	
C.V.(%)		1.18		6.19	0.5	0.11	0.6	
Mean of varieties:								
	V1	3.95	1	280	3.37	25.77	112	16.91
	V2	3.63	3	267	3.25	25.69	112	16.36
	V3	3.27	4	261	3.19	25.64	115	18.64
	V4	-		-	-	-	-	
	V5	3.84	2	274	3.30	25.73	88	17.91
	V6	3.23	5	258	3.15	25.62	118	18.45
	V7							
C.D.(0.05)		0.11		15.55	0.02	0.03	0.95	
C.V. (%)		2.4		4.74	0.54	0.08	0.71	
Expt. Mean		3.58		268	3.25	25.69	109	
Soil type		-						
pH		7.70						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 31494(H)						
V2		WGL 14 (NC 1)						
V3		BPT 5204 (NC 2)						
V4		-						
V5		Ketekejoha (NE)						
V6		Karjat-6 (W)						
V7		-						
Available N:P:K of soil (kg/ha)		21:18.33:209						

Table 4.1(i): Contd.

F-levels	Varieties	NAWAGAM						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	5.54	4	236	5.19	15.17	110	
	V2	4.41	12	208	3.06	14.77	117	
	V3	5.10	9	259	2.68	13.50	94	
	V4	-		-	-	-	-	
	V5	5.28	7	249	2.64	24.87	108	
	V6	4.77	11	227	1.96	11.07	112	
	V7	4.97	10	264	3.21	15.10	100	
F2: Optimum input (100% NPK)	V1	5.94	2	259	5.25	15.47	112	6.40
	V2	5.21	8	249	3.27	15.57	117	12.80
	V3	5.57	3	290	2.65	14.80	94	7.52
	V4	-		-	-	-	-	
	V5	6.15	1	275	2.76	23.07	108	13.92
	V6	5.34	6	255	2.61	12.47	113	9.12
	V7	5.46	5	293	3.49	14.73	100	7.84
Interaction								
F at same V		NS		NS	NS	0.67	NS	
V at same F		NS		NS	NS	0.73	NS	
F1		5.01	2	241	3.12	15.75	107	
F2		5.61	1	270	3.34	16.02	107	9.60
C.D.(0.05)		0.52		23.55	NS	0.02	NS	
C.V.(%)		6.78		6.43	6.02	0.1	0.78	
Mean of varieties:								
	V1	5.74	1	248	5.22	15.32	111	6.40
	V2	4.81	6	229	3.17	15.17	117	12.80
	V3	5.34	3	275	2.67	14.15	94	7.52
	V4	-		-	-	-	-	
	V5	5.72	2	262	2.70	23.97	108	13.92
	V6	5.06	5	241	2.29	11.77	113	9.12
	V7	5.22	4	279	3.35	14.92	100	7.84
C.D.(0.05)		0.42		13.3	0.41	0.52	0.9	
C.V. (%)		6.53		4.32	10.47	2.69	0.7	
Expt. Mean		5.31		256	3.23	15.88	107	
Soil type		Clay loam						
pH		7.88						
F - levels (kg/ha)								
F1		50:12.5:0						
F2		100:25:0						
Recommended N:P:K (kg/ha)		100:25:0						
Varieties								
V1		IET 31494(H)						
V2		WGL 14 (NC 1)						
V3		BPT 5204 (NC 2)						
V4		-						
V5		Ketekejoha (NE)						
V6		Karjat-6 (W)						
V7		Local check - GAR 13, 125-130 days						
Available N:P:K of soil (kg/ha)		250:78.6:428						

Table 4.1(i): Contd.

F-levels	Varieties	RAIPUR							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	5.07	3	202	3.23	15.17	92		4.51	8
	V2	3.82	12	196	2.45	15.83	93		3.96	13
	V3	4.49	7	220	3.03	16.10	99		3.98	12
	V4	3.57	13	214	2.24	14.47	97		4.43	9
	V5	3.89	11	200	2.50	17.60	112		4.01	11
	V6	3.22	14	170	2.51	13.57	103		3.51	14
	V7	4.29	8	188	3.36	17.27	92		4.58	7
F2: Optimum input (100% NPK)	V1	5.82	1	249	5.08	15.43	93	6.82	5.85	1
	V2	4.60	6	248	3.32	16.30	93	7.09	5.04	3
	V3	5.06	4	288	3.11	16.57	99	5.18	4.63	6
	V4	4.15	10	235	2.58	15.00	97	5.27	4.89	4
	V5	4.62	5	228	2.80	18.10	112	-	4.76	5
	V6	4.18	9	226	2.82	13.93	104	8.73	4.26	10
	V7	5.09	2	216	4.02	17.77	92	-	5.64	2
Interaction										
F at same V		NS		NS	NS	NS	NS			
V at same F		NS		NS	NS	NS	NS			
F1		4.05	2	199	2.76	15.72	98		4.08	2
F2		4.79	1	241	3.39	16.16	99	6.71	5.01	1
C.D.(0.05)		0.63		31.67	0.54	NS	NS			
C.V.(%)		10.81		10.84	13.18	2.92	0.16			
Mean of varieties:										
	V1	5.45	1	226	4.16	15.30	93	6.82	5.18	1
	V2	4.21	5	222	2.89	16.07	93	7.09	4.50	4
	V3	4.78	2	254	3.07	16.34	99	5.18	4.30	6
	V4	3.86	6	225	2.41	14.74	97	5.27	4.66	3
	V5	4.26	4	214	2.65	17.85	112	-	4.38	5
	V6	3.70	7	198	2.67	13.75	104	8.73	3.89	7
	V7	4.69	3	202	3.69	17.52	92	-	5.11	2
C.D.(0.05)		0.54		30.92	0.63	0.66	0.37			
C.V. (%)		10.26		11.79	17.12	3.49	0.31			
Expt. Mean		4.42		220	3.08	15.94	98		4.54	
Soil type		Vertisols								
pH		6.90								
F - levels (kg/ha)										
F1		60:30:20								
F2		120:60:40								
Recommended										
N:P:K (kg/ha)		120:60:40								
Varieties										
V1		IET 31494(H)								
V2		WGL 14 (NC 1)								
V3		BPT 5204 (NC 2)								
V4		Improved Samba Mahsuri (N, E & C)								
V5		Ketekejoha (NE)								
V6		Karjat-6 (W)								
V7		Local check - CG 1919, 130 days								
Available N:P:K of soil (kg/ha)		211.6:20.6:326.7								

AET 1(j) AVT-2 Biofortified

Six AVT-2 Biofortified cultures (IET 31925, IET 31927, IET 31938, IET 31939, IET 31947 and IET 31961) were evaluated for its response to different levels of nutrients (50% and 100% RDF) on grain yield from eight locations viz., **Gangavathi (150-75-75), Kaul (150-60-60), Kota (150-75-60), Nagina (120-60-40), Nawagam (100-25-0), Pusa (120-60-40), Raipur (120-60-40) and Warangal (120-60-40)**. The details and data received from these locations are summarized and presented in Table 4.1(j).

Application of different nutrient levels registered significantly higher grain yield at all locations except at **Nawagam**. Application of 100% RDF recorded significantly higher grain yields at **Gangavathi (3.85 t/ha), Kaul (6.44 t/ha), Kota (6.81 t/ha), Nagina (4.51 t/ha), Nawagam (5.56 t/ha), Pusa (4.69 t/ha), Raipur (4.06 t/ha) and Warangal (4.89 t/ha)**. It indicated need for higher nutrient application for better yields at these centers. The percentage mean grain yield increase was 30.4% with application of 100% RFD over 50% of the RFD application.

Grain yield differences among the tested cultures were found to be significant at all the locations. The highest grain yield was recorded by IET 31947 (5.96 t/ha) followed by IET 31939 (5.85 t/ha) and IET 31925 (5.73 t/ha) at **Kaul**. The best entry at **Kota** was IET 31927 (7.35 t/ha); at Nagina IET 31925 (3.67 t/ha) IET 31939 (3.65 t/ha), IET 31938 (3.64 t/ha); at **Nawagam** IET 31927 (6.43 t/ha); at **Pusa** IET 31927 (4.26 t/ha) and IET 31938 (4.06 t/ha); at **Raipur** IET 31938 (4.78 t/ha) and IET 31927 (4.52 t/ha); at **Warangal** IET 31947 (5.87 t/ha) and IET 31925 (5.69 t/ha) and found promising over other test cultures. Mean over the locations, IET 31927 (4.90 t/ha) followed by IET 31925 (4.86 t/ha) and IET 31947 (4.82 t/ha) performed better and were found superior over test cultures. Interaction effects among RDF x varieties were found to be non-significant at all the locations except at **Nagina** and **Pusa** where significant interaction was noted.

Table 4.1(j): Summary of data on grain yield and ancillary characters of selected AET Biofortified cultures grown under transplanted conditions at low and optimum recommended fertilizer doses, kharif 2025.

F-levels	Varieties	GANGAVATHI						KAUL					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.65	13	178	3.79	19.20		4.36	14	281	1.71	24.40	
	V2	2.67	21	170	2.98	19.17		3.89	17	264	1.57	24.43	
	V3	3.56	14	172	2.38	20.57		3.66	20	265	1.62	24.07	
	V4	2.28	24	162	2.54	23.50		4.48	13	288	1.74	24.53	
	V5	3.80	9	169	2.57	19.77		4.50	12	291	1.76	24.97	
	V6	3.68	12	158	2.63	19.73		3.86	18	261	1.70	25.33	
	V7	3.95	7	177	3.29	15.27		2.96	22	264	1.64	24.80	
	V8	2.79	20	170	2.25	23.67		3.31	21	261	1.57	24.43	
	V9	3.17	19	166	2.62	24.93		3.81	19	256	1.62	24.23	
	V10	3.42	16	166	2.28	23.87		4.10	16	261	1.58	24.93	
	V11	2.36	23	162	2.27	13.53							
	V12	3.94	8	178	3.07	24.77		4.17	15	274	1.65	24.70	
F2: Optimum input (100% NPK)	V1	4.44	2	183	4.37	19.80	5.27	7.10	3	341	1.86	25.80	20.30
	V2	3.34	17	182	4.18	20.07	4.47	6.03	9	340	1.70	25.73	15.85
	V3	4.11	5	181	3.22	23.00	3.67	5.95	11	316	1.75	25.57	16.96
	V4	3.34	17	169	2.71	25.27	7.07	7.21	2	348	1.95	26.07	20.22
	V5	4.00	6	178	3.59	25.87	1.33	7.42	1	359	1.96	25.67	21.63
	V6	4.19	4	166	3.23	21.93	3.40	6.05	8	335	1.67	25.43	16.22
	V7	4.29	3	181	3.70	16.10	2.27	6.06	7	328	1.69	25.30	22.96
	V8	3.80	9	181	3.00	24.93	6.73	6.02	10	318	1.68	25.70	20.07
	V9	3.46	15	183	3.29	25.40	1.93	6.10	6	322	1.65	25.10	16.96
	V10	3.78	11	170	2.83	25.07	2.40	6.32	5	323	1.74	25.73	16.44
	V11	2.66	22	178	3.27	14.50	2.00						
	V12	4.82	1	185	3.81	25.93	5.87	6.54	4	335	1.77	25.77	17.56
Interaction F at same V V at same F		NS		NS	NS	NS		0.5		NS	NS	NS	
		NS		NS	NS	NS		0.44		NS	NS	NS	
	F1	3.27	2	169	2.72	20.67		3.92	2	270	1.65	24.62	
	F2	3.85	1	178	3.43	22.32	3.87	6.44	1	333	1.77	25.62	18.65
C.D.(0.05) C.V.(%)		0.47		4.47	0.47	NS		0.36		12.13	NS	NS	
		12.95		2.54	15.1	8.66		6.5		3.8	8.8	4.77	

Table 4.1(j): Contd.

F-levels		Varieties	GANGAVATHI						KAUL					
			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:														
V1			4.05	3	181	4.08	19.50	5.27	5.73	3	311	1.79	25.10	20.30
V2			3.01	10	176	3.58	19.62	4.47	4.96	6	302	1.64	25.08	15.85
V3			3.84	6	177	2.80	21.79	3.67	4.81	9	290	1.69	24.82	16.96
V4			2.81	11	166	2.63	24.39	7.07	5.85	2	318	1.85	25.30	20.22
V5			3.90	5	174	3.08	22.82	1.33	5.96	1	325	1.86	25.32	21.63
V6			3.94	4	162	2.93	20.83	3.40	4.96	7	298	1.69	25.38	16.22
V7			4.12	2	179	3.50	15.69	2.27	4.51	11	296	1.67	25.05	22.96
V8			3.30	9	176	2.63	24.30	6.73	4.67	10	289	1.63	25.07	20.07
V9			3.32	8	174	2.96	25.17	1.93	4.96	7	289	1.64	24.67	16.96
V10			3.60	7	168	2.56	24.47	2.40	5.21	5	292	1.66	25.33	16.44
V11			2.51	12	170	2.77	14.02	2.00						
V12			4.38	1	182	3.44	25.35	5.87	5.36	4	305	1.71	25.24	17.56
C.D.(0.05)			0.84		12.12	0.85	4.36		0.31		20.57	0.12	NS	
C.V. (%)			20.25		6	23.85	17.42		5.1		5.85	5.86	3.17	
Expt. Mean			3.56		174	3.08	21.49		5.18		301	1.71	25.12	
Soil type			-						Clay loam					
pH			-						8.00					
N - levels (kg/ha)														
F1			75:37.5:37.5											
F2			150:75:75											
Recomnd N:P:K (kg/ha)			150:75:75											
Varieties														
V1			IET 31925								IET 31925			
V2			IET 31927								IET 31927			
V3			IET 31938								IET 31938			
V4			IET 31939								IET 31939			
V5			IET 31947								IET 31947			
V6			IET 31961								IET 31961			
V7			BPT 5204								BPT 5204			
V8			IR 64								IR 64			
V9			DRR Dhan 45								DRR Dhan 45			
V10			DRR Dhan 48								DRR Dhan 48			
V11			Chittimuthyalu								-			
V12			Local Check - Spoorthi, 130-135 days								Local Check - HKR 47, 140days			
Available N:P:K of soil			-								160:16:320			

Table 4.1(j): Contd.

F-levels	Varieties	KOTA						NAGINA							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low Input (50% NPK)	V1	5.95	15	231	5.47	15.95	91		2.44	14	235	2.72	22.91	102	
	V2	6.85	5	280	4.19	21.43	88		2.48	13	233	2.74	23.13	103	
	V3	5.29	17	289	3.53	21.06	87		2.40	16	239	2.77	22.87	97	
	V4	4.91	19	256	3.59	20.24	85		2.53	12	224	2.77	23.17	95	
	V5	6.25	10	256	5.77	17.05	85		2.43	15	237	2.66	22.95	104	
	V6	6.04	12	275	3.37	23.24	85		2.37	17	220	2.62	23.63	98	
	V7	4.83	20	253	3.08	13.42	105		2.18	21	205	2.77	21.86	112	
	V8	5.99	14	285	3.49	25.62	85		2.35	18	214	3.21	24.79	96	
	V9	6.38	9	272	3.93	24.96	86		2.22	20	219	2.76	23.88	97	
	V10	5.13	18	231	4.00	21.33	85		2.32	19	214	2.67	23.90	101	
	V11	1.70	22	156	2.75	6.37	119		2.17	22	203	2.47	22.64	114	
	V12														
F2: Optimum Input (100% NPK)	V1	7.21	4	257	5.85	16.72	92	8.84	4.89	1	360	2.84	24.40	102	22.27
	V2	7.85	1	299	5.17	21.95	89	7.02	4.74	5	342	2.85	24.55	105	20.55
	V3	6.66	7	305	3.87	21.46	89	9.61	4.88	2	365	2.84	24.47	97	22.55
	V4	5.56	16	277	4.01	21.12	84	4.56	4.76	4	358	2.85	24.41	95	20.27
	V5	6.75	6	278	6.13	17.34	87	3.51	4.77	3	338	2.71	24.63	104	21.27
	V6	6.45	8	296	3.78	23.50	86	2.88	4.47	6	326	2.84	24.57	98	19.09
	V7	6.02	13	282	3.60	13.75	105	8.35	4.25	9	312	2.87	22.16	114	18.82
	V8	7.56	2	303	3.92	26.54	87	11.02	4.06	11	304	3.46	25.26	96	15.55
	V9	7.44	3	289	4.59	25.21	87	7.44	4.29	8	317	2.87	24.16	98	18.82
	V10	6.08	11	251	4.34	21.54	87	6.67	4.33	7	323	2.77	24.12	101	18.27
	V11	1.95	21	163	3.00	6.67	121	1.75	4.12	10	299	2.53	23.21	116	17.73
	V12														
Interaction F at same V V at same F		NS		NS	NS	NS	NS		0.23		16.58	0.02	0.06	1.39	
		NS		NS	NS	NS	NS		0.23		15.87	0.02	0.06	1.17	
	F1	5.85	2	262	4.51	19.15	87		2.35	2	222	2.74	23.25	102	
	F2	6.81	1	283	5.01	19.72	88	6.71	4.51	1	331	2.86	24.18	102	19.56
	C.D.(0.05) C.V.(%)	0.58 9.31		14.24 5.11	0.38 8.62	0.44 2.15	1.07 1.1		0.08 2.28		1.72 0.59	0.01 0.27	0.01 0.04	NS 0.99	

Table 4.1(j): Contd.

F-levels		Varieties	KOTA					NAGINA							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:															
V1		6.58	4	244	5.66	16.34	92	8.84	3.67	1	298	2.78	23.66	102	22.27
V2		7.35	1	289	4.68	21.69	88	7.02	3.61	4	288	2.80	23.84	104	20.55
V3		5.98	7	297	3.70	21.26	88	9.61	3.64	3	302	2.81	23.67	97	22.55
V4		5.24	10	267	3.80	20.68	85	4.56	3.65	2	291	2.81	23.79	95	20.27
V5		6.50	5	267	5.95	17.20	86	3.51	3.60	5	287	2.69	23.79	104	21.27
V6		6.25	6	286	3.58	23.37	86	2.88	3.42	6	273	2.73	24.10	98	19.09
V7		5.43	9	267	3.34	13.59	105	8.35	3.22	9	259	2.82	22.01	113	18.82
V8		6.78	3	294	3.71	26.08	86	11.02	3.21	10	259	3.34	25.03	96	15.55
V9		6.91	2	281	4.26	25.09	86	7.44	3.26	8	268	2.82	24.02	98	18.82
V10		5.61	8	241	4.17	21.44	86	6.67	3.33	7	268	2.72	24.01	101	18.27
V11		1.83	11	160	2.88	6.52	120	1.75	3.15	11	251	2.50	22.93	115	17.73
V12															
C.D.(0.05)		0.46		12.02	0.44	0.66	0.82		0.16		11.73	0.02	0.05	0.83	
C.V. (%)		6.75		3.92	9.16	2.91	0.76		4.03		3.63	0.53	0.17	0.69	
Expt. Mean		5.86		263	4.16	19.39	92		3.43		277	2.80	23.71	102	
Soil type		Clay loam							Sandy Loam						
pH		7.52							7.70						
N - levels (kg/ha)															
F1		75:37.5:30							60:30:20						
F2		150:75:60							120:60:40						
Recomnd N:P:K (kg/ha)		150:75:60							120:60:40						
Varieties															
V1		IET 31925							IET 31925						
V2		IET 31927							IET 31927						
V3		IET 31938							IET 31938						
V4		IET 31939							IET 31939						
V5		IET 31947							IET 31947						
V6		IET 31961							IET 31961						
V7		BPT 5204							BPT 5204						
V8		IR 64							IR 64						
V9		DRR Dhan 45							DRR Dhan 45						
V10		DRR Dhan 48							DRR Dhan 48						
V11		Chittimuthyalu							Chittimuthyalu						
V12		-							-						
Available N:P:K of soil		208.6:21.7:423.9							21:158.33:209						

Table 4.1(j): Contd.

F-levels	Varieties	NAWAGAM						PUSA							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.64	19	226	4.08	17.73	111		2.99	16	188	1.71	19.88	88	
	V2	6.15	3	259	3.24	20.60	103		3.19	13	201	1.85	19.80	90	
	V3	5.40	12	249	3.25	22.33	102		3.04	14	190	1.74	20.00	87	
	V4	4.06	21	249	2.39	23.27	95		2.75	19	177	1.62	19.44	94	
	V5	5.20	14	189	3.50	18.83	93		2.82	17	173	1.64	20.38	91	
	V6	5.49	10	244	3.42	23.53	92		2.63	20	157	1.57	20.95	91	
	V7	5.12	15	255	2.74	15.90	111		3.03	15	179	1.77	21.15	98	
	V8	5.52	9	255	3.71	27.23	95		2.82	17	172	1.77	20.53	97	
	V9	5.56	8	222	3.87	26.53	95		2.40	23	141	1.64	21.38	102	
	V10	5.12	15	228	3.84	21.13	95		2.50	21	142	1.70	22.07	100	
	V11	3.63	22	240	2.20	9.17	91		2.28	24	135	1.60	21.11	99	
	V12								2.48	22	159	1.83	19.51	80	
F2: Optimum input (100% NPK)	V1	5.32	13	249	4.63	17.13	112	10.88	5.11	3	289	2.28	22.09	90	19.27
	V2	6.70	1	267	3.72	21.27	102	8.80	5.32	1	302	2.47	22.00	92	19.36
	V3	5.99	5	275	3.66	22.17	103	9.44	5.07	4	285	2.40	22.22	89	18.45
	V4	4.26	20	276	2.71	22.70	95	3.20	4.60	7	266	2.18	21.59	95	16.82
	V5	5.49	10	203	4.46	19.27	94	4.64	4.88	5	269	2.20	22.65	92	18.73
	V6	4.79	17	265	3.57	23.63	92	-11.20	4.54	8	244	2.11	23.28	93	17.36
	V7	5.61	7	288	2.60	15.70	112	7.84	5.21	2	278	2.39	23.50	101	19.82
	V8	6.40	2	278	3.55	26.87	95	14.08	4.88	5	267	2.36	22.81	100	18.73
	V9	6.00	4	267	3.89	28.40	96	7.04	4.15	11	219	2.19	23.76	104	15.91
	V10	5.94	6	249	3.71	21.70	95	13.12	4.32	9	220	2.26	24.52	104	16.55
	V11	4.65	18	275	2.68	9.83	92	16.32	3.97	12	212	2.14	23.46	101	15.36
	V12								4.21	10	243	2.45	21.67	81	15.73
Interaction F at same V V at same F		NS		NS	NS	NS	NS	0.3			10.84	NS	NS	NS	
		NS		NS	NS	NS	NS	0.2			16.19	NS	NS	NS	
F1 F2		5.08	2	238	3.29	20.57	98		2.74	2	168	1.70	20.52	93	
		5.56	1	263	3.56	20.79	99	7.65	4.69	1	258	2.29	22.80	95	17.67
C.D.(0.05) C.V.(%)		NS		11.14	NS	NS	0.45		0.3		15.99	0.07	0.06	1.18	
		8.89		4.2	13.95	7.42	0.43		7.88		7.41	3.28	0.26	1.23	

Table 4.1(j): Contd.

F-levels	Varieties	NAWAGAM							PUSA							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	
Mean of varieties:		V1	4.98	9	238	4.36	17.43	112	10.88	4.05	4	239	2.00	20.99	89	19.27
		V2	6.43	1	263	3.48	20.94	102	8.80	4.26	1	252	2.16	20.90	91	19.36
		V3	5.70	4	262	3.46	22.25	103	9.44	4.06	3	238	2.07	21.11	88	18.45
		V4	4.16	10	263	2.55	22.99	95	3.20	3.68	7	222	1.90	20.52	95	16.82
		V5	5.35	7	196	3.98	19.05	93	4.64	3.85	5	221	1.92	21.52	92	18.73
		V6	5.14	8	254	3.50	23.58	92	-11.20	3.59	8	200	1.84	22.12	92	17.36
		V7	5.37	6	272	2.67	15.80	111	7.84	4.12	2	229	2.08	22.33	100	19.82
		V8	5.96	2	267	3.63	27.05	95	14.08	3.85	5	220	2.07	21.67	99	18.73
		V9	5.78	3	245	3.88	27.47	95	7.04	3.28	11	180	1.92	22.57	103	15.91
		V10	5.53	5	239	3.78	21.42	95	13.12	3.41	9	181	1.98	23.30	102	16.55
		V11	4.14	11	257	2.44	9.50	91	16.32	3.13	12	173	1.87	22.29	100	15.36
		V12								3.35	10	201	2.14	20.59	80	15.73
C.D.(0.05) C.V. (%) Expt. Mean Soil type pH			0.54		24.58	0.42	0.75	0.9		0.14		7.67	0.06	0.29	1.7	
			8.71		8.41	10.46	3.1	0.79		3.27		3.1	2.55	1.15	1.55	
			5.32		250	3.43	20.68	99		3.72		213	1.99	21.66	94	
N - levels (kg/ha) F1 F2 Recomnd N:P:K (kg/ha)			Clay Loam							Sandy Loam						
			7.88							8.23						
			50:12.5:0							60:30:20						
			100:25:0							120:60:40						
			100:25:0							120:60:40						
Varieties			IET 31925							IET 31925						
			IET 31927							IET 31927						
			IET 31938							IET 31938						
			IET 31939							IET 31939						
			IET 31947							IET 31947						
			IET 31961							IET 31961						
			BPT 5204							BPT 5204						
			IR 64							IR 64						
			DRR Dhan 45							DRR Dhan 45						
			DRR Dhan 48							DRR Dhan 48						
			Chittimuthyalu							Chittimuthyalu						
			-							Local Check - Rajenrdra Nilam, 115-120 days						
Available N:P:K of soil			250:78.6:428							212:13.2:110						

Table 4.1(j): Contd.

		RAIPUR						
F-levels	Varieties	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.01	10	192	383	17.37	82	
	V2	3.95	11	204	287	23.23	82	
	V3	4.53	4	223	243	23.57	83	
	V4	2.90	22	210	211	21.00	78	
	V5	3.13	21	210	298	19.03	79	
	V6	3.36	19	218	210	25.23	79	
	V7	4.32	6	268	383	14.37	95	
	V8	3.93	13	218	237	28.10	79	
	V9	3.73	15	220	187	27.23	79	
	V10	3.69	16	224	202	23.23	78	
	V11	1.73	24	234	322	9.70	88	
	V12	3.54	18	223	250	23.03	80	2.55
F2: Optimum input (100% NPK)	V1	4.29	7	239	387	17.97	83	10.36
	V2	5.09	1	223	333	23.30	82	4.45
	V3	5.02	2	254	299	23.67	83	2.45
	V4	3.17	20	292	267	21.20	78	7.36
	V5	3.94	12	226	356	19.67	79	2.82
	V6	3.67	17	249	225	25.67	79	4.45
	V7	4.81	3	290	405	14.60	95	5.00
	V8	4.48	5	244	253	28.17	79	1.64
	V9	3.91	14	244	231	27.43	80	3.55
	V10	4.08	9	268	292	23.63	78	2.45
	V11	2.00	23	263	347	9.87	88	6.82
	V12	4.29	7	251	273	23.17	81	
Interaction F at same V V at same F		NS		NS	NS	NS	NS	
		NS		NS	NS	NS	NS	
	F1	3.57	2	220	2.68	21.26	82	4.49
	F2	4.06	1	254	3.06	21.53	82	
C.D.(0.05) C.V.(%)		0.41		29.85	0.3	NS	NS	
		10.62		12.43	10.15	2.92	0.38	

Table 4.1(j): Contd.

		RAIPUR						
F-levels	Varieties	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:								
V1		4.15	5	216	3.85	17.67	83	2.55
V2		4.52	3	214	3.10	23.27	82	10.36
V3		4.78	1	239	2.71	23.62	83	4.45
V4		3.04	11	251	2.39	21.10	78	2.45
V5		3.54	9	218	3.27	19.35	79	7.36
V6		3.52	10	233	2.18	25.45	79	2.82
V7		4.57	2	279	3.94	14.49	95	4.45
V8		4.21	4	231	2.45	28.14	79	5.00
V9		3.82	8	232	2.09	27.33	79	1.64
V10		3.89	7	246	2.47	23.43	78	3.55
V11		1.87	12	248	3.35	9.79	88	2.45
V12		3.92	6	237	2.62	23.10	81	6.82
C.D.(0.05)		0.51		27.78	0.55	0.38	0.67	
C.V. (%)		11.6		10.08	16.6	1.54	0.71	
Expt. Mean		3.82		237	2.87	21.39	82	
Soil type		Vertisols						
pH		7.10						
N - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recomnd N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 31925						
V2		IET 31927						
V3		IET 31938						
V4		IET 31939						
V5		IET 31947						
V6		IET 31961						
V7		BPT 5204						
V8		IR 64						
V9		DRR Dhan 45						
V10		DRR Dhan 48						
V11		Chittimthyalu						
V12		Local Check - Zinco Rice, 135 days						
Available N:P:K of soil		202.3:19.4:333.8						

Table 4.1(j): Contd.

F-levels	Varieties	WARANGAL							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	5.50	6	312	6.80	14.23	117		4.19	14
	V2	4.40	16	328	3.07	19.60	94		4.20	13
	V3	5.33	7	330	2.97	22.43	117		4.15	15
	V4	3.10	21	316	1.60	16.23	100		3.38	22
	V5	5.77	5	304	5.53	16.23	87	-	4.24	12
	V6	4.10	20	335	2.80	22.93	98		3.94	17
	V7	4.23	17	320	2.83	14.87	111		3.83	20
	V8	4.17	18	318	3.00	18.27	87		3.86	18
	V9	5.03	12	317	3.17	20.33	89		4.04	16
	V10	4.13	19	326	3.50	19.73	63		3.80	21
	V11	2.53	24	443	2.47	8.70	119		2.34	24
	V12	5.17	10	327	4.03	12.77	102		3.86	18
F2: Optimum input (100% NPK)	V1	5.87	3	330	6.30	15.93	117	3.36	5.53	2
	V2	5.80	4	319	3.30	20.97	94	12.73	5.61	1
	V3	5.20	8	336	3.50	24.37	117	-1.18	5.36	4
	V4	3.00	22	323	2.67	17.80	98	-0.91	4.49	11
	V5	5.97	2	329	5.17	17.10	87	1.82	5.40	3
	V6	4.50	14	335	3.20	24.13	96	3.64	4.83	10
	V7	5.13	11	353	2.67	15.63	111	8.18	5.17	7
	V8	4.43	15	361	2.53	25.07	86	2.36	5.20	5
	V9	5.20	8	331	3.63	21.67	88	1.55	5.07	8
	V10	4.63	13	322	3.90	22.27	89	4.55	4.94	9
	V11	2.93	23	476	2.70	9.20	120	3.64	3.18	23
	V12	6.03	1	331	4.47	13.03	101	7.82	5.18	6
Interaction F at same V V at same F F1 F2 C.D.(0.05) C.V.(%)		NS		NS	NS	NS	NS			
		NS		NS	NS	NS	NS			
		4.46	2	331	3.48	17.19	99		3.91	2
		4.89	1	346	3.67	18.93	100	3.96	5.10	1
		0.29		13.04	NS	NS	NS			
		6.14		3.8	5.83	16.8	10.14			

Table 4.1(j): Contd.

F-levels		Varieties	WARANGAL							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)				
Mean of varieties:											
	V1	5.69	2	321	6.55	117	15.08	3.36	4.86	2	
	V2	5.10	6	323	3.19	94	20.29	12.73	4.90	1	
	V3	5.27	4	333	3.24	117	23.40	-1.18	4.76	4	
	V4	3.05	11	320	2.14	99	17.02	-0.91	3.93	11	
	V5	5.87	1	317	5.35	87	16.67	1.82	4.82	3	
	V6	4.30	9	335	3.00	97	23.53	3.64	4.39	9	
	V7	4.68	7	337	2.75	111	15.25	8.18	4.50	8	
	V8	4.30	9	340	2.77	87	21.67	2.36	4.53	6	
	V9	5.12	5	324	3.40	88	21.00	1.55	4.55	5	
	V10	4.38	8	324	3.70	76	21.00	4.55	4.37	10	
	V11	2.73	12	460	2.59	120	8.95	3.64	2.76	12	
	V12	5.60	3	329	4.25	101	12.90	7.82	4.52	7	
C.D.(0.05)		0.74		22.76	0.54	11.06	2.28				
C.V. (%)		13.56		5.78	12.9	9.56	10.86		4.44		
Expt. Mean		4.67		338	3.58	99	18.06				
Soil type		Clay									
pH		8.60									
N - levels (kg/ha)											
	F1	60:30:20									
	F2	120:60:40									
Recomnd N:P:K (kg/ha)		120:60:40									
Varieties											
	V1	IET 31925									
	V2	IET 31927									
	V3	IET 31938									
	V4	IET 31939									
	V5	IET 31947									
	V6	IET 31961									
	V7	BPT 5204									
	V8	IR 64									
	V9	DRR Dhan 45									
	V10	DRR Dhan 48									
	V11	Chittimuthyalu									
	V12	Local Check - WGL 962, 135 days									
Available N:P:K of soil		129:48:468									

4. 1(k) AVT 2 - AL & ISTVT

Saline tolerant cultures (three) Viz., IET 31858, IET 31861, IET 31862 were evaluated for its response to different doses of nutrients on grain yield at **Navasari (120-30-0)**, **Panvel (100-50-50)** and **Pusa (120-60-40)**. The details and data received from these locations are summarized and presented in Table 4.1(k).

Application of RDF doses influence the grain yield significantly at all 3 locations and higher dose of 100% RDF resulted in the higher grain yield of 3.34 t/ha at Navsari, 2.27 t/ha at **Panvel** and 4.19 t/ha at **Pusa**.

Grain yield differences among the tested cultures was found to be significant at 3 locations. At **Panvel**, IET 31861 (2.84 t/ha) followed by IET 31862 (2.35 t/ha) and IET 31858 (2.31 t/ha) were found promising entries. Similarly, at **Pusa** IET 31862 (3.76 t/ha), followed by IET 31861 (3.70 t/ha) were found superior than check. Interaction effects among RFD x varieties on grain yield was found to be non-significant.

In this trial, 100% RDF was found to be promising however, exhibited higher nutrient efficiency than 50%. IET 31861 and IET 31862 cultures were found to be promising over other local checks at **Panvel** and **Pusa**.

Table 4.1(k): Summary of data on grain yield and ancillary characters of selected AET AL&ISTVT cultures grown under transplanted conditions at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	NAVSARI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.03	11	314	2.75	24.77	101	
	V2	2.28	18	300	2.60	27.34	100	
	V3	2.58	15	293	2.38	24.75	116	
	V4	3.63	5	313	3.12	27.51	114	
	V5	3.67	4	305	2.28	24.73	97	
	V6	2.89	13	296	3.67	29.20	95	
	V7	2.44	17	289	2.45	27.36	98	
	V8	3.21	10	296	3.43	22.78	111	
	V9	3.43	8	302	4.75	28.57	101	
F2: Optimum input (100% NPK)	V1	3.44	7	325	2.66	24.61	102	5.47
	V2	2.69	14	307	2.53	28.76	111	5.47
	V3	2.99	12	311	4.45	26.74	117	5.47
	V4	3.85	2	316	2.25	27.57	100	2.93
	V5	3.96	1	313	2.74	25.56	96	3.87
	V6	3.29	9	311	3.29	27.13	96	5.33
	V7	2.52	16	325	2.86	27.23	99	1.07
	V8	3.63	5	309	4.57	24.56	111	5.60
	V9	3.72	3	318	4.21	25.12	106	3.87
Interaction								
F at same V		NS		NS	0.17	0.25	6.11	
V at same F		NS		NS	0.15	0.25	4.97	
F1		3.02	2	301	3.05	26.33	104	
F2		3.34	1	315	3.28	26.36	104	4.34
C.D.(0.05)		0.08		NS	0.1	NS	NS	
C.V.(%)		2.11		13.93	2.69	0.43	4.12	
Mean of varieties:								
V1		3.24	5	319	2.71	24.69	101	5.47
V2		2.49	8	304	2.57	28.05	106	5.47
V3		2.79	7	302	3.42	25.75	117	5.47
V4		3.74	2	314	2.69	27.54	107	2.93
V5		3.82	1	309	2.51	25.15	97	3.87
V6		3.09	6	304	3.48	28.17	96	5.33
V7		2.48	9	307	2.66	27.30	99	1.07
V8		3.42	4	302	4.00	23.67	111	5.60
V9		3.58	3	310	4.48	26.85	104	3.87
C.D.(0.05)		0.46		21.94	0.11	0.17	3.52	
C.V. (%)		12.2		6.06	2.94	0.56	2.88	
Expt. Mean		3.18		308	3.17	26.35	104	
Soil type		Clayey						
pH		8.52						
F - levels (kg/ha)								
F1		60:15:0						
F2		120:30:0						
Recomnd N:P:K (kg/ha)		120:30:0						
Varieties								
V1		IET 31858						
V2		IET 31861						
V3		IET 31862						
V4		CSR 36						
V5		CSR 10						
V6		FL 478						
V7		CSR 23						
V8		Pusa 44 (Sensitive)						
V9		Local Check - GNR 5, 130 days						
Avlb N:P:K of soil (kg/ha)		287.5:51.4:1956						

Table 4.1(k): Contd.

F-levels	Varieties	PANVEL						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	2.04	9	311	3.24	24.50	103	
	V2	2.72	2	358	3.53	25.27	100	
	V3	2.03	11	345	3.53	25.07	108	
	V4	1.84	12	268	3.27	26.73	104	
	V5	0.96	16	332	1.93	23.83	86	
	V6	1.61	13	280	3.00	22.90	99	
	V7	1.60	14	242	3.76	27.57	94	
	V8	-	-	-	-	-	-	
	V9	2.04	9	312	3.25	27.50	101	
F2: Optimum input (100% NPK)	V1	2.57	4	312	3.48	24.60	103	5.30
	V2	2.96	1	390	3.60	25.60	100	2.40
	V3	2.67	3	338	3.63	25.10	108	6.40
	V4	2.25	6	273	3.33	27.00	104	4.10
	V5	1.11	15	338	1.90	24.03	86	1.50
	V6	2.13	8	276	3.10	22.90	99	5.20
	V7	2.27	5	252	2.83	27.73	94	6.70
	V8	-	-	-	-	-	-	
	V9	2.18	7	311	3.41	27.50	101	1.40
Interaction								
F at same V		NS		NS	0.2	NS	NS	
V at same F		NS		NS	0.21	NS	NS	
F1		1.86	2	306	3.19	25.42	99	
F2		2.27	1	311	3.16	25.56	99	4.13
C.D.(0.05)		0.11		NS	NS	0.11	NS	
C.V.(%)		4.36		6.13	1.68	0.35	0	
Mean of varieties:								
	V1	2.31	3	311	3.36	24.55	103	5.30
	V2	2.84	1	374	3.57	25.44	100	2.40
	V3	2.35	2	342	3.58	25.09	108	6.40
	V4	2.05	5	271	3.30	26.87	104	4.10
	V5	1.04	8	335	1.92	23.93	86	1.50
	V6	1.87	7	278	3.05	22.90	99	5.20
	V7	1.94	6	247	3.30	27.65	94	6.70
	V8	-	-	-	-	-	-	
	V9	2.11	4	311	3.33	27.50	101	1.40
C.D.(0.05)		0.22		22.79	0.15	0.28	1.04	
C.V. (%)		9.13		6.25	3.98	0.94	0.89	
Expt. Mean		2.06		309	3.17	25.49	99	
Soil type		Clay loam						
pH		7.60						
F - levels (kg/ha)								
F1		50:25:25						
F2		100:50:50						
Recomnd N:P:K (kg/ha)		100:50:50						
Varieties								
V1		IET 31858						
V2		IET 31861						
V3		IET 31862						
V4		CSR 36						
V5		CSR 10						
V6		FL 478						
V7		CSR 23						
V8		-						
V9		Local Check - Trombay Konkan Khara, 125-130 days						
Avlb N:P:K of soil (kg/ha)		-						

Table 4.1(k): Contd.

F-levels	Varieties	PUSA							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	2.39	16	160	2.13	19.38	100		2.49	14
	V2	2.82	10	184	2.23	19.80	90		2.61	13
	V3	2.82	10	182	2.36	20.08	90		2.48	15
	V4	2.49	15	170	1.85	18.96	99		2.65	12
	V5	2.62	14	177	1.87	19.05	99		2.42	16
	V6	2.34	17	157	1.83	19.28	99		2.28	17
	V7	2.71	13	174	1.86	20.12	93		2.25	18
	V8	2.15	18	147	1.70	18.92	87		2.68	11
	V9	2.82	10	190	2.41	19.22	97		2.76	10
F2: Optimum input (100% NPK)	V1	3.88	7	230	2.66	21.78	102	13.55	3.30	6
	V2	4.58	2	266	2.78	22.24	93	16.00	3.41	4
	V3	4.70	1	269	2.97	22.56	92	17.09	3.45	3
	V4	4.06	6	246	2.33	21.31	100	14.27	3.39	5
	V5	4.22	5	255	2.35	21.41	101	14.55	3.10	7
	V6	3.78	8	226	2.30	21.66	101	13.09	3.07	9
	V7	4.43	4	253	2.32	22.61	95	15.64	3.07	8
	V8	3.48	9	211	2.14	21.26	89	12.09	3.56	1
	V9	4.57	3	273	3.00	21.60	99	15.91	3.49	2
Interaction										
F at same V		NS		NS	NS	NS	NS			
V at same F		NS		NS	NS	NS	NS			
F1		2.57	2	171	2.03	19.42	95		2.48	2
F2		4.19	1	248	2.54	21.83	97	14.69	3.27	1
C.D.(0.05)		0.2		9.72	0.05	0.02	1.46			
C.V.(%)		5.15		3.97	1.87	0.09	1.3			
Mean of varieties:										
	V1	3.14	7	195	2.40	20.58	101	13.55	2.89	6
	V2	3.70	2	225	2.51	21.02	91	16.00	3.01	4
	V3	3.76	1	225	2.67	21.32	91	17.09	2.97	5
	V4	3.28	6	208	2.09	20.14	100	14.27	3.02	3
	V5	3.42	5	216	2.11	20.23	100	14.55	2.76	7
	V6	3.06	8	191	2.07	20.47	100	13.09	2.67	8
	V7	3.57	4	214	2.09	21.37	94	15.64	2.66	9
	V8	2.82	9	179	1.92	20.09	88	12.09	3.12	2
	V9	3.70	3	231	2.71	20.41	98	15.91	3.13	1
C.D.(0.05)		0.19		11.58	0.17	0.31	2.14			
C.V. (%)		4.85		4.7	6.29	1.27	1.9			
Expt. Mean		3.38		209	2.28	20.62	96		2.87	
Soil type		Sandy loam								
pH		8.22								
F - levels (kg/ha)										
F1		60:30:20								
F2		120:60:40								
Recomnd N:P:K (kg/ha)		120:60:40								
Varieties										
V1		IET 31858								
V2		IET 31861								
V3		IET 31862								
V4		CSR 36								
V5		CSR 10								
V6		FL 478								
V7		CSR 23								
V8		Pusa 44 (Sensitive)								
V9		Local Check - Rajendra Sweta, 130-135 days								
Avlb N:P:K of soil (kg/ha)		211:13:112								

4.1(l) AVT 2 – CSTVT

Two cultures viz., IET 31877 and IET 31878 were evaluated in comparison with standard check varieties (Pusa 44, CSR-10, Bhootnath and FL 478) at **Chinsura** (80-40-40), **Gangavathi (150-75-75)**, **Vytilla (75-108-20)**, **Navsari (120-30-0)** and under two recommended level of input (50 and 100% RDF). The data is summarized and presented in Table 4.1(l).

Different levels of RDF did not exhibit significant differences in grain yield at **Gangavathi**. Application of 100% RDF recorded significantly higher grain yield of (4.07 t/ha) over 50% RDF (3.47 t/ha) at **Chinsura**. At **Vytilla** (4.67 t/ha) and **Navsari** (3.56 t/ha) 100% RDF resulted higher grain yield. Nutrient response (kg grain / kg Nutrients) was also marginally higher at 100% RDF over 50% RDF (4.10 to 7.52 kg grain/kg nutrient).

Among test cultures at **Gangavathi** IET 31877 resulted in the highest grain yield (5.15 t/ha) over checks. Similarly, at Vytilla, IET 31878 resulted higher grain yield of 5.13 t/ha than those of checks. Average yield of culture IET 30201 (4.63 t/ha) found to be promising over checks. Interaction effects of N levels and varieties were found to be non-significant at all locations except **Vytilla**.

Table 4.1(l): Summary of data on grain yield and ancillary characters of selected AET CSTVT cultures grown under transplanted conditions at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.66	6	240	2.26	96	
	V2	4.02	5	264	2.49	111	
	V3	4.83	3	317	2.99	112	
	V4	2.74	11	180	1.77	98	
	V5	2.91	10	217	1.80	120	
	V6	2.65	12	234	1.71	94	
	V7	-	-	-	-	-	
F2: Optimum input (100% NPK)	V1	4.68	4	292	2.90	97	12.75
	V2	4.92	2	303	3.05	113	11.25
	V3	5.13	1	342	3.17	114	3.75
	V4	3.28	8	282	2.28	101	6.75
	V5	3.37	7	285	2.08	122	5.75
	V6	3.04	9	270	2.24	96	4.88
	V7	-	-	-	-	-	-
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
F1		3.47	2	242	2.17	105	
F2		4.07	1	296	2.62	107	7.52
C.D.(0.05)		0.08		43	0.18	1	
C.V.(%)		1.43		11	5.25	0.4	
Mean of varieties:							
	V1	4.17	3	266	2.58	97	12.75
	V2	4.47	2	283	2.77	112	11.25
	V3	4.98	1	330	3.08	113	3.75
	V4	3.01	5	231	2.03	100	6.75
	V5	3.14	4	251	1.94	121	5.75
	V6	2.85	6	252	1.98	95	4.88
	V7	-	-	-	-	-	-
C.D.(0.05)		0.40		36	0.23	2	
C.V. (%)		8.80		11	7.90	2	
Expt. Mean		3.77		269	2.40	106	
Soil type		Clay loam					
pH		7.10					
F - levels (kg/ha)							
	F1	40:20:20					
	F2	80:40:40					
Recommended N:P:K (kg/ha)		80:40:40					
Varieties							
	V1	IET 31877					
	V2	IET 31878					
	V3	Bhootnath					
	V4	FL 478					
	V5	Pusa 44					
	V6	CSR-10					
	V7	-					
Available N:P:K of soil (kg/ha)		-					

Table 4.1(l): Contd.

F-levels	Varieties	GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.52	3	142	2.95	25.1	
	V2	2.99	12	170	2.65	26.3	
	V3	3.67	7	160	2.67	25.3	
	V4	3.20	11	151	2.89	28.1	
	V5	3.58	8	159	2.52	22.4	
	V6	2.37	14	145	2.34	25.3	
	V7	3.39	10	170	3.37	25.7	
F2: Optimum input (100% NPK)	V1	5.77	1	163	3.75	27.0	8.33
	V2	3.89	5	181	3.18	26.8	6.00
	V3	3.81	6	176	2.87	26.4	0.93
	V4	3.45	9	167	3.27	32.0	1.67
	V5	4.00	4	171	3.59	24.6	2.80
	V6	2.99	12	157	2.95	26.2	4.13
	V7	4.98	2	186	3.53	26.0	10.60
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
F1		3.39	2	157	2.77	25.45	
F2		4.13	1	171	3.31	26.98	4.92
C.D.(0.05)		NS		5	0.28	1.1	
C.V.(%)		24.20		2	6.92	3.2	
Mean of varieties:							
	V1	5.15	1	153	3.35	26.02	8.33
	V2	3.44	5	175	2.92	26.54	6.00
	V3	3.74	4	168	2.77	25.85	0.93
	V4	3.33	6	159	3.08	30.05	1.67
	V5	3.79	3	165	3.06	23.47	2.80
	V6	2.68	7	151	2.65	25.72	4.13
	V7	4.19	2	178	3.45	25.87	10.60
C.D.(0.05)		0.85		20	NS	2.8	
C.V. (%)		19.03		10	26.32	9.1	
Expt. Mean		3.76		164	3.04	26.22	
Soil type		-					
pH		-					
F - levels (kg/ha)							
	F1	75:37.5:37.5					
	F2	150:75:75					
Recommended N:P:K (kg/ha)		150:75:75					
Varieties							
	V1	IET 31877					
	V2	IET 31878					
	V3	Bhootnath					
	V4	FL 478					
	V5	Pusa 44					
	V6	CSR-10					
	V7	Local Check (GNV1109) 130-135 days					
Available N:P:K of soil (kg/ha)		-					

Table 4.1(l): Contd.

F-levels	Varieties	VYTILLA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.92	5	399	2.98	2.25	88	
	V2	4.63	7	360	3.53	2.60	84	
	V3	5.09	3	439	4.79	2.42	86	
	V4	3.66	12	344	2.79	2.61	75	
	V5	4.18	8	529	3.13	2.34	85	
	V6	3.64	13	499	3.61	2.28	86	
	V7	3.64	13	347	3.80	2.92	91	
F2: Optimum input (100% NPK)	V1	4.94	4	359	3.56	2.08	86	0.20
	V2	5.63	1	435	3.78	2.81	84	9.85
	V3	5.13	2	445	3.72	2.76	83	0.39
	V4	4.14	9	346	3.34	2.40	78	4.73
	V5	4.86	6	549	3.41	2.71	82	6.70
	V6	3.94	11	407	3.32	2.72	86	2.96
	V7	4.03	10	334	4.02	2.94	91	3.84
Interaction								
F at same V		0.28		25	0.24	0.16	3	
V at same F		0.27		34	0.25	0.17	2	
F1		4.25	2	417	3.52	2.49	85	
F2		4.67	1	411	3.59	2.63	84	4.10
C.D.(0.05)		0.17		NS	NS	0.05	NS	
C.V.(%)		2.79		6	2.18	1.40	3	
Mean of varieties:								
	V1	4.93	3	379	3.27	2.17	87	0.20
	V2	5.13	1	398	3.66	2.71	84	9.85
	V3	5.11	2	442	4.26	2.59	85	0.39
	V4	3.90	5	345	3.07	2.51	77	4.73
	V5	4.52	4	539	3.27	2.53	83	6.70
	V6	3.79	7	453	3.47	2.50	86	2.96
	V7	3.84	6	340	3.91	2.93	91	3.84
C.D.(0.05)		0.19		18	0.18	0.12	1	
C.V. (%)		3.58		4	4.16	3.90	1	
Expt. Mean		4.46		414	3.56	2.56	85	
Soil type		Clay Lom						
pH		5.84						
F - levels (kg/ha)								
	F1	37.5:54:10						
	F2	75:108:20						
Recommended N:P:K (kg/ha)		75:108:20						
Varieties		.						
	V1	IET 31877						
	V2	IET 31878						
	V3	Bhootnath						
	V4	FL 478						
	V5	Pusa 44						
	V6	CSR-10						
	V7	Local Check (VTL-8) 120 days						
Available N:P:K of soil (kg/ha)		324:27:549						

Table 4.1(l): Contd.

F-levels	Varieties	NAVSARI							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	2.86	12	296	3.89	26.4	101		3.99	6
	V2	3.35	8	282	2.66	23.4	113		3.75	7
	V3	3.96	4	311	3.54	21.4	113		4.39	4
	V4	3.82	5	316	2.81	26.5	96		3.36	12
	V5	1.65	14	313	2.95	22.4	105		3.08	13
	V6	3.63	6	307	1.74	19.2	103		3.07	14
	V7	3.31	9	287	4.24	19.4	100		3.45	11
F2: Optimum input (100% NPK)	V1	3.19	11	278	3.16	24.5	99	4.40	4.65	2
	V2	4.16	2	273	3.30	20.7	113	10.80	4.65	1
	V3	4.12	3	276	3.23	22.3	106	2.13	4.55	3
	V4	3.24	10	291	4.05	27.6	98	-7.73	3.53	10
	V5	2.64	13	302	3.15	23.0	110	13.20	3.72	8
	V6	4.18	1	333	2.35	25.8	109	7.33	3.54	9
	V7	3.38	7	307	2.83	25.0	102	0.93	4.13	5
Interaction										
F at same V		NS		29	0.17	0.3	3			
V at same F		NS		31	0.13	0.2	3			
F1		3.23	2	302	3.12	22.66	104		3.58	2
F2		3.56	1	294	3.15	24.13	105	4.44	4.11	1
C.D.(0.05)		0.28		NS	NS	0.2	1			
C.V.(%)		6.28		5	3.53	0.7	1			
Mean of varieties:										
	V1	3.03	6	287	3.53	25.43	100	4.40	4.32	2
	V2	3.76	3	278	2.98	22.07	113	10.80	4.20	3
	V3	4.04	1	293	3.39	21.87	110	2.13	4.47	1
	V4	3.53	4	304	3.43	27.00	97	-7.73	3.44	5
	V5	2.15	7	308	3.05	22.66	108	13.20	3.40	6
	V6	3.91	2	320	2.05	22.50	106	7.33	3.31	7
	V7	3.35	5	297	3.54	22.23	101	0.93	3.79	4
C.D.(0.05)		0.68		20	0.09	0.1	2			
C.V. (%)		16.94		6	2.46	0.5	2			
Expt. Mean		3.39		298	3.14	23.39	105		3.84	
Soil type		Saline								
pH		8.54								
F - levels (kg/ha)										
	F1	60:15:0								
	F2	120:30:0								
Recommended N:P:K (kg/ha)		120:30:0								
Varieties										
	V1	IET 31877								
	V2	IET 31878								
	V3	Bhootnath								
	V4	FL 478								
	V5	Pusa 44								
	V6	CSR-10								
	V7	Local Check (GR-19) 125 days								
Available N:P:K of soil (kg/ha)		284:51:1793								

AET 1(m) AVT-2 AGT

One AVT-2 AGT culture IET 31909 was evaluated for its response to different levels of nutrients (50% and 100% RDF) on grain yield from seven locations viz., **Chinsurah (60-30-30)**, **Dhangain (100-50-40)**, **Masodha (120-60-40)**, **Nagina (120-60-40)**, **Navsari (120-30-0)**, **Titabar (60-20-40)**. The details and data received from these locations are summarized and presented in Table 4.1(m).

Application of different nutrient levels registered significantly higher grain yield at all locations except at **Navsari**. Application of 100% RDF recorded significantly higher grain yields at **Chinsurah (4.21 t/ha)**, **Dhangain (4.33 t/ha)**, **Masodha (3.08 t/ha)**, **Nagina (3.86 t/ha)**, **Navsari (3.76 t/ha)** and **Titabar (3.66 t/ha)**. Higher nutrient response was recorded with 100% RDF over 50% RDF at **Chinsurah (9.92)**; **Dhangain (5.26)**, **Masodha (5.82)**, **Nagina (18.16)**, and **Titabar (9.37)** indicating need for higher nutrient application for better yields at these centers. The percentage mean grain yield increase was 23.7% with application of 100% RFD over 50% of the RFD application.

Grain yield differences among the tested cultures were found to be significant at all the locations. At Masodha IET 31909 (2.89 t/ha) resulted on par yield with GAR 14 (2.92 t/ha). At **Nagina**, the highest grain yield was recorded under IET 31909 (3.38 t/ha) and found promising over other test cultures. Interaction effects among RDF x varieties was found to be significant at all the locations except at **Chinsurah**, **Dhangain** and **Masodha**.

Table 4.1(m): Summary of data on grain yield and ancillary characters of selected AVT-2 AET AGT cultures grown under transplanted conditions at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	CHINSURAH						DHANGAIN							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/ m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input (50% NPK)	V1	3.71	11	242	2.38	17.40	91		4.40	9	311	3.07	18.40	95	
	V2	-		-	-	-	-		4.52	5	324	3.16	17.27	98	
	V3	3.05	16	199	1.96	11.99	96		2.28	20	258	1.63	12.13	107	
	V4	4.00	8	260	2.57	20.01	94		3.93	13	292	2.62	16.07	114	
	V5	3.68	12	240	2.36	18.43	96		4.01	11	300	2.91	18.40	98	
	V6	3.42	15	223	2.19	20.86	94		3.15	17	277	2.37	15.27	95	
	V7	3.82	9	249	2.45	23.06	95		2.98	18	269	2.36	17.33	108	
	V8	3.64	13	237	2.33	22.44	102		4.52	5	335	3.73	24.27	89	
	V9	-		-	-	-	-		3.54	15	278	2.52	20.33	92	
	V10	3.74	10	244	2.40	19.36	91		4.45	7	294	2.64	17.13	102	
F2: Optimum input (100% NPK)	V1	4.35	4	294	2.86	20.43	92	10.67	4.95	4	315	3.50	19.00	97	5.79
	V2	-		-	-	-	-		5.07	3	330	3.63	18.13	99	5.79
	V3	3.50	14	237	2.31	12.06	97	7.50	2.83	19	269	1.63	14.07	107	5.79
	V4	4.57	1	309	3.00	20.53	95	9.50	4.36	10	292	2.93	17.27	113	4.53
	V5	4.40	3	297	2.89	19.49	97	12.00	4.43	8	307	3.07	19.67	99	4.42
	V6	4.17	7	281	2.74	20.77	95	12.50	3.63	14	284	2.51	15.53	96	5.05
	V7	4.44	2	300	2.91	24.12	96	10.33	3.35	16	283	2.45	18.53	109	3.89
	V8	4.28	5	290	2.82	22.71	102	10.67	5.51	2	339	3.86	24.37	90	10.42
	V9	-		-	-	-	-		3.99	12	287	2.63	21.67	94	4.74
	V10	4.25	6	287	2.79	20.96	93	8.50	5.55	1	302	2.95	18.47	102	11.58
Interaction N at same V V at same N		NS		NS	NS	0.84	NS		NS		NS	NS	NS	0.59	
		NS		NS	NS	0.78	NS		NS		NS	NS	NS	0.62	
	F1	3.61	2	235	2.32		94		3.83	2	297	2.68	16.45	102	
	F2	4.21	1	284	2.77		95	9.92	4.33	1	303	2.95	17.63	103	5.26
	C.D.(0.05) C.V.(%)	0.33 6.67		18.85 5.8	0.26 8.17	0.51 2.1	NS 2.2		0.27 5.86		NS 9.29	NS 8.99	NS 7.58	0 0	

Table 4.1(m): Contd.

F-levels		Varieties	CHINSURAH						DHANGAIN							
			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:			4.03	4	268	2.62	18.92	91	10.67	4.68	4	313	3.29	18.70	96	5.79
			-		-	-	-	-		4.80	3	327	3.40	17.70	98	5.79
			3.28	8	218	2.14	12.03	97	7.50	2.56	10	264	1.63	13.10	107	5.79
			4.29	1	285	2.79	20.27	94	9.50	4.15	6	292	2.78	16.67	114	4.53
			4.04	3	269	2.63	18.96	96	12.00	4.22	5	303	2.99	19.04	98	4.42
			3.80	7	252	2.47	20.82	94	12.50	3.39	8	281	2.44	15.40	95	5.05
			4.13	2	274	2.68	23.59	96	10.33	3.17	9	276	2.41	17.93	109	3.89
			3.96	6	263	2.58	22.58	102	10.67	5.02	1	337	3.80	24.32	89	10.42
			-		-	-	-	-		3.77	7	283	2.58	21.00	93	4.74
			4.00	5	265	2.60	20.16	92	8.50	5.00	2	298	2.80	17.80	102	11.58
C.D.(0.05)			0.35		22.91	0.22	0.55	2.21		0.44		24.79	0.59	1.04	0.44	
C.V.(%)			7.42		7.4	7.37	2.38	1.96		9.32		7.12	18.04	4.91	0.37	
Expt. Mean			3.94		262	2.56	19.66	95		4.07		297	2.81	18.17	100	
Soil type			Clay loam							Clay loam						
pH			7.1							6.8						
F - levels (kg/ha)			F1							50:25:20						
			F2							100:50:40						
Recomd NPK (kg/ha)			60:30:30							100:50:40						
Varieties			V1	IET 31909						IET 31909						
			V2	-						Shodini						
			V3	Badshadhog Sel - 1						Badshadhog Sel - 1						
			V4	CR Sugandh Dhan - 907						CR Sugandh Dhan - 907						
			V5	GAR 14						GAR 14						
			V6	Sugandh Sambha						Sugandh Sambha						
			V7	Dubraj Sel - 1						Dubraj Sel - 1						
			V8	Katekejotha						Katekejotha						
			V9	-						RNR 15435						
			V10	Local check - Sukumar, 125-130 days						Local check - Sabour Sona, 130-135 days						
Availabe NPK of soil			-							329.6:44.1:240.3						

Table 4.1(m): Contd.

F-levels	Varieties	MASODHA						NAGINA							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input (50% NPK)	V1	2.57	10	244	3.13	18.41	82		2.36	9	219	2.64	23.17	112	
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	2.37	11	240	2.75	18.34	109		1.56	16	206	2.34	19.46	100	
	V4	2.08	14	225	2.37	17.37	119		1.69	15	215	2.47	19.71	115	
	V5	2.78	7	233	2.63	18.59	114		1.84	13	210	2.39	19.92	105	
	V6	2.08	14	216	2.34	17.23	447		2.05	12	203	2.60	23.13	109	
	V7	2.37	11	237	2.75	17.41	116		1.83	14	204	2.44	19.87	104	
	V8	2.03	16	223	2.23	16.46	118		2.21	10	215	2.44	19.96	89	
	V9	2.09	13	220	2.59	17.61	119		2.18	11	212	2.33	19.88	104	
	V10	-		-	-	-	-		-		-	-	-	-	
F2: Optimum input (100% NPK)	V1	3.21	2	264	3.92	22.10	123	5.82	4.4	1	319	3.28	23.38	113	18.55
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	3.23	1	265	3.99	24.43	115	7.82	3.46	7	225	2.86	20.43	102	17.27
	V4	2.8	6	255	3.37	17.80	118	6.55	3.69	6	241	3.11	20.68	116	18.18
	V5	3.06	4	258	3.79	19.97	120	2.55	3.89	4	280	2.84	21.37	106	18.64
	V6	2.62	9	249	3.48	17.28	113	4.91	3.77	5	262	3.20	23.70	109	15.64
	V7	2.83	5	264	3.51	19.50	121	4.18	3.41	8	237	3.22	20.69	105	14.36
	V8	2.69	8	242	3.11	17.96	121	6.00	4.1	2	314	2.85	20.77	91	17.18
	V9	3.17	3	231	3.45	19.38	117	9.82	4.07	3	306	2.71	20.47	107	17.18
	V10	-		-	-	-	-		-		-	-	-	-	
Interaction N at same V V at same N		NS		NS	NS	NS	NS		0.17		24.78	0.05	0.21	NS	
		NS		NS	NS	NS	NS		0.17		29.19	0.05	0.18	NS	
	F1	2.45	2	236	2.72	18.18	106		1.86	2	213	2.46	20.57	108	
	F2	3.08	1	260	3.77	21.08	119	5.68	3.86	1	266	3.02	21.47	109	18.16
	C.D.(0.05) C.V.(%)	0.55 16.72		22.34 7.44	0.91 23.75	2.03 8.71	NS 114.57		0.08 2.27		22.67 7.55	0.02 0.59	0.15 0.57	NS 2.05	

Table 4.1(m): Contd.

F-levels		Varieties	MASODHA						NAGINA							
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	
Mean of varieties:																
	V1	2.89	2	254	3.53	20.26	102	5.82	3.38	1	269	2.96	23.28	112	18.55	
	V2	-		-	-	-	-	-	-		-	-	-	-	-	
	V3	2.80	3	252	3.37	21.39	112	7.82	2.51	8	215	2.60	19.95	101	17.27	
	V4	2.44	6	240	2.87	17.59	118	6.55	2.69	6	228	2.79	20.20	115	18.18	
	V5	2.92	1	245	3.21	19.28	117	2.55	2.87	5	245	2.62	20.65	105	18.64	
	V6	2.35	8	233	2.91	17.26	280	4.91	2.91	4	232	2.90	23.42	109	15.64	
	V7	2.60	5	251	3.13	18.46	119	4.18	2.62	7	220	2.83	20.28	104	14.36	
	V8	2.36	7	232	2.67	17.21	119	6.00	3.16	2	264	2.65	20.37	90	17.18	
	V9	2.63	4	226	3.02	18.50	118	9.82	3.13	3	259	2.52	20.18	106	17.18	
	V10	-		-	-	-	-	-								
C.D.(0.05)																
	C.V.(%)	NS		13.88	0.45	2.09	NS		0.12		17.52	0.03	0.13	1.18		
	Expt. Mean	15.57		4.86	12.31	9.41	107.56		3.43		6.13	1.07	0.52	0.95		
		2.62		242	3.09	18.74	136		2.91		242	2.73	21.04	105		
Soil type																
	pH	Sandy loam														
F - levels (kg/ha)																
	F1	7.7														
	F2	60:30:20														
		120:60:40														
		120:60:40														
Recomd NPK (kg/ha)																
	Varieties															
	V1	IET 31909														
	V2	-														
	V3	Badshadhog Sel - 1														
	V4	CR Sugandh Dhan - 907														
	V5	GAR 14														
	V6	Sugandh Sambha														
	V7	Dubraj Sel - 1														
	V8	Katekejoha														
	V9	RNR 15435														
	V10	-														
Availabe NPK of soil																
		75.4:13.5:22.5														

Table 4.1(m): Contd.

F-levels	Varieties	NAVSARI						TITABAR						Over all mean	Rank		
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)			Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input (50% NPK)	V1	3.80	8	203	4.08	25.88	95		3.63	9	263	4.07	19.27	119		3.41	13
	V2	-		-	-	-	-		3.43	12	247	3.33	19.33	115		3.98	6
	V3	3.65	12	211	4.66	27.26	100		3.04	15	345	2.33	21.90	117		2.66	20
	V4	3.04	18	184	4.12	25.59	100		2.77	18	249	2.20	14.70	119		2.92	18
	V5	3.95	6	217	4.82	27.19	96		2.63	20	244	2.67	22.90	115		3.15	15
	V6	3.71	11	236	4.15	26.37	92		4.33	3	272	3.13	18.87	114		3.12	16
	V7	3.80	8	220	3.76	24.98	99		2.73	19	198	2.43	17.20	119		2.92	17
	V8	4.02	5	212	4.25	26.86	88		3.47	11	246	2.63	19.67	126		3.32	14
	V9	3.39	16	213	4.08	24.31	91		3.00	16	260	2.97	17.10	114		2.84	19
	V10	4.16	4	240	5.16	28.75	90		3.83	7	266	3.33	20.50	120		4.05	5
F2: Optimum input (100% NPK)	V1	4.46	2	228	5.25	26.13	97	8.80	3.97	5	276	5.00	21.50	121	5.67	4.22	3
	V2	-		-	-	-	-		4.17	4	266	4.00	21.43	120	12.33	4.62	2
	V3	3.78	10	225	4.93	28.60	98	1.73	3.77	8	313	2.83	25.37	122	12.17	3.43	12
	V4	3.42	15	220	4.61	26.25	97	5.07	3.30	13	265	2.53	13.57	117	8.83	3.69	9
	V5	3.37	17	236	5.13	27.86	96	-7.73	3.10	14	265	3.37	23.13	120	7.83	3.71	8
	V6	3.48	14	246	4.77	27.72	91	-3.07	4.60	1	281	3.47	19.50	114	4.50	3.71	7
	V7	3.95	6	257	4.52	25.37	97	2.00	2.98	17	237	2.80	17.90	120	4.17	3.49	11
	V8	4.20	3	257	4.71	27.30	89	2.40	3.90	6	251	3.13	18.13	125	7.17	4.11	4
	V9	3.54	13	233	4.38	25.76	90	2.00	3.53	10	287	3.73	18.17	117	8.83	3.66	10
	V10	5.00	1	266	5.45	29.23	91	11.20	4.37	2	274	4.43	23.27	121	9.00	4.79	1
Interaction N at same V V at same N F1 F2 C.D.(0.05) C.V.(%)		0.76		NS	NS	NS	1.47		NS		NS	NS	1.91	1.79			
		0.54		NS	NS	NS	1.41		NS		NS	NS	1.45	1.51			
		3.61	2	204	4.42	26.48	98		3.10	2	270	2.92	19.62	117		3.08	2
		3.76	1	227	4.98	27.21	97	1.97	3.66	1	277	3.55	21.00	120	9.37	3.81	1
		NS		23.41	0.13	NS	NS		0.16		NS	0.37	NS	1.38			
		16.21		8.77	2.32	3.21	0.72		3.97		8.76	10.23	7.72	1.05			

Table 4.1(m): Contd.

F-levels		Varieties	NAVSARI					TITABAR					Over all mean	Rank				
			Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
Mean of varieties:			4.13	2	216	4.67	26.01	96	8.80	3.80	3	270	4.54	20.39	120	5.67	3.82	3
			-		-	-	-	-		3.80	3	257	3.67	20.38	118	12.33	4.30	2
			3.72	5	218	4.80	27.93	99	1.73	3.41	6	329	2.58	23.64	120	12.17	3.04	10
			3.23	9	202	4.37	25.92	99	5.07	3.04	8	257	2.37	14.14	118	8.83	3.30	7
			3.66	6	226	4.98	27.53	96	-7.73	2.87	9	255	3.02	23.02	118	7.83	3.43	5
			3.60	7	241	4.46	27.05	92	-3.07	4.47	1	276	3.30	19.19	114	4.50	3.42	6
			3.88	4	238	4.14	25.18	98	2.00	2.86	10	217	2.62	17.55	120	4.17	3.21	9
			4.11	3	234	4.48	27.08	89	2.40	3.69	5	249	2.88	18.90	126	7.17	3.71	4
			3.47	8	223	4.23	25.04	90	2.00	3.27	7	274	3.35	17.64	115	8.83	3.25	8
			4.58	1	253	5.31	28.99	91	11.20	4.10	2	270	3.88	21.89	121	9.00	4.42	1
C.D.(0.05)			0.38		20.69	0.37	0.91	1		0.41		25.42	0.61	1.03	1.07			
C.V.(%)			8.54		7.72	6.83	2.89	0.9		9.91		8.18	16.28	4.46	0.77			
Expt. Mean			3.82		228	4.60	26.75	94		3.53		265	3.22	19.67	119		3.48	
Soil type			Clayey							Clay loam								
pH			7.9							5.7								
F - levels (kg/ha)			60:15:0							30:10:20								
			120:30:0							60:20:40								
			120:30:0							60:20:40								
Recomd NPK (kg/ha)																		
Varieties			V1							IET 31909								
			V2							Shodini								
			V3							Badshadhog Sel - 1								
			V4							CR Sugandh Dhan - 907								
			V5							GAR 14								
			V6							Sugandh Sambha								
			V7							Dubraj Sel - 1								
			V8							Katekejotha								
			V9							RNR 15435								
			V10							Local check -GR 20, 120-125 days								
Availabe NPK of soil										263.65:48.57:845.36								

4.1(n) AVT 2 - Phosphorous efficient cultivars (LPT)

Phosphorus is an important nutrient for rice production but the use efficiency of this nutrient is very low (20-30%) and its deficiency has been identified as one of the major constraint limiting production of rice in most of the Indian soils. Enhancing phosphorus use efficiency (PUE) in rice would offer an affordable option for improving yields and economic returns with reduced inputs to farming community. Further, research studies have revealed that genotypic differences for PUE exist and there is a need to identify the cultivars which are adopted to low P situations and have higher P use efficiency. Hence, the present trial is constituted to evaluate the identified cultures and cultivars with the following objectives: 1) To study the comparative performance of elite lines and cultivars in different levels of Phosphorus and 2) To identify the elite lines for tolerance to low soil P conditions. The trial was conducted at seven locations (**Gangavathi, Mandya, Maruteru, Pusa, Raipur, Ranchi and Varanasi**). Split plot design was adopted with 3 main plots of phosphorus levels (P₁- No Phosphorus (Control) (N and K Constant), P₂: 50% of recommended P dose (N and K is constant) and P₃: 100 % of recommended dose of P (N and K constant). Subplots consist of advanced cultures and checks. The results were summarized and presented in **Table 4.1(n)** and the salient findings are as followed.

Interaction effect of phosphorus level and advanced cultures on grain yield was found significant only at **Mandya, Pusa and Varanasi** while, higher 'P' application recorded better yields (50 and 100% of recommended P) at these centers. At **Mandya** under 50% RDP, IET 31979 (5.81 t/ha), IET 31976 (5.43 t/ha) and IET 31969 (5.09 t/ha) were promising. At **Pusa** under no P application, IET 31966 (2.84 t/ha), IET 31985 (2.69 t/ha) and IET 31986 (2.69 t/ha) were promising. Under 50% RDP, IET31966 (3.71 t/ha), IET 31986 (3.49 t/ha) and IET 31985 (3.46 t/ha) were promising. At **Varanasi** under 50% RDP, IET 31980 (4.53 t/ha), IET 31107 (3.53 t/ha) and IET 31969 (3.33 t/ha) were promising.

Among phosphorus levels, all the locations fertilized under 100% RDP resulted the highest grain yield followed by 50% and the lowest under no fertilization of phosphorus.

Among the different AVT-2 entries top 3 performer were listed below in tabular form.

Location	1 st rank	2 nd rank	3 rd rank
Gangavathi	IET 31969 (4.85 t/ha)	IET 31107 (4.74 t/ha)	IET 31968 (4.54 t/ha)
Mandya	IET 31979 (6.00 t/ha)	IET 31968 (5.58 t/ha)	IET 31966 (5.56 t/ha)
Maruteru	IET 31966 (5.20 t/ha)	IET 31985 (5.06 t/ha)	IET 31973 (5.01 t/ha)
Pusa	IET 31966 (3.92 t/ha)	IET 31986 (3.71 t/ha)	Swarna (3.65 t/ha)
Raipur	IET 31979 (5.09 t/ha)	IET 31966 (4.77 t/ha)	CG Devbhog (4.55 t/ha)
Ranchi	IET 31980 (4.80 t/ha)	IET 31985 (4.68 t/ha)	IET 31979 (4.65 t/ha)
Varanasi	IET 31979 (4.90 t/ha)	IET 31980 (4.40 t/ha)	BPT 5204 (3.97 t/ha)

Table 4.1(n): Summary of data on grain yield and ancillary characters of selected AVT LPT cultures grown under transplanted conditions at graded levels of recommended N fertilizer doses, kharif 2025.

P-levels	Varieties	GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
P1: 0% of recommended P dose (N and K is constant)	V1	4.25	21	167	1.90	16.50	
	V2	3.68	34	191	2.40	19.00	
	V3	3.91	30	148	2.80	21.00	
	V4	4.26	19	142	2.40	21.50	
	V5	2.88	45	140	2.90	17.50	
	V6	-	-	-	-	-	
	V7	3.01	43	152	2.00	20.00	
	V8	3.54	37	156	4.30	21.00	
	V9	2.94	44	133	2.20	20.00	
	V10	3.47	39	159	2.70	20.00	
	V11	4.12	25	174	1.70	17.00	
	V12	4.01	27	138	1.70	21.00	
	V13	3.40	41	155	2.60	17.00	
	V14	3.68	34	154	2.10	18.50	
	V15	3.45	40	148	2.10	15.00	
	V16	3.52	38	179	2.20	17.50	
P2: 0% of recommended P dose (N and K is constant)	V1	4.73	8	176	2.40	18.50	12.80
	V2	4.21	22	240	2.70	21.00	14.13
	V3	4.28	17	163	4.30	22.00	9.87
	V4	4.30	16	156	2.50	22.00	1.07
	V5	3.38	42	166	3.40	17.50	13.33
	V6	-	-	-	-	-	
	V7	3.58	36	164	2.40	20.50	15.20
	V8	4.03	26	164	4.60	21.00	13.07
	V9	4.14	24	140	2.80	20.50	32.00
	V10	4.20	23	167	2.90	21.00	19.47
	V11	4.38	14	179	2.40	17.00	6.93
	V12	4.37	15	147	2.10	22.50	9.60
	V13	3.81	32	168	2.80	17.00	10.93
	V14	4.01	27	161	2.30	19.00	8.80
	V15	3.78	33	159	2.40	16.50	8.80
	V16	4.26	19	186	2.50	18.00	19.73
P3: 0% of recommended P dose (N and K is constant)	V1	5.24	5	178	3.10	20.00	13.20
	V2	4.53	11	253	3.10	22.00	11.33
	V3	5.42	2	164	4.80	22.50	20.13
	V4	5.99	1	166	2.80	22.50	23.07
	V5	3.83	31	171	3.70	19.50	12.67
	V6	-	-	-	-	-	
	V7	3.99	29	164	3.20	21.50	13.07
	V8	4.27	18	170	5.30	22.00	9.73
	V9	4.42	13	155	3.10	21.00	19.73
	V10	5.36	3	181	3.30	21.50	25.20
	V11	4.69	10	188	2.60	18.00	7.60
	V12	5.20	7	150	2.60	22.50	15.87
	V13	4.49	12	170	3.00	18.00	14.53
	V14	4.72	9	167	2.90	19.50	13.87
	V15	5.26	4	170	2.40	17.50	24.13
	V16	5.24	5	191	2.60	19.50	22.93

Table 4.1(n): Contd.

P-levels	Varieties	GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
Interaction P at same V V at same P		NS		NS	NS	NS	
		NS		NS	NS	NS	
	F1	3.61	3	156	2.40	18.83	
	F2	4.10	2	169	2.83	19.60	13.05
	F3	4.84	1	176	3.23	20.50	16.47
	C.D.(0.05)	0.41		5.57	0.1	0.12	
	C.V.(%)	16.78		5.7	6.23	1	
	Mean of varieties:						
	V1	4.74	2	174	2.47	18.33	13.00
	V2	4.14	9	228	2.73	20.67	12.73
	V3	4.54	3	158	3.97	21.83	15.00
	V4	4.85	1	155	2.57	22.00	12.07
	V5	3.36	15	159	3.33	18.17	13.00
	V6	-		-	-	-	
	V7	3.53	14	160	2.53	20.67	14.13
	V8	3.95	11	163	4.73	21.33	11.40
	V9	3.83	13	143	2.70	20.50	25.87
	V10	4.34	6	169	2.97	20.83	22.33
	V11	4.40	5	180	2.23	17.33	7.27
	V12	4.53	4	145	2.13	22.00	12.73
	V13	3.90	12	164	2.80	17.33	12.73
	V14	4.14	10	161	2.43	19.00	11.33
	V15	4.16	8	159	2.30	16.33	16.47
	V16	4.34	7	185	2.43	18.33	21.33
	C.D.(0.05)	0.76		20.71	0.45	2.61	
	C.V.(%)	19.36		13.24	16.87	14.19	
	Expt. Mean	4.18		167	2.82	19.64	
	Soil type	-					
	pH	-					
	N - levels (kg/ha)						
	F1	0					
	F2	37.5					
	F3	75					
	Recommended NPK (kg/ha)	150:75:75					
	Varieties						
	V1	IET 31107					
V2	IET 31966						
V3	IET 31968						
V4	IET 31969						
V5	IET 31973						
V6	-						
V7	IET 31976						
V8	IET 31979						
V9	IET 31980						
V10	IET 31982						
V11	IET 31985						
V12	IET 31986						
V13	Swarna						
V14	Improved Samba Mahsuri						
V15	BPT 5204						
V16	Local check - Gangavathisona, 130-135days						
Available NPK (kg/ha)	-						

Table 4.1(n): Contd.

P-levels	Varieties	MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
P1: 0% of recommended P dose (N and K is constant)	V1	-		-	-	-	-	
	V2	-		-	-	-	-	
	V3	-		-	-	-	-	
	V4	-		-	-	-	-	
	V5	-		-	-	-	-	
	V6	-		-	-	-	-	
	V7	-		-	-	-	-	
	V8	-		-	-	-	-	
	V9	-		-	-	-	-	
	V10	-		-	-	-	-	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
P2: 0% of recommended P dose (N and K is constant)	V1	4.03	25	295	3.37	24.71	87	
	V2	5.44	10	288	3.32	28.93	98	
	V3	4.97	17	261	4.13	18.42	97	
	V4	5.09	14	292	3.20	20.17	92	
	V5	5.03	16	314	3.30	24.53	103	
	V6	-		-	-	-	-	
	V7	5.43	12	266	4.52	20.55	90	
	V8	5.81	5	284	4.23	25.33	92	
	V9	4.94	18	307	3.08	19.88	87	
	V10	4.51	22	328	2.12	21.99	103	
	V11	4.02	26	295	3.05	15.32	101	
	V12	4.23	23	280	2.51	29.54	87	
	V13	4.22	24	328	2.48	18.50	110	
	V14	4.58	21	306	2.46	14.79	94	
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
P3: 0% of recommended P dose (N and K is constant)	V1	5.05	15	305	4.24	24.84	87	32.90
	V2	5.67	6	300	4.01	30.30	98	7.42
	V3	6.19	1	302	4.77	19.25	97	39.35
	V4	5.83	4	320	3.36	20.20	92	23.87
	V5	5.89	3	334	3.67	26.38	103	27.74
	V6	-		-	-	-	-	
	V7	5.44	10	329	5.15	20.72	90	0.32
	V8	6.19	1	338	4.62	25.42	92	12.26
	V9	5.50	9	315	3.96	20.26	87	18.06
	V10	5.22	13	377	2.82	22.67	103	22.90
	V11	5.61	7	358	3.54	15.61	101	51.29
	V12	4.80	19	333	3.03	30.61	87	18.39
	V13	4.78	20	378	3.19	19.12	110	18.06
	V14	5.55	8	335	3.13	14.15	94	31.29
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	

Table 4.1(n): Contd.

P-levels	Varieties	MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
Interaction P at same V V at same P		0.76		NS	NS	NS	NS	
		0.58		NS	NS	NS	NS	
	F1	-		-	-	-	-	
	F2	4.79	2	296	3.21	21.74	95	
	F3	5.52	1	333	3.81	22.27	95	23.37
	C.D.(0.05)	0.67		NS	NS	0.02	NS	
	C.V.(%)	13.41		17.97	19.4	0.09	0	
Mean of varieties:								
	V1	4.54	11	300	3.81	24.78	87	32.90
	V2	5.56	3	294	3.67	29.62	98	7.42
	V3	5.58	2	282	4.45	18.84	97	39.35
	V4	5.46	4	306	3.28	20.19	92	23.87
	V5	5.46	4	324	3.49	25.46	103	27.74
	V6	-		-	-	-	-	
	V7	5.44	6	298	4.84	20.64	90	0.32
	V8	6.00	1	311	4.43	25.38	92	12.26
	V9	5.22	7	311	3.52	20.07	87	18.06
	V10	4.87	9	353	2.47	22.33	103	22.90
	V11	4.82	10	327	3.30	15.47	101	51.29
	V12	4.52	12	307	2.77	30.08	87	18.39
	V13	4.50	13	353	2.84	18.81	110	18.06
	V14	5.07	8	321	2.80	14.47	94	31.29
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
	C.D.(0.05)	0.41		22.85	0.48	1.28	0	
	C.V.(%)	6.84		6.26	11.78	5.01	0	
	Expt. Mean	5.15		314	3.51	22.01	95	
	Soil type	Red sandy loam						
	pH	7.85						
	N - levels (kg/ha)							
	F1	0						
	F2	31						
	F3	62						
	Recommended NPK (kg/ha)	125:62:62						
	Varieties							
	V1	IET 31107						
	V2	IET 31966						
	V3	IET 31968						
	V4	IET 31969						
	V5	IET 31973						
	V6	-						
	V7	IET 31976						
	V8	IET 31979						
	V9	IET 31980						
	V10	IET 31982						
	V11	IET 31985						
	V12	IET 31986						
	V13	Swarna						
	V14	Improved Samba Mahsuri						
	V15	-						
	V16	-						
	Available NPK (kg/ha)	368.5:68.5:248.0						

Table 4.1(n): Contd.

P-levels	Varieties	MARUTERU						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
P1: 0% of recommended P dose (N and K is constant)	V1	4.67	22	209	2.41	20.70	98	
	V2	4.78	18	244	2.48	22.13	98	
	V3	4.63	25	242	2.53	23.13	98	
	V4	3.70	38	218	2.62	15.90	99	
	V5	4.72	20	213	2.97	18.23	98	
	V6	-	-	-	-	-	-	
	V7	4.22	32	231	2.86	18.67	98	
	V8	4.22	32	209	2.44	23.80	99	
	V9	4.49	29	185	2.45	15.03	99	
	V10	4.50	27	192	2.58	15.63	99	
	V11	4.68	21	251	2.21	13.50	99	
	V12	4.05	35	231	2.44	23.53	98	
	V13	3.56	39	216	2.69	17.53	98	
	V14	4.31	31	219	2.35	14.33	100	
	V15	-	-	-	-	-	-	
	V16	-	-	-	-	-	-	
P2: 0% of recommended P dose (N and K is constant)	V1	4.54	26	215	2.58	21.67	98	-4.33
	V2	5.32	6	250	2.79	23.80	98	18.00
	V3	4.82	17	251	2.84	23.57	98	6.33
	V4	3.96	36	228	2.78	18.40	99	8.67
	V5	4.90	14	219	3.20	18.33	98	6.00
	V6	-	-	-	-	-	-	
	V7	4.50	27	239	2.99	18.67	98	9.33
	V8	4.67	22	215	2.62	21.73	99	15.00
	V9	4.90	14	191	2.62	15.70	99	13.67
	V10	4.86	16	200	1.81	15.30	99	12.00
	V11	5.00	9	259	1.70	13.50	99	10.67
	V12	4.74	19	239	2.56	24.33	98	23.00
	V13	3.71	37	226	2.93	17.67	98	5.00
	V14	4.66	24	224	2.35	14.20	100	11.67
	V15	-	-	-	-	-	-	
	V16	-	-	-	-	-	-	
P3: 0% of recommended P dose (N and K is constant)	V1	4.95	12	229	2.58	23.70	98	4.67
	V2	5.49	2	265	2.79	24.63	98	11.83
	V3	5.32	6	259	2.84	24.63	98	11.50
	V4	4.46	30	240	2.78	18.73	99	12.67
	V5	5.40	3	234	3.20	19.40	98	11.33
	V6	-	-	-	-	-	-	
	V7	5.00	9	255	2.99	18.97	98	13.00
	V8	5.17	8	226	2.62	21.87	99	15.83
	V9	5.40	3	203	2.62	15.40	99	15.17
	V10	5.36	5	211	1.81	15.70	99	14.33
	V11	5.50	1	273	1.70	13.73	99	13.67
	V12	4.99	11	253	2.56	24.60	98	15.67
	V13	4.21	34	236	2.93	18.23	98	10.83
	V14	4.93	13	250	31.60	14.97	105	10.33
	V15	-	-	-	-	-	-	
	V16	-	-	-	-	-	-	

Table 4.1(n): Contd.

P-levels	Varieties	MARUTERU						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
Interaction P at same V V at same P		NS		NS	NS	1.19	NS	
		NS		NS	NS	1.18	NS	
	F1	4.35	3	220	2.54	18.62	99	
	F2	4.66	2	227	2.60	18.99	99	10.38
	F3	5.09	1	241	4.85	19.58	99	12.37
	C.D.(0.05)	0.11		6.93	NS	0.43	0.25	
	C.V.(%)	3.72		4.8	0	3.58	0.41	
Mean of varieties:								
	V1	4.72	7	218	2.52	22.02	98	0.17
	V2	5.20	1	253	2.69	23.52	98	14.92
	V3	4.92	5	251	2.74	23.78	98	8.92
	V4	4.04	12	228	2.73	17.68	99	10.67
	V5	5.01	3	222	3.12	18.65	98	8.67
	V6	-		-	-	-	-	
	V7	4.57	11	242	2.95	18.77	98	11.17
	V8	4.69	8	217	2.56	22.47	99	15.42
	V9	4.93	4	193	2.56	15.38	99	14.42
	V10	4.91	6	201	2.07	15.54	99	13.17
	V11	5.06	2	261	1.87	13.58	99	12.17
	V12	4.59	10	241	2.52	24.15	98	19.33
	V13	3.83	13	226	2.85	17.81	98	7.92
	V14	4.63	9	231	12.10	14.50	102	11.00
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
	C.D.(0.05)	0.39		19.98	NS	0.68	1.29	
	C.V.(%)	8.74		9.26	0	3.8	1.39	
	Expt. Mean	4.70		230	3.33	19.07	99	
Soil type		-						
pH		6.50						
N - levels (kg/ha)								
	F1	0						
	F2	30						
	F3	60						
Recommended NPK (kg/ha)		90:60:60						
Varieties								
	V1	IET 31107						
	V2	IET 31966						
	V3	IET 31968						
	V4	IET 31969						
	V5	IET 31973						
	V6	-						
	V7	IET 31976						
	V8	IET 31979						
	V9	IET 31980						
	V10	IET 31982						
	V11	IET 31985						
	V12	IET 31986						
	V13	Swarna						
	V14	Improved Samba Mahsuri						
	V15	-						
	V16	-						
Available NPK (kg/ha)		151:19.49:253						

Table 4.1(n): Contd.

P-levels	Varieties	PUSA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
P1: 0% of recommended P dose (N and K is constant)	V1	2.20	43	169	2.12	18.66	88	
	V2	2.84	29	211	2.34	19.34	98	
	V3	2.25	42	181	2.21	17.87	92	
	V4	2.29	40	179	2.17	18.47	95	
	V5	2.08	45	171	2.13	17.48	95	
	V6	-	-	-	-	-	-	
	V7	2.35	38	185	1.94	18.23	98	
	V8	2.19	44	167	1.88	18.83	94	
	V9	2.30	39	170	2.06	19.46	88	
	V10	2.42	35	184	1.86	18.95	90	
	V11	2.69	32	213	2.27	18.13	97	
	V12	2.69	32	203	2.09	19.07	89	
	V13	2.59	34	186	2.06	20.03	98	
	V14	2.28	41	173	2.08	18.96	99	
	V15	2.40	36	181	2.16	19.09	96	
	V16	2.38	37	186	2.04	18.37	99	
P2: 0% of recommended P dose (N and K is constant)	V1	2.89	28	192	2.46	20.51	90	23.00
	V2	3.71	16	238	2.70	21.25	98	29.00
	V3	2.95	27	205	2.57	19.63	93	23.33
	V4	3.01	25	202	2.52	20.30	96	24.00
	V5	2.70	31	192	2.48	19.21	97	20.67
	V6	-	-	-	-	-	-	
	V7	3.05	23	207	2.26	20.04	99	23.33
	V8	2.84	29	187	2.18	20.70	95	21.67
	V9	2.98	26	190	2.39	21.39	89	22.67
	V10	3.16	21	207	2.16	20.83	91	24.67
	V11	3.46	18	236	2.67	19.93	98	25.67
	V12	3.49	17	227	2.44	20.96	90	26.67
	V13	3.41	19	211	2.39	22.01	99	27.33
	V14	3.03	24	198	2.42	20.83	99	25.00
	V15	3.18	20	206	2.51	20.98	97	26.00
	V16	3.15	22	212	2.38	20.18	99	25.67
P3: 0% of recommended P dose (N and K is constant)	V1	4.18	12	244	2.77	22.34	92	33.00
	V2	5.20	1	293	3.03	23.15	100	39.33
	V3	4.21	11	256	2.87	21.49	96	32.67
	V4	4.27	10	253	2.83	22.03	98	33.00
	V5	3.92	15	246	2.76	20.83	99	30.67
	V6	-	-	-	-	-	-	
	V7	4.28	9	257	2.55	21.74	100	32.17
	V8	3.96	14	230	2.45	22.45	96	29.50
	V9	4.15	13	233	2.72	23.19	91	30.83
	V10	4.43	8	256	2.45	22.58	93	33.50
	V11	4.80	4	291	2.95	21.55	100	35.17
	V12	4.95	2	284	2.71	22.73	93	37.67
	V13	4.95	2	270	2.72	23.87	101	39.33
	V14	4.44	7	256	2.74	22.69	101	36.00
	V15	4.55	5	265	2.82	22.44	99	35.83
	V16	4.54	6	271	2.67	21.81	101	36.00

Table 4.1(n): Contd.

P-levels	Varieties	PUSA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
Interaction P at same V V at same P		0.14		6.25	NS	NS	NS	
		0.11		6.83	NS	NS	NS	
F1		2.40	3	184	2.09	18.73	95	
F2		3.13	2	207	2.44	20.58	95	24.58
F3		4.46	1	260	2.74	22.33	97	34.31
C.D.(0.05)		0.11		4	0.02	0.05	0.23	
C.V.(%)		5.78		3.15	1.64	0.38	0.41	
Mean of varieties:								
V1		3.09	13	202	2.45	20.50	90	28.00
V2		3.92	1	247	2.69	21.25	99	34.17
V3		3.14	12	214	2.55	19.66	94	28.00
V4		3.19	10	211	2.51	20.27	96	28.50
V5		2.90	15	203	2.46	19.17	97	25.67
V6		-		-	-	-	-	
V7		3.23	9	216	2.25	20.00	99	27.75
V8		3.00	14	195	2.17	20.66	95	25.58
V9		3.14	11	198	2.39	21.35	90	26.75
V10		3.34	7	215	2.16	20.79	91	29.08
V11		3.65	3	247	2.63	19.87	98	30.42
V12		3.71	2	238	2.41	20.92	91	32.17
V13		3.65	3	223	2.39	21.97	99	33.33
V14		3.25	8	209	2.41	20.83	100	30.50
V15		3.38	5	217	2.50	20.84	98	30.92
V16		3.36	6	223	2.36	20.12	100	30.83
C.D.(0.05)		0.06		3.61	0.09	0.22	1.49	
C.V.(%)		2.08		1.77	4.04	1.14	1.66	
Expt. Mean		3.33		217	2.42	20.55	96	
Soil type		Sandy loam						
pH		8.27						
N - levels (kg/ha)								
F1		0						
F2		30						
F3		60						
Recommended NPK (kg/ha)		120:60:40						
Varieties								
V1		IET 31107						
V2		IET 31966						
V3		IET 31968						
V4		IET 31969						
V5		IET 31973						
V6		-						
V7		IET 31976						
V8		IET 31979						
V9		IET 31980						
V10		IET 31982						
V11		IET 31985						
V12		IET 31986						
V13		Swarna						
V14		Improved Samba Mahsuri						
V15		BPT 5204						
V16		Local check - Rajendra Sweta, 130-135 days						
Available NPK (kg/ha)		214:13.9:113						

Table 4.1(n): Contd.

P-levels	Varieties	RAIPUR						Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	
P1: 0% of recommended P dose (N and K is constant)	V1	3.78	33	170	2.23	24.77	85	
	V2	4.54	9	144	2.57	27.79	89	
	V3	4.10	26	148	4.31	17.87	88	
	V4	3.63	36	191	2.46	18.73	85	
	V5	3.65	35	195	2.08	23.77	96	
	V6	-		-	-	-	-	
	V7	3.91	30	146	3.52	18.53	88	
	V8	4.79	4	195	2.47	24.47	96	
	V9	3.66	34	190	2.77	19.31	87	
	V10	3.00	40	212	1.56	23.19	85	
	V11	3.96	29	177	3.64	14.77	96	
	V12	2.76	42	149	1.93	26.37	84	
	V13	4.28	17	218	3.16	19.67	105	
	V14	3.89	31	193	3.33	15.00	100	
	V15	-		-	-	-	-	
	V16	4.43	11	229	2.55	18.87	101	
P2: 0% of recommended P dose (N and K is constant)	V1	3.81	32	177	2.47	25.67	86	1.00
	V2	4.66	5	178	2.60	28.39	89	4.00
	V3	4.34	15	163	4.56	18.33	89	8.00
	V4	4.21	22	213	2.56	18.83	86	19.33
	V5	4.06	28	196	2.26	24.07	96	13.67
	V6	-		-	-	-	-	
	V7	4.13	25	166	3.76	18.70	88	7.33
	V8	5.20	2	198	2.53	24.60	96	13.67
	V9	4.20	23	195	2.90	19.78	87	18.00
	V10	3.08	39	220	1.79	23.63	84	2.67
	V11	4.20	23	201	3.99	14.87	96	8.00
	V12	2.96	41	171	1.95	26.40	84	6.67
	V13	4.41	12	222	3.44	19.77	105	4.33
	V14	4.08	27	215	3.42	15.10	100	6.33
	V15	-		-	-	-	-	
	V16	4.60	7	251	2.75	18.90	100	5.67
P3: 0% of recommended P dose (N and K is constant)	V1	4.60	7	178	2.71	25.70	85	13.67
	V2	5.10	3	182	2.86	28.56	89	9.33
	V3	4.37	14	172	4.60	18.90	88	4.50
	V4	4.26	20	217	2.72	19.47	86	10.50
	V5	4.34	15	196	2.71	24.47	95	11.50
	V6	-		-	-	-	-	
	V7	4.26	20	171	4.19	19.63	88	5.83
	V8	5.29	1	218	3.01	25.23	96	8.33
	V9	4.28	17	198	2.94	20.25	87	10.33
	V10	3.37	37	265	1.81	23.76	85	6.17
	V11	4.40	13	220	4.29	15.33	96	7.33
	V12	3.30	38	197	2.28	27.27	84	9.00
	V13	4.51	10	237	3.60	20.07	105	3.83
	V14	4.28	17	238	3.72	15.33	100	6.50
	V15	-		-	-	-	-	
	V16	4.61	6	257	2.89	19.10	101	3.00

Table 4.1(n): Contd.

P-levels	Varieties	RAIPUR						Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	
Interaction								
P at same V		NS		NS	NS	NS	NS	
V at same P		NS		NS	NS	NS	NS	
	F1	3.90	3	177	2.76	21.32	90	
	F2	4.19	2	191	2.94	21.69	90	9.57
	F3	4.43	1	202	3.18	22.13	89	8.75
C.D.(0.05)		NS		NS	NS	NS	NS	
C.V.(%)		16.21		18.85	18.75	4.67	1.04	
Mean of varieties:								
	V1	4.06	9	175	2.47	25.38	85	7.33
	V2	4.77	2	168	2.68	28.25	89	6.67
	V3	4.27	5	161	4.49	18.37	89	6.25
	V4	4.03	11	207	2.58	19.01	86	14.92
	V5	4.02	12	196	2.35	24.10	96	12.58
	V6	-		-	-	-	-	
	V7	4.10	7	161	3.82	18.95	88	6.58
	V8	5.09	1	204	2.67	24.77	96	11.00
	V9	4.05	10	194	2.87	19.78	87	14.17
	V10	3.15	13	232	1.72	23.53	85	4.42
	V11	4.19	6	199	3.97	14.99	96	7.67
	V12	3.01	14	172	2.05	26.68	84	7.83
	V13	4.40	4	226	3.40	19.84	105	4.08
	V14	4.08	8	215	3.49	15.14	100	6.42
	V15	-		-	-	-	-	
	V16	4.55	3	246	2.73	18.96	101	4.33
C.D.(0.05)		0.47		27.58	0.39	0.74	0.75	
C.V.(%)		12.05		14.93	14.01	3.71	0.87	
Expt. Mean		4.13		197	2.95	21.27	92	
Soil type		Vertisol						
pH		7.00						
N - levels (kg/ha)								
	F1	0						
	F2	30						
	F3	60						
Recommended NPK (kg/ha)		100:60:40						
Varieties								
	V1	IET 31107						
	V2	IET 31966						
	V3	IET 31968						
	V4	IET 31969						
	V5	IET 31973						
	V6	-						
	V7	IET 31976						
	V8	IET 31979						
	V9	IET 31980						
	V10	IET 31982						
	V11	IET 31985						
	V12	IET 31986						
	V13	Swarna						
	V14	Improved Samba Mahsuri						
	V15	BPT 5204						
	V16	Local check - CG Devbhog, 135days						
Available NPK (kg/ha)		169.3:18.1:295.4						

Table 4.1(n): Contd.

P-levels	Varieties	RANCHI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Grains/Panicle (No.)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
P1: 0% of recommended P dose (N and K is constant)	V1	3.93	36	227	91	24.17	91	
	V2	4.07	33	237	94	24.70	97	
	V3	4.28	26	248	99	26.17	94	
	V4	4.07	33	222	89	23.49	90	
	V5	4.22	27	214	99	25.73	86	
	V6	3.84	39	210	82	21.92	98	
	V7	4.16	30	242	96	27.33	95	
	V8	4.33	23	253	97	26.49	92	
	V9	4.54	17	256	102	26.41	96	
	V10	3.91	37	225	91	23.69	94	
	V11	4.44	22	261	103	27.09	88	
	V12	4.11	32	243	96	25.40	97	
	V13	4.30	25	254	100	26.81	114	
	V14	-		-	-	-	-	
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
P2: 0% of recommended P dose (N and K is constant)	V1	4.12	31	247	97	25.76	94	6.33
	V2	4.18	29	251	97	25.95	100	3.67
	V3	4.48	21	268	106	27.60	97	6.67
	V4	4.63	14	264	103	24.80	93	18.67
	V5	3.87	38	230	91	26.98	89	-11.67
	V6	4.65	13	267	108	24.45	101	27.00
	V7	4.58	16	274	108	28.21	98	14.00
	V8	4.71	10	282	111	28.10	95	12.67
	V9	4.78	8	286	107	28.15	99	8.00
	V10	3.98	35	249	97	25.59	97	2.33
	V11	4.67	12	279	110	28.47	91	7.67
	V12	4.52	18	269	105	26.91	100	13.67
	V13	4.63	14	278	109	27.77	117	11.00
	V14	-		-	-	-	-	
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
P3: 0% of recommended P dose (N and K is constant)	V1	4.33	23	267	101	26.00	95	6.67
	V2	4.52	18	279	106	26.13	101	7.50
	V3	4.71	10	290	111	27.93	98	7.17
	V4	4.84	7	285	108	24.77	94	12.83
	V5	4.21	28	258	98	27.20	90	-0.17
	V6	4.98	2	294	112	23.88	102	19.00
	V7	4.90	5	301	115	28.75	98	12.33
	V8	4.92	4	311	120	28.80	96	9.83
	V9	5.07	1	299	114	27.29	100	8.83
	V10	4.50	20	277	105	25.21	98	9.83
	V11	4.93	3	304	116	28.90	92	8.17
	V12	4.77	9	294	112	27.30	101	11.00
	V13	4.86	6	300	114	27.97	118	9.33
	V14	-		-	-	-	-	
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	

Table 4.1(n): Contd.

P-levels	Varieties	RANCHI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Grains/ Panicle (No.)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)
Interaction	P at same V	NS		NS	NS	NS	NS	
	V at same P	NS		NS	NS	NS	NS	
	F1	4.16	3	236	95	25.20	93	
	F2	4.42	2	263	103	26.73	96	8.67
	F3	4.72	1	288	109	26.81	97	9.27
	C.D.(0.05)	0.11		12.09	1.33	0.98	0.15	
	C.V.(%)	4.07		7.29	2.06	5.93	0.25	
Mean of varieties:								
	V1	4.13	12	247	96	25.31	94	6.50
	V2	4.26	10	255	99	25.59	99	5.58
	V3	4.49	7	269	105	27.23	97	6.92
	V4	4.51	6	257	100	24.35	92	15.75
	V5	4.10	13	234	96	26.64	89	-5.92
	V6	4.49	8	257	101	23.42	100	23.00
	V7	4.55	5	272	106	28.10	97	13.17
	V8	4.65	3	282	109	27.80	95	11.25
	V9	4.80	1	280	107	27.28	98	8.42
	V10	4.13	11	250	98	24.83	97	6.08
	V11	4.68	2	282	110	28.15	90	7.92
	V12	4.47	9	268	104	26.54	100	12.33
	V13	4.60	4	277	108	27.52	116	10.17
	V14	-		-	-	-	-	
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
	C.D.(0.05)	0.43		25.33	7.46	2.02	0.56	
	C.V.(%)	10.35		10.22	7.71	8.15	0.61	
	Expt. Mean	4.45		264	103	26.37	97	
	Soil type	-						
	pH	-						
	N - levels (kg/ha)							
	F1	0						
	F2	30						
	F3	60						
	Recommended NPK (kg/ha)	120:60:40						
	Varieties							
	V1	IET 31107						
	V2	IET 31966						
	V3	IET 31968						
	V4	IET 31969						
	V5	IET 31973						
	V6	IET 31975						
	V7	IET 31976						
	V8	IET 31979						
	V9	IET 31980						
	V10	IET 31982						
	V11	IET 31985						
	V12	IET 31986						
	V13	Swarna						
	V14	-						
	V15	-						
	V16	-						
	Available NPK (kg/ha)	214:38:161						

Table 4.1(n): Contd.

P-levels	Varieties	VARANASI							Mean Grain Yield (t/ha)	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Phosphorous res. (kg grain/kg P) (Base level 0% RDP)		
P1: 0% of recommended P dose (N and K is constant)	V1	-		-	-	-	-		3.77	36
	V2	-		-	-	-	-		3.98	25
	V3	-		-	-	-	-		3.83	31
	V4	-		-	-	-	-		3.59	39
	V5	-		-	-	-	-		3.51	45
	V6	-		-	-	-	-		3.84	30
	V7	-		-	-	-	-		3.53	42
	V8	-		-	-	-	-		3.81	33
	V9	-		-	-	-	-		3.59	40
	V10	-		-	-	-	-		3.46	46
	V11	-		-	-	-	-		3.98	26
	V12	-		-	-	-	-		3.52	43
	V13	-		-	-	-	-		3.63	38
	V14	-		-	-	-	-		3.54	41
	V15	-		-	-	-	-		2.93	48
	V16	-		-	-	-	-		3.44	47
P2: 0% of recommended P dose (N and K is constant)	V1	3.53	14	208	25.38	26.12	91		3.95	27
	V2	2.37	28	197	22.84	14.21	90		4.27	20
	V3	3.23	20	174	20.15	14.85	88		4.15	21
	V4	3.33	17	201	27.94	26.46	87		4.08	22
	V5	3.17	21	198	29.44	26.41	131		3.87	29
	V6	-		-	-	-	-		4.65	11
	V7	2.93	23	171	17.56	15.32	90		4.03	24
	V8	3.27	19	209	24.42	20.13	108		4.36	18
	V9	4.53	2	218	20.65	21.06	103		4.35	19
	V10	2.93	23	194	24.93	20.70	105		3.82	32
	V11	2.53	26	193	22.48	17.75	98		4.04	23
	V12	2.30	29	203	31.89	19.34	92		3.80	34
	V13	1.87	30	180	24.67	15.51	86		3.72	37
	V14	3.33	17	180	25.44	16.66	116		3.95	28
	V15	3.60	13	206	32.28	25.04	111		3.52	44
	V16	3.13	22	204	27.45	22.51	106		3.79	35
P3: 0% of recommended P dose (N and K is constant)	V1	4.07	6	183	24.02	26.16	92	27.00	4.63	12
	V2	2.53	26	170	18.90	23.90	91	8.00	4.72	7
	V3	3.83	9	172	19.92	28.53	90	30.00	4.86	3
	V4	3.67	11	194	33.54	20.17	87	17.00	4.76	5
	V5	3.37	15	198	30.28	25.46	96	10.00	4.42	16
	V6	-		-	-	-	-		4.98	2
	V7	3.70	10	143	24.65	15.65	90	38.50	4.51	14
	V8	6.53	1	188	14.71	17.41	110	163.00	5.19	1
	V9	4.27	5	210	35.23	18.87	104	-13.00	4.73	6
	V10	3.37	15	176	17.97	23.94	106	22.00	4.52	13
	V11	3.87	8	188	27.83	20.08	132	67.00	4.83	4
	V12	2.93	23	186	31.66	25.44	88	31.50	4.42	17
	V13	3.67	11	170	29.25	15.41	83	90.00	4.50	15
	V14	4.07	6	202	19.11	24.82	114	37.00	4.67	10
	V15	4.33	4	215	33.76	18.90	111	36.50	4.71	9
	V16	4.47	3	185	26.82	24.21	105	67.00	4.72	8

Table 4.1(n): Contd.

P-levels	Varieties	VARANASI						Mean Grain Yield (t/ha)	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering		
Interaction	P at same V	0.35		17.4	3.83	3.04	NS		
	V at same P	0.36		19.97	3.4	2.3	NS		
F1		-		-	-	-	-	3.68	3
F2		3.18	2	196	23.58	20.30	99	4.07	2
F3		3.92	1	182	24.71	22.02	100	4.71	1
								36.95	
	C.D.(0.05)	0.1		NS	NS	NS	NS		
	C.V.(%)	3.27		7.99	10.89	13.99	1.11		
Mean of varieties:									
V1		3.80	4	195	24.70	26.14	91	4.15	8
V2		2.45	15	184	20.87	19.06	91	4.33	5
V3		3.53	7	173	20.04	21.69	89	4.35	3
V4		3.50	8	198	30.74	23.32	87	4.23	7
V5		3.27	10	198	29.86	25.94	114	4.02	11
V6		-		-	-	-	-	4.49	2
V7		3.32	9	157	21.11	15.49	90	4.10	10
V8		4.90	1	199	19.57	18.77	109	4.61	1
V9		4.40	2	214	27.94	19.97	104	4.34	4
V10		3.15	12	185	21.45	22.32	105	3.98	13
V11		3.20	11	191	25.16	18.92	115	4.28	6
V12		2.62	14	194	31.78	22.39	90	3.92	15
V13		2.77	13	175	26.96	15.46	85	3.95	14
V14		3.70	6	191	22.28	20.74	115	4.14	9
V15		3.97	3	211	33.02	21.97	111	3.84	16
V16		3.80	4	194	27.14	23.36	106	4.01	12
	C.D.(0.05)	0.25		12.3	2.41	1.63	17.42		
	C.V.(%)	6.22		5.58	8.16	6.68	15.06		
Expt. Mean		3.49		191	25.51	21.03	100	4.20	
Soil type		Loam							
pH		7.1							
N - levels (kg/ha)									
F1		0							
F2		20							
F3		40							
Recommended NPK (kg/ha)		150:40:05							
Varieties									
V1		IET 31107							
V2		IET 31966							
V3		IET 31968							
V4		IET 31969							
V5		IET 31973							
V6		-							
V7		IET 31976							
V8		IET 31979							
V9		IET 31980							
V10		IET 31982							
V11		IET 31985							
V12		IET 31986							
V13		Swarna							
V14		Improved Samba Mahsuri							
V15		BPT 5204							
V16		Local check - HUR 156							
Available NPK (kg/ha)		-							

4.1(o) AET – AVT-2 LNT

Evaluation of identified cultures and cultivars for enhancing nitrogen use efficiency in irrigated rice

The productivity of rice is very low due to imbalanced and excessive use of nitrogen fertilizers by the farmers. It has been reported that the apparent recovery efficiency of applied nitrogen is approximately about 30-33% whereas, the remaining amount of N is either lost through surface runoff, leaching, volatilization or denitrification and further adds to increased cost of production and environmental degradation. The use of efficient and economical rates of nitrogen fertilizer is important for enhancing crop productivity and maintaining environmental sustainability. To achieve this, it is imperative to identify high nitrogen efficient cultivars which can minimize the losses. Large numbers of rice cultivars have been released in India so far, but the question is that whether these cultivars are capable of utilizing the nitrogen efficiently and there by enhance NUE. Inter varietal differences for nitrogen use efficiency has been reported by many researchers. Therefore, there is a need to identify the cultivars which can efficiently utilize the N and to develop a sustainable nitrogen rate recommendation for these cultivars which can further give enhanced yield and resource use efficiency. The trial was conducted at nine locations (**Gangavathi, Karjat, Mandya, Maruteru, Pantnagar, Pusa, Raipur, Ranchi and Varanasi**). Split plot design was adopted with 3 main plots of nitrogen levels (N₁- No nitrogen, N₂: 50 %of recommended N dose (P and K is constant) and N₃: 100 % of recommended dose of N (P and K constant). Subplots consists of 9 advanced cultures along with four checks. The results were summarized and presented in **Table 4.1(o)** and the salient findings are as followed.

Interaction effect of nitrogen level and advanced cultures on grain yield was found significant at **Karjat, Pantnagar, and Varanasi**. However, the objective is to find out suitable and efficient cultivars under low recommended N application for reducing nitrogen input without any yield penalty. At **Karjat**, under no application of nitrogen, IET 31990 (3.64 t/ha), IET 31998 (3.20 t/ha) and IET 31993 (3.16 t/ha) performed well. Similarly, under 50% RDN, IET 31990 and IET 29577 resulted grain yield of 5.61 t/ha and 4.86 t/ha, respectively and found promising. At **Pantnagar**, under no application of nitrogen, IET 32009 (2.29 t/ha), IET 31994 (2.20 t/ha) and IET 31998 (2.15 t/ha) performed well. Similarly, under 50% RDN, IET 32009, IET 31994 and IET 31998 resulted 4.68 t/ha, 4.24 t/ha and 4.13 t/ha, respectively and found

promising. At **Varanasi**, under 50% RDN, IET 32009 and IET 31998 resulted 4.23 t/ha and 3.97 t/ha, respectively and found promising.

Among nitrogen levels, all the locations fertilized under 100% RDN resulted the highest grain yield followed by 50% and the lowest under no fertilization of nitrogen.

Among the different AVT-2 entries top 3 performer were listed below in tabular form.

Location	1 st rank	2 nd rank	3 rd rank
Gangavathi	IET 31994 (5.21 t/ha)	IET 31990 (5.15 t/ha)	IET 32009 (4.59 t/ha)
Karjat	IET 31990 (5.01 t/ha)	IET 29577 (4.42 t/ha)	IET 31998 (4.07 t/ha)
Mandya	IET 31998 (6.38 t/ha)	IET 29577 (5.61 t/ha)	IET 32009 (5.24 t/ha)
Maruteru	IET 31998 (5.32 t/ha)	IET 29577 (5.01 t/ha)	IET 32009 (4.81 t/ha)
Pantnagar	IET 32009 (3.74 t/ha)	IET 31994 (3.63 t/ha)	IET 31998 (3.46 t/ha)
Pusa	IET 30261 (4.18 t/ha)	IET 29577 (3.81 t/ha)	IET 31990 (3.77 t/ha)
Raipur	Swarna (5.04 t/ha)	IET 32009 (4.90 t/ha)	IET 32010 (4.73 t/ha)
Ranchi	IET 31990 (3.82 t/ha)	IET 31998 (3.78 t/ha)	IET 29577 (3.61 t/ha)
Varanasi	IET 32010 (4.12 t/ha)	IET 32009 (4.08 t/ha)	IET 31998 (4.05 t/ha)

Table 4.1(o): Summary of data on grain yield and ancillary characters of selected AET LNT cultures grown under transplanted conditions at graded levels of recommended N fertilizer doses, kharif 2025.

N-levels	Varieties	GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nitrogen. res. (kg grain/kg N) (Base level 50% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	3.53	35	129	2.40	16.50	
	V2	3.90	26	140	3.10	16.90	
	V3	3.78	30	120	3.10	17.50	
	V4	4.25	19	125	3.10	21.10	
	V5	3.64	32	114	2.10	18.87	
	V6	4.93	7	125	2.40	20.50	
	V7	3.56	34	137	2.60	22.00	
	V8	3.96	23	129	2.40	16.50	
	V9	3.81	28	143	3.10	22.00	
	V10	2.74	42	143	1.50	16.50	
	V11	3.46	37	119	2.70	18.50	
	V12	3.33	39	134	2.70	21.80	
	V13	2.75	41	130	1.90	18.50	
	V14	3.39	38	128	2.60	14.67	
N2: 50% of recommended N dose (P and K is constant)	V1	4.04	22	141	2.90	16.80	6.80
	V2	3.94	24	141	3.30	17.50	0.53
	V3	4.11	21	142	3.40	18.00	4.40
	V4	5.13	4	142	3.60	22.10	11.73
	V5	3.83	27	146	2.90	22.60	2.53
	V6	5.08	5	151	2.80	21.00	2.00
	V7	4.42	16	146	3.00	22.70	11.47
	V8	4.56	13	138	2.50	18.00	8.00
	V9	4.77	10	148	3.40	22.50	12.80
	V10	3.31	40	146	2.10	16.50	7.60
	V11	4.13	20	130	3.00	19.50	8.93
	V12	4.35	17	140	3.10	22.40	13.60
	V13	3.79	29	133	2.30	19.00	13.87
	V14	3.48	36	150	2.90	14.80	1.20
N3: 100% of recommended N dose	V1	4.50	15	152	3.20	17.50	6.47
	V2	4.63	11	166	3.80	18.80	4.87
	V3	4.78	9	168	3.70	18.00	6.67
	V4	6.06	1	157	4.10	23.17	12.07
	V5	4.59	12	157	3.30	23.00	6.33
	V6	5.61	2	165	3.30	22.50	4.53
	V7	4.91	8	159	3.40	23.50	9.00
	V8	5.25	3	168	2.90	18.00	8.60
	V9	5.05	6	169	3.70	23.00	8.27
	V10	3.77	31	161	2.60	18.00	6.87
	V11	4.29	18	138	3.10	19.67	5.53
	V12	4.56	13	163	3.50	22.57	8.20
	V13	3.93	25	150	2.80	19.00	7.87
	V14	3.58	33	165	3.30	15.50	1.27

Table 4.1(o): Contd.

N- levels	Varieties	GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nitrogen. res. (kg grain/kg N) (Base level 50% RDN)
Interaction N at same V V at same N F1 F2 F3 C.D.(0.05) C.V.(%) Mean of varieties: V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 C.D.(0.05) C.V.(%) Expt. Mean Soil type pH N - levels (kg/ha) F1 F2 F3 Recommended NPK (kg/ha) Varieties V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 Available NPK (kg/ha)	NS		NS	NS	NS		
	NS		NS	NS	NS		
	3.65	3	130	2.55	18.70		
	4.21	2	142	2.94	19.53	7.53	
	4.68	1	160	3.34	20.16	6.90	
	0.13		7.46	0.02	0.48		
	5.21		8.55	1.39	4.05		
	4.02	9	141	2.83	16.93	6.63	
	4.16	7	149	3.40	17.73	2.70	
	4.22	6	144	3.40	17.83	5.53	
	5.15	2	141	3.60	22.12	11.90	
	4.02	10	139	2.77	21.49	4.43	
	5.21	1	147	2.83	21.33	3.27	
	4.30	5	147	3.00	22.73	10.23	
	4.59	3	145	2.60	17.50	8.30	
	4.54	4	153	3.40	22.50	10.53	
	3.27	14	150	2.07	17.00	7.23	
	3.96	11	129	2.93	19.22	7.23	
	4.08	8	146	3.10	22.26	10.90	
	3.49	12	138	2.33	18.83	10.87	
	3.48	13	148	2.93	14.99	1.23	
	0.62		11.17	0.57	2.23		
	15.82		8.27	20.48	12.19		
	4.18		144	2.94	19.46		
	-						
	-						
	0						
	75						
150							
150:75:75							
IET 29577							
IET 30261							
IET 31124							
IET 31990							
IET 31993							
IET 31994							
IET 31998							
IET 32009							
IET 32010							
Varadhan							
Swarna							
Improved Samba Mahsuri							
BPT 5204							
Local check - Gangavathi sona, 130-135 days							
-							

Table 4.1(o): Contd.

N-levels	Varieties	KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	3.21	24	242	2.50	15.10	108	
	V2	2.31	34	201	1.64	15.58	108	
	V3	2.93	27	217	1.93	13.76	106	
	V4	3.64	14	246	2.56	19.80	105	
	V5	3.16	26	218	1.93	19.90	106	
	V6	2.50	32	206	1.71	14.12	106	
	V7	3.20	25	218	2.25	16.79	110	
	V8	2.65	31	208	1.74	15.29	106	
	V9	2.66	30	217	1.90	18.53	106	
	V10	-		-	-	-	-	
	V11	2.28	35	201	1.48	15.33	107	
	V12	2.27	36	197	1.38	11.25	110	
	V13	-		-	-	-	-	
	V14	2.38	33	204	1.68	18.64	95	
N2: 50% of recommended N dose (P and K is constant)	V1	4.86	5	336	2.71	15.72	107	33.00
	V2	3.32	22	294	2.05	15.90	108	20.20
	V3	3.62	15	217	2.21	15.30	106	13.80
	V4	5.61	2	309	3.63	19.60	106	39.40
	V5	3.87	12	319	2.23	21.45	107	14.20
	V6	3.46	19	297	2.14	14.54	106	19.20
	V7	4.07	9	324	2.47	14.67	111	17.40
	V8	3.48	18	300	2.15	15.35	107	16.60
	V9	3.52	17	308	2.15	19.96	107	17.20
	V10	-		-	-	-	-	
	V11	2.78	28	278	1.89	15.11	108	10.00
	V12	2.75	29	275	1.09	11.09	111	9.60
	V13	-		-	-	-	-	
	V14	3.42	20	295	2.08	18.76	96	20.80
N3: 100% of recommended N dose	V1	5.19	3	378	3.79	16.38	108	19.80
	V2	3.58	16	320	2.25	15.47	109	12.70
	V3	4.45	7	362	2.87	15.16	106	15.20
	V4	5.78	1	387	3.88	20.16	107	21.40
	V5	4.73	6	368	2.94	22.37	108	15.70
	V6	3.92	11	334	2.60	14.73	106	14.20
	V7	4.94	4	373	3.08	16.08	110	17.40
	V8	3.93	10	340	2.71	16.07	108	12.80
	V9	4.31	8	348	2.73	20.25	108	16.50
	V10	-		-	-	-	-	
	V11	3.38	21	314	2.20	14.90	112	11.00
	V12	3.30	23	310	1.51	10.64	112	10.30
	V13	-		-	-	-	-	
	V14	3.76	13	334	2.27	19.02	97	13.80

Table 4.1(o): Contd.

N-levels	Varieties	KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
Interaction								
N at same V		0.28		18.07	0.2	NS	1.28	
V at same N		0.26		17.85	0.19	NS	1.23	
	F1	2.77	3	215	1.89	16.17	106	
	F2	3.73	2	296	2.23	16.45	106	19.28
	F3	4.27	1	347	2.74	16.77	107	15.07
C.D.(0.05)		0.16		5.46	0.1	NS	0.63	
C.V.(%)		6.78		2.92	6.82	4.26	0.9	
Mean of varieties:								
	V1	4.42	2	319	3.00	15.73	107	26.40
	V2	3.07	10	272	1.98	15.65	108	16.45
	V3	3.67	5	265	2.34	14.74	106	14.50
	V4	5.01	1	314	3.36	19.85	106	30.40
	V5	3.92	4	301	2.37	21.24	107	14.95
	V6	3.29	8	279	2.15	14.46	106	16.70
	V7	4.07	3	305	2.60	15.85	110	17.40
	V8	3.35	7	283	2.20	15.57	107	14.70
	V9	3.50	6	291	2.26	19.58	107	16.85
	V10	-		-	-	-	-	
	V11	2.81	11	265	1.86	15.11	109	10.50
	V12	2.77	12	261	1.33	10.99	111	
	V13	-		-	-	-	-	
	V14	3.19	9	278	2.01	18.81	96	17.30
C.D.(0.05)		0.15		10.43	0.11	0.88	0.71	
C.V.(%)		4.42		3.88	5	5.65	0.71	
Expt. Mean		3.59		286	2.29	16.47	106	
Soil type		Medium black						
pH		-						
N - levels (kg/ha)								
	F1	0						
	F2	50						
	F3	100						
Recommended NPK (kg/ha)		100:50:50						
Varieties								
	V1	IET 29577						
	V2	IET 30261						
	V3	IET 31124						
	V4	IET 31990						
	V5	IET 31993						
	V6	IET 31994						
	V7	IET 31998						
	V8	IET 32009						
	V9	IET 32010						
	V10	Varadhan						
	V11	Swarna						
	V12	Improved Samba Mahsuri						
	V13	BPT 5204						
	V14	Local check - Karjat 3, 110 to 125 days						
Available NPK (kg/ha)		-						

Table 4.1(o): Contd.

N-levels	Varieties	MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	-		-	-	-	-	
	V2	-		-	-	-	-	
	V3	-		-	-	-	-	
	V4	-		-	-	-	-	
	V5	-		-	-	-	-	
	V6	-		-	-	-	-	
	V7	-		-	-	-	-	
	V8	-		-	-	-	-	
	V9	-		-	-	-	-	
	V10	-		-	-	-	-	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	
N2: 50% of recommended N dose (P and K is constant)	V1	5.01	12	288	4.63	20.27	97	
	V2	4.60	20	271	4.52	19.34	104	
	V3	4.40	21	277	4.00	18.81	85	
	V4	4.78	16	266	3.99	27.02	94	
	V5	4.94	14	291	3.75	27.65	99	
	V6	4.72	18	310	2.56	17.12	93	
	V7	5.77	3	294	3.88	19.59	97	
	V8	5.14	9	317	3.11	18.66	93	
	V9	4.61	19	300	4.64	25.89	93	
	V10	-		-	-	-	-	
	V11	4.40	21	305	2.67	18.59	108	
	V12	4.83	15	296	2.55	14.15	94	
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	
N3: 100% of recommended N dose	V1	6.20	2	321	4.90	20.06	97	19.04
	V2	5.22	8	315	5.17	21.23	104	9.92
	V3	5.13	10	299	4.40	19.12	85	11.68
	V4	5.53	4	302	4.15	27.49	94	12.00
	V5	5.48	5	328	4.09	27.77	99	8.64
	V6	5.02	11	332	2.67	17.38	93	4.80
	V7	6.99	1	344	3.90	19.52	97	19.52
	V8	5.34	6	347	3.29	18.76	93	3.20
	V9	4.77	17	326	4.84	26.01	93	2.56
	V10	-		-	-	-	-	
	V11	5.00	13	324	2.78	18.68	108	9.60
	V12	5.27	7	332	2.75	15.15	94	7.04
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	

Table 4.1(o): Contd.

N- levels	Varieties	MANDYA						
		Grain Yield (t/ha)	<i>Rank</i>	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
Interaction <i>N at same V</i> <i>V at same N</i> F1 F2 F3 <i>C.D.(0.05)</i> C.V.(%) Mean of varieties: V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 <i>C.D.(0.05)</i> C.V.(%) Expt. Mean Soil type pH N - levels (kg/ha) F1 F2 F3 Recommended NPK (kg/ha) Varieties V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 Available NPK (kg/ha)	NS NS		NS NS	NS NS	NS NS	NS NS		
	4.84 5.45	2 1	292 325	3.66 3.90	20.64 21.02	96 96	 87.20	
	0.61 11.22		NS 14.58	NS 9.28	NS 0	NS 0		
	5.61 4.91 4.77 5.16 5.21 4.87 6.38 5.24 4.69 - 4.70 5.05 - -	2 7 9 5 4 8 1 3 11 10 6	305 293 288 284 310 321 319 332 313 - 315 314 - -	4.77 4.85 4.20 4.07 3.92 2.62 3.89 3.20 4.74 - 2.73 2.65 - -	20.17 20.29 18.97 27.26 27.71 17.25 19.56 18.71 25.95 - 18.64 14.65 - -	97 104 85 94 99 93 97 93 93 - 108 94 - -	19.04 9.92 11.68 12.00 8.64 4.80 19.52 3.20 2.56 9.60 7.04 0 0 96	
	0.57 9.58 5.14		20.62 5.73 308	0.43 9.76 3.78	NS 0 20.83	0 0 96		
	Red sandy loam							
	8.21							
	0							
	62.5							
	125							
	125:62:62							
	IET 29577							
	IET 30261							
	IET 31124							
	IET 31990							
	IET 31993							
	IET 31994							
	IET 31998							
	IET 32009							
	IET 32010							
	Varadhan							
	Swarna							
	Improved Samba Mahsuri							
	BPT 5204							
	Local check - Karjat 3, 110 to 125 days							
	286.2:83.5:254							

Table 4.1(o): Contd.

N-levels	Varieties	MARUTERU						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	4.53	18	227	2.93	18.13	98	
	V2	4.05	29	229	2.41	18.17	98	
	V3	3.72	32	209	2.76	17.13	98	
	V4	3.69	33	201	3.53	19.57	100	
	V5	3.73	31	207	3.73	24.59	97	
	V6	4.33	21	233	3.20	16.77	87	
	V7	4.84	9	187	3.66	19.17	100	
	V8	4.33	21	222	3.53	15.90	98	
	V9	4.22	23	198	3.26	21.50	87	
	V10	3.47	36	174	2.96	20.60	87	
	V11	3.61	35	277	3.57	17.80	97	
	V12	3.66	34	170	3.02	13.43	99	
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	
N2: 50% of recommended N dose (P and K is constant)	V1	4.98	8	262	2.94	18.70	97	10.00
	V2	4.50	19	247	2.46	18.57	98	10.00
	V3	4.17	25	252	2.79	17.43	98	10.00
	V4	4.14	26	233	3.65	19.60	99	10.00
	V5	4.18	24	244	3.77	24.60	100	10.00
	V6	4.78	10	253	3.29	17.13	98	10.00
	V7	5.29	5	238	3.75	19.33	103	10.00
	V8	4.78	10	233	3.59	16.20	90	10.00
	V9	4.67	15	234	3.33	22.47	102	10.00
	V10	3.92	30	228	3.05	21.10	84	10.00
	V11	4.06	28	257	3.71	18.17	101	10.00
	V12	4.11	27	186	3.04	13.63	99	10.00
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	
N3: 100% of recommended N dose	V1	5.53	2	262	2.96	18.83	99	11.11
	V2	5.05	7	247	2.55	18.77	99	11.11
	V3	4.72	13	252	2.52	17.53	100	11.11
	V4	4.69	14	233	3.72	20.07	103	11.11
	V5	4.73	12	244	3.85	25.10	103	11.11
	V6	5.33	3	253	3.39	17.47	99	11.11
	V7	5.84	1	238	3.82	19.93	107	11.11
	V8	5.33	3	233	3.65	16.30	98	11.11
	V9	5.22	6	234	3.39	22.80	98	11.11
	V10	4.47	20	228	3.12	22.30	84	11.11
	V11	4.61	17	257	3.88	18.37	104	11.11
	V12	4.66	16	186	3.22	14.07	98	11.11
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	

Table 4.1(o): Contd.

N-levels	Varieties	MARUTERU						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
	Interaction	NS		NS	NS	NS	2.45	
	<i>N at same V</i>	NS		NS	NS	NS	2.22	
	<i>V at same N</i>							
	F1	4.02	3	211	3.21	18.56	96	
	F2	4.47	2	239	3.28	18.91	97	10.00
	F3	5.02	1	239	3.34	19.30	99	11.11
	C.D.(0.05)	0		6.41	NS	0.17	1.54	
	C.V.(%)	0		4.26	4.52	1.4	2.41	
	Mean of varieties:							
	V1	5.01	2	250	2.94	18.55	98	10.56
	V2	4.53	6	241	2.47	18.50	98	10.56
	V3	4.20	8	237	2.69	17.36	99	10.56
	V4	4.17	9	223	3.63	19.75	101	10.56
	V5	4.21	7	232	3.78	24.76	100	10.56
	V6	4.81	3	246	3.29	17.12	95	10.56
	V7	5.32	1	221	3.74	19.48	104	10.56
	V8	4.81	3	229	3.59	16.13	95	10.56
	V9	4.70	5	222	3.33	22.26	96	10.56
	V10	3.95	12	210	3.04	21.33	85	10.56
	V11	4.09	11	264	3.72	18.11	101	10.56
	V12	4.14	10	181	3.09	13.71	99	10.56
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	
	C.D.(0.05)	0.4		28.15	0.29	0.42	1.28	
	C.V.(%)	9.43		13.02	9.46	2.34	1.4	
	Expt. Mean	4.50		230	3.28	18.92	97	
	Soil type	-						
	pH	6.50						
	N - levels (kg/ha)							
	F1	0						
	F2	45						
	F3	90						
	Recommended NPK (kg/ha)	90:60:60						
	Varieties							
	V1	IET 29577						
	V2	IET 30261						
	V3	IET 31124						
	V4	IET 31990						
	V5	IET 31993						
	V6	IET 31994						
	V7	IET 31998						
	V8	IET 32009						
	V9	IET 32010						
	V10	Varadhan						
	V11	Swarna						
	V12	Improved Samba Mahsuri						
	V13	-						
	V14	-						
	Available NPK (kg/ha)	151:19.49:253						

Table 4.1(o): Contd.

N-levels	Varieties	PANTNAGAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	2.06	27	104	2.30	15.29	76	
	V2	2.05	28	107	2.11	16.38	74	
	V3	2.12	24	108	2.30	15.35	83	
	V4	2.07	25	105	2.15	19.39	83	
	V5	2.01	29	106	2.17	15.53	83	
	V6	2.20	22	114	2.20	18.58	78	
	V7	2.15	23	114	2.17	16.64	76	
	V8	2.29	21	122	2.11	15.05	75	
	V9	1.85	30	99	2.27	19.21	86	
	V10	-		-	-	-	-	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	-		-	-	-	-	
	V14	2.07	25	102	2.32	25.75	80	
N2: 50% of recommended N dose (P and K is constant)	V1	3.47	13	192	2.06	15.79	79	23.50
	V2	3.10	18	179	2.05	16.88	79	17.50
	V3	3.54	12	200	2.03	15.85	88	23.67
	V4	2.85	19	179	1.90	16.05	89	13.00
	V5	3.31	15	171	2.23	15.22	89	21.67
	V6	4.24	6	222	2.14	19.08	79	34.00
	V7	4.13	7	216	2.13	17.14	79	33.00
	V8	4.68	1	226	2.26	15.55	80	39.83
	V9	2.82	20	160	2.12	19.54	95	16.17
	V10	-		-	-	-	-	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	-		-	-	-	-	
	V14	3.27	16	165	2.27	26.15	87	20.00
N3: 100% of recommended N dose	V1	3.59	9	200	2.02	16.39	79	12.75
	V2	3.44	14	195	2.03	17.23	79	11.58
	V3	3.58	10	203	2.00	16.38	28	12.17
	V4	4.26	4	216	2.20	16.66	89	18.25
	V5	3.57	11	177	2.36	15.78	89	13.00
	V6	4.45	3	230	2.14	19.33	79	18.75
	V7	4.10	8	217	2.12	17.62	79	16.25
	V8	4.25	5	229	2.10	16.05	80	16.33
	V9	3.27	16	200	1.85	19.81	95	11.83
	V10	-		-	-	-	-	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	-		-	-	-	-	
	V14	4.60	2	224	2.31	27.37	90	21.08

Table 4.1(o): Contd.

N-levels	Varieties	PANTNAGAR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
	Interaction	0.32		8.29	0.13	0.34	2.13	
	N at same V	0.3		8	0.13	0.33	1.41	
	V at same N							
	F1	2.09	3	109	2.20	16.82	79	
	F2	3.57	2	194	2.10	16.79	84	24.70
	F3	3.83	1	207	2.09	17.25	77	14.55
	C.D.(0.05)	0.18		1.8	0.04	0.16	2.18	
	C.V.(%)	7.94		1.48	2.4	1.22	3.76	
	Mean of varieties:							
	V1	3.04	7	165	2.13	15.82	78	18.13
	V2	2.86	9	160	2.06	16.83	77	14.54
	V3	3.08	5	170	2.11	15.86	66	17.92
	V4	3.06	6	167	2.08	17.37	87	15.63
	V5	2.96	8	151	2.25	15.51	87	17.33
	V6	3.63	2	189	2.16	19.00	79	26.38
	V7	3.46	3	182	2.14	17.13	78	24.63
	V8	3.74	1	192	2.16	15.55	78	28.08
	V9	2.65	10	153	2.08	19.52	92	14.00
	V10	-		-	-	-	-	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	-		-	-	-	-	
	V14	3.31	4	164	2.30	26.42	86	20.54
	C.D.(0.05)	0.17		4.79	0.07	0.19	0.81	
	C.V.(%)	5.81		2.99	3.66	1.12	1.06	
	Expt. Mean	3.18		169	2.15	17.90	81	
	Soil type	Silt loam						
	pH	7.50						
	N - levels (kg/ha)							
	F1	0						
	F2	60						
	F3	120						
	Recommended NPK (kg/ha)	120:60:40						
	Varieties							
	V1	IET 29577						
	V2	IET 30261						
	V3	IET 31124						
	V4	IET 31990						
	V5	IET 31993						
	V6	IET 31994						
	V7	IET 31998						
	V8	IET 32009						
	V9	IET 32010						
	V10	-						
	V11	-						
	V12	-						
	V13	-						
	V14	Local check - Pant Dhan-24, 130-135 days						
	Available NPK (kg/ha)	222.3-38.5-212.3						

Table 4.1(o): Contd.

N-levels	Varieties	PUSA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	2.56	28	236	1.79	17.42	89	
	V2	2.85	27	260	1.96	17.53	91	
	V3	2.03	33	187	1.79	17.44	92	
	V4	2.56	28	254	1.99	16.17	96	
	V5	2.04	32	195	1.80	16.78	98	
	V6	2.02	34	200	1.90	16.17	96	
	V7	1.85	38	173	1.89	17.13	92	
	V8	1.98	35	184	1.88	17.27	95	
	V9	2.25	30	220	1.85	16.35	92	
	V10	1.86	37	176	1.64	16.96	91	
	V11	2.20	31	202	1.82	17.48	100	
	V12	1.94	36	183	1.83	16.96	97	
	V13	-		-	-	-	-	
	V14	1.79	39	178	1.80	16.10	80	
N2: 50% of recommended N dose (P and K is constant)	V1	3.89	14	269	2.11	20.93	90	22.17
	V2	4.27	6	293	2.30	21.09	93	23.67
	V3	3.18	19	220	2.10	20.92	92	19.17
	V4	3.86	15	287	2.35	19.44	96	21.67
	V5	3.18	19	228	2.12	20.17	98	19.00
	V6	3.13	22	233	2.23	19.40	97	18.50
	V7	2.94	25	206	2.23	20.62	93	18.17
	V8	3.11	23	217	2.21	20.77	98	18.83
	V9	3.44	18	253	2.18	19.61	92	19.83
	V10	3.03	24	215	1.98	20.43	92	19.50
	V11	3.52	17	242	2.19	21.06	100	22.00
	V12	3.15	21	223	2.21	20.43	98	20.17
	V13	-		-	-	-	-	
	V14	2.94	25	219	2.15	19.41	82	19.17
N3: 100% of recommended N dose	V1	4.98	2	288	2.33	23.28	94	20.17
	V2	5.42	1	311	2.53	23.45	98	21.42
	V3	4.14	8	240	2.32	23.25	96	17.58
	V4	4.88	3	304	2.59	21.59	98	19.33
	V5	4.12	9	248	2.33	22.40	101	17.33
	V6	4.07	10	253	2.46	21.63	101	17.08
	V7	3.84	16	226	2.44	22.90	96	16.58
	V8	4.06	11	237	2.43	23.06	100	17.33
	V9	4.43	5	273	2.40	21.79	95	18.17
	V10	4.06	11	241	2.28	22.70	94	18.33
	V11	4.61	4	267	2.51	23.24	101	20.08
	V12	4.19	7	248	2.49	22.74	101	18.75
	V13	-		-	-	-	-	
	V14	3.91	13	245	2.45	21.52	83	17.67

Table 4.1(o): Contd.

N- levels	Varieties	PUSA						
		Grain Yield (t/ha)	<i>Rank</i>	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
Interaction <i>N at same V</i> <i>V at same N</i>		NS		NS	NS	NS	NS	
		NS		NS	NS	NS	NS	
	F1	2.20	3	208	1.85	16.97	94	
	F2	3.41	2	242	2.18	20.40	95	20.23
	F3	4.42	1	263	2.42	22.66	98	18.49
	C.D.(0.05)	0.1		0.41	0.01	0.05	0.64	
	C.V.(%)	4.77		0.28	0.61	0.42	1.08	
	Mean of varieties:							
	V1	3.81	2	264	2.08	20.54	91	21.17
	V2	4.18	1	288	2.26	20.69	94	22.54
	V3	3.12	6	216	2.07	20.54	94	18.38
	V4	3.77	3	282	2.31	19.07	97	20.50
	V5	3.11	7	223	2.08	19.78	99	18.17
	V6	3.07	9	229	2.20	19.07	98	17.79
	V7	2.88	13	202	2.19	20.22	94	17.38
	V8	3.05	10	213	2.17	20.37	97	18.08
	V9	3.37	5	249	2.14	19.25	93	19.00
	V10	2.98	11	210	1.97	20.03	92	18.92
	V11	3.44	4	237	2.17	20.59	100	21.04
	V12	3.09	8	218	2.18	20.04	99	19.46
	V13	-		-	-	-	-	#DIV/0!
	V14	2.88	12	214	2.13	19.01	82	18.42
	C.D.(0.05)	0.15		10.88	0.08	0.24	2.03	
	C.V.(%)	4.93		4.94	3.92	1.3	2.28	
	Expt. Mean	3.29		234	2.15	19.94	95	
	Soil type	Sandy loam						
	pH	8.28						
	N - levels (kg/ha)							
	F1	0						
	F2	60						
F3	120							
Recommended NPK (kg/ha)	120:60:40							
Varieties								
V1	IET 29577							
V2	IET 30261							
V3	IET 31124							
V4	IET 31990							
V5	IET 31993							
V6	IET 31994							
V7	IET 31998							
V8	IET 32009							
V9	IET 32010							
V10	Varadhan							
V11	Swarna							
V12	Improved Samba Mahsuri							
V13	-							
V14	Local check - Rajendra Nilam, 115-120 days							
Available NPK (kg/ha)	214:13.8:114							

Table 4.1(o): Contd.

N-levels	Varieties	RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	3.79	30	147	4.27	19.80	86	
	V2	3.67	31	155	4.15	19.77	93	
	V3	3.62	33	174	3.80	17.73	81	
	V4	3.90	26	185	2.41	24.54	82	
	V5	3.81	28	178	2.20	26.23	87	
	V6	3.99	25	207	2.97	17.73	81	
	V7	3.19	36	176	2.37	20.14	92	
	V8	3.81	28	204	2.97	19.60	81	
	V9	4.31	19	167	2.94	25.63	82	
	V10	-		-	-	-	-	
	V11	4.52	17	216	3.56	19.87	98	
	V12	3.31	35	206	3.01	14.13	93	
	V13	-		-	-	-	-	
	V14	4.12	21	228	2.95	18.29	98	
N2: 50% of recommended N dose (P and K is constant)	V1	4.09	22	163	4.52	20.63	86	6.00
	V2	4.70	14	181	4.52	19.97	93	20.60
	V3	4.15	20	189	4.32	18.23	81	10.60
	V4	4.95	9	194	3.09	25.41	82	21.00
	V5	4.02	23	201	2.73	26.70	87	4.20
	V6	4.74	13	240	3.24	18.03	82	15.00
	V7	3.67	31	230	2.68	20.47	92	9.60
	V8	5.19	4	258	3.21	20.50	81	27.60
	V9	4.87	11	194	3.09	26.30	82	11.20
	V10	-		-	-	-	-	
	V11	5.09	5	235	3.98	20.03	98	11.40
	V12	3.54	34	215	3.39	14.23	93	4.60
	V13	-		-	-	-	-	
	V14	4.67	15	247	2.98	18.59	98	11.00
N3: 100% of recommended N dose	V1	4.97	8	186	4.98	21.20	86	11.80
	V2	5.01	6	218	4.79	21.13	93	13.40
	V3	4.55	16	214	4.47	19.10	81	9.30
	V4	5.25	3	229	3.34	26.08	82	13.50
	V5	4.41	18	215	2.81	26.93	87	6.00
	V6	4.87	11	256	3.53	19.37	81	8.80
	V7	4.02	23	233	2.99	21.17	92	8.30
	V8	5.70	1	259	3.33	20.90	81	18.90
	V9	5.01	6	199	3.30	26.77	82	7.00
	V10	-		-	-	-	-	
	V11	5.50	2	243	4.21	20.40	98	9.80
	V12	3.89	27	233	3.59	14.63	93	5.80
	V13	-		-	-	-	-	
	V14	4.93	10	275	3.28	19.22	98	8.10

Table 4.1(o): Contd.

N- levels	Varieties	RAIPUR						
		Grain Yield (t/ha)	<i>Rank</i>	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
Interaction N at same V V at same N F1 F2 F3 C.D.(0.05) C.V.(%) Mean of varieties: V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 C.D.(0.05) C.V.(%) Expt. Mean Soil type pH N - levels (kg/ha) F1 F2 F3 Recommended NPK (kg/ha) Varieties V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 Available NPK (kg/ha)	NS		NS	NS	NS	NS		
	NS		NS	NS	NS	NS		
	3.86	3	181	3.16	21.10	86		
	4.55	2	209	3.54	21.63	86	13.72	
	4.93	1	225	3.78	22.31	86	10.68	
	0.31		16.68	0.23	0.59	NS		
	10.81		12.15	9.99	4.33	0.33		
	4.28	8	165	4.59	20.54	86	8.90	
	4.46	7	185	4.49	20.29	93	17.00	
	4.11	9	192	4.20	18.35	81	9.95	
	4.70	4	203	2.95	25.34	82	17.25	
	4.08	10	198	2.58	26.62	87	5.10	
	4.53	6	234	3.25	18.38	81	11.90	
	3.63	11	213	2.68	20.59	92	8.95	
	4.90	2	240	3.17	20.33	81	23.25	
	4.73	3	187	3.11	26.23	82	9.10	
	-		-	-	-	-		
	5.04	1	231	3.92	20.10	98	10.60	
	3.58	12	218	3.33	14.33	93	5.20	
	4.57	5	250	3.07	18.70	98	9.55	
	-		-	-	-	-		
	0.44		27.45	0.42	0.62	0.2		
	10.74		13.91	13	3.15	0.24		
	4.38		210	3.44	20.82	88		
	Vertisol							
	6.80							
	0							
	50							
	100							
100:60:40								
IET 29577								
IET 30261								
IET 31124								
IET 31990								
IET 31993								
IET 31994								
IET 31998								
IET 32009								
IET 32010								
Varadhan								
Swarna								
Improved Samba Mahsuri								
BPT 5204								
Local check - CG Devbhog, 135 days								
201.7:19.8:337.2								

Table 4.1(o): Contd.

N-levels	Varieties	RANCHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
N1: No nitrogen (Control) (P and K is constant)	V1	1.92	25	175	23.70	91	
	V2	1.71	30	154	20.70	89	
	V3	1.76	27	162	21.40	88	
	V4	2.10	23	194	25.60	97	
	V5	1.44	32	143	19.23	93	
	V6	1.52	31	136	18.60	90	
	V7	1.97	24	179	23.80	97	
	V8	1.74	28	136	21.10	94	
	V9	1.43	33	133	18.40	91	
	V10	-		-	-	-	
	V11	1.73		169	22.90	100	
	V12	-		-	-	-	
	V13	-		-	-	-	
	V14	1.80	26	163	22.00	109	
N2: 50% of recommended N dose (P and K is constant)	V1	4.30	14	244	23.97	93	39.67
	V2	3.88	21	220	23.60	91	36.17
	V3	4.32	12	251	24.40	90	42.67
	V4	4.51	10	262	24.75	99	40.17
	V5	3.89	20	221	21.18	95	40.83
	V6	4.21	16	241	23.80	92	44.83
	V7	4.55	7	260	25.36	99	43.00
	V8	4.13	18	234	21.68	96	39.83
	V9	3.67	22	217	19.38	89	37.33
	V10	-		-	-	-	
	V11	4.39		251	24.17	102	44.33
	V12	-		-	-	-	
	V13	-		-	-	-	
	V14	4.30	14	230	22.94	111	41.67
N3: 100% of recommended N dose	V1	4.62	6	265	25.66	95	22.50
	V2	4.21	16	245	23.31	93	20.83
	V3	4.68	4	273	25.47	92	24.33
	V4	4.84	1	286	27.78	101	22.83
	V5	4.32	12	252	23.83	96	24.00
	V6	4.54	8	265	26.04	94	25.17
	V7	4.82	2	282	27.20	101	23.75
	V8	4.54	8	264	24.79	98	23.33
	V9	4.10	19	238	22.56	91	22.25
	V10	-		-	-	-	
	V11	4.63		270	26.07	105	24.17
	V12	-		-	-	-	
	V13	-		-	-	-	
	V14	4.74	3	276	27.18	112	24.50

Table 4.1(o): Contd.

N- levels	Varieties	RANCHI					
		Grain Yield (t/ha)	<i>Rank</i>	Panicle/m ² (No.)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
Interaction <i>N at same V</i> <i>V at same N</i> F1 F2 F3 <i>C.D.(0.05)</i> C.V.(%) Mean of varieties: V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 <i>C.D.(0.05)</i> C.V.(%) Expt. Mean Soil type pH N - levels (kg/ha) F1 F2 F3 Recommended NPK (kg/ha) Varieties V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 Available NPK (kg/ha)	NS		NS	NS	NS		
	NS		NS	NS	NS		
	1.73	3	158	21.54	93		
	4.19	2	240	23.23	95	40.88	
	4.53	1	264	25.27	97	23.32	
	0.17		15.04	1.23	0.75		
	7.05		9.97	7.66	1.13		
	3.61	3	228	24.44	93	31.08	
	3.27	9	206	22.54	91	28.50	
	3.59	5	228	23.76	90	33.50	
	3.82	1	247	26.04	99	31.50	
	3.22	10	205	21.41	95	32.42	
	3.42	8	214	22.81	92	35.00	
	3.78	2	240	25.45	99	33.38	
	3.47	7	211	22.52	96	31.58	
	3.07	11	196	20.11	90	29.79	
	-		-	-	-		
	3.58	6	230	24.38	103	34.25	
	-		-	-	-		
	-		-	-	-		
	3.61	3	223	24.04	111	33.08	
	0.36		23.14	1.94	0.98		
	11.02		11.12	8.78	1.08		
	3.49		221	23.41	96		
	-						
	-						
	0						
	60						
	120						
	120:60:40						
	IET 29577						
IET 30261							
IET 31124							
IET 31990							
IET 31993							
IET 31994							
IET 31998							
IET 32009							
IET 32010							
-							
Swarna							
-							
-							
Local check - Swarna							
245:41:155							

Table 4.1(o): Contd.

N-levels	Varieties	VARANASI							Mean Grain Yield (t/ha)	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)		
N1: No nitrogen (Control) (P and K is constant)	V1	-		-	-	-	-		3.09	30
	V2	-		-	-	-	-		2.93	35
	V3	-		-	-	-	-		2.85	38
	V4	-		-	-	-	-		3.17	29
	V5	-		-	-	-	-		2.83	39
	V6	-		-	-	-	-		3.07	31
	V7	-		-	-	-	-		2.97	33
	V8	-		-	-	-	-		2.97	34
	V9	-		-	-	-	-		2.93	36
	V10	-		-	-	-	-		2.69	41
	V11	-		-	-	-	-		2.97	32
	V12	-		-	-	-	-		2.90	37
	V13	-		-	-	-	-		2.75	40
	V14	-		-	-	-	-		2.59	42
N2: 50% of recommended N dose (P and K is constant)	V1	2.63	21	168	27.33	18.23	94		4.14	17
	V2								4.04	19
	V3	2.50	22	211	32.17	17.83	105		3.78	25
	V4	3.20	16	186	24.27	17.73	109		4.34	12
	V5	3.23	14	191	17.27	18.00	105		3.83	23
	V6	3.23	14	220	27.50	18.87	108		4.18	16
	V7	3.97	5	221	30.43	19.93	90		4.31	13
	V8	4.23	2	217	28.67	20.53	90		4.37	11
	V9	3.97	5	215	30.10	18.00	106		4.04	20
	V10								3.42	28
	V11	3.47	12	172	22.97	19.33	105		3.98	21
	V12	2.70	20	185	33.77	15.20	108		3.63	26
	V13								3.79	24
	V14	2.73	19	172	24.70	21.20	95		3.54	27
N3: 100% of recommended N dose	V1	4.00	4	197	30.83	22.60	90	22.83	4.84	3
	V2								4.57	6
	V3	3.43	13	190	23.17	23.37	91	15.50	4.38	10
	V4	2.97	18	178	22.40	20.90	91	-3.83	4.92	1
	V5	3.83	10	195	24.73	24.30	89	10.00	4.42	8
	V6	3.87	9	214	20.63	18.70	100	10.67	4.63	5
	V7	4.13	3	186	23.93	17.33	91	2.67	4.84	2
	V8	3.93	7	224	20.27	16.83	101	-5.00	4.70	4
	V9	4.27	1	223	23.23	20.67	90	5.00	4.49	7
	V10								4.10	18
	V11	3.13	17	221	26.47	23.83	88	-5.67	4.39	9
	V12	3.70	11	196	33.43	15.37	108	16.67	4.22	14
	V13								3.93	22
	V14	3.90	8	173	24.80	23.23	91	19.50	4.20	15

Table 4.1(o): Contd.

N-levels	Varieties	VARANASI						Mean Grain Yield (t/ha)	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)	
Interaction	N at same V	0.62		13.11	1.65	1.86	0.92		
	V at same N	0.51		15.71	1.69	1.89	0.92		
	F1	-		-	-	-	-	2.90	3
	F2	3.38	2	200	26.75	18.72	101	4.04	2
	F3	3.73	1	203	23.96	20.95	92	4.54	1
	C.D.(0.05)	NS		NS	0.44	0.59	0.34		
	C.V.(%)	13.19		5.8	1.61	2.83	0.33		
Mean of varieties:									
	V1	3.32	6	183	29.08	20.42	92	4.12	4
	V2	-		-	-	-	-	3.93	6
	V3	2.97	11	201	27.67	20.60	98	3.75	10
	V4	3.09	10	182	23.34	19.32	100	4.21	1
	V5	3.53	5	193	21.00	21.15	97	3.81	9
	V6	3.55	4	217	24.07	18.79	104	4.04	5
	V7	4.05	3	204	27.18	18.63	90	4.21	2
	V8	4.08	2	220	24.47	18.68	96	4.14	3
	V9	4.12	1	219	26.67	19.34	98	3.93	7
	V10	-		-	-	-	-	3.40	14
	V11	3.30	8	197	24.72	21.58	97	3.87	8
	V12	3.20	9	191	33.60	15.29	108	3.70	11
	V13	-		-	-	-	-	3.49	12
	V14	3.32	6	172	24.75	22.22	93	3.48	13
	C.D.(0.05)	0.36		9.27	1.2	1.34	0.65		
	C.V.(%)	8.81		4.01	3.94	5.84	0.57		
	Expt. Mean	3.50		198	26.05	19.64	98	3.92	
	Soil type	-							
	pH	7.3							
	N - levels (kg/ha)								
	F1	0							
	F2	60							
	F3	120							
	Recommended NPK (kg/ha)	120:60:40							
	Varieties								
	V1	IET 29577							
	V2	IET 30261							
	V3	IET 31124							
	V4	IET 31990							
	V5	IET 31993							
	V6	IET 31994							
	V7	IET 31998							
	V8	IET 32009							
	V9	IET 32010							
	V10	-							
	V11	Swarna							
	V12	Improved Samba Mahsuri							
	V13	-							
	V14	Local check -							
	Available NPK (kg/ha)	-							

AET 1(p) AVT-2 NIL & GEL

Two AVT-2 NIL & GEL culture IET 32964 and IET 32990 were evaluated for its response to different levels of nutrients (50% and 100% RDF) on grain yield from eight locations viz., **Chinsurah (80-40-40)**, **Dhangain (110-50-40)**, **Gangavathi (150-75-75)**, **Jagdarpur (100-50-25)**, **Masodha (120-60-40)**, **Nagina (120-60-40)**, **Navsari (100-30-0)** and **Titabar (60-20-40)**. The details and data received from these locations are summarized and presented in Table 4.1(p).

Application of different nutrient levels registered significantly higher grain yield at all locations except at **Dhangain, Jagdarpur, Navsari and Titabar**. Application of 100% RDF recorded significantly higher grain yields at **Chinsurah (5.10 t/ha)**, **Gangavathi (4.74 t/ha)**, **Masodha (4.41 t/ha)** and **Nagina (4.61 t/ha)**. Higher nutrient response was recorded with 100% RDF over 50% RDF at **Chinsurah (7.72)**; Dhangain (6.86), **Jagdarpur (6.24)** and **Masodha (7.68)**, **Nagina (20.14)**, Navsari (6.40) and Titabar (6.97) indicating need for higher nutrient application for better yields at these centers. The percentage mean grain yield increase was 14.3% with application of 100% RFD over 50% of the RFD application.

Grain yield differences among the tested cultures were found to be significant at all the locations except **Chinsurah**. The highest grain yield was recorded by IET 32990 (5.16 t/ha) at **Dhangain**, IET 32964 (4.51 t/ha) and IET 32990 (4.15 t/ha) at **Masodha**, IET 32964 (3.68 t/ha) and IET 32990 (3.61 t/ha) at **Nagina**, IET 32964 (5.28 t/ha) at **Navsari** and IET 32964 (5.27 t/ha) at **Titabar** found promising over other test cultures. Interaction effects among RDF x varieties was found to be non-significant at all the locations except at **Dhangain** where significant interaction was noted.

In this trial, mean over the locations nutrient management with 100% had higher grain yield and performance of standard checks were found to be promising and recorded higher mean grain yield across the locations.

Table 4.1(p): Summary of data on grain yield and ancillary characters of selected AET NIL & GEL cultures grown under transplanted conditions at low and optimum recommended fertilizer doses, Kharif 2025.

F-levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.70	6	290	2.60	106	
	V2	4.60	7	285	2.54	105	
	V3	4.12	10	256	2.28	109	
	V4	4.50	8	279	2.49	114	
	V5	4.49	9	279	2.48	106	
F2: Optimum input (100% NPK)	V1	5.23	1	332	3.06	110	6.63
	V2	5.13	3	325	2.99	109	6.63
	V3	4.91	5	312	2.87	112	9.88
	V4	5.22	2	332	3.05	117	9.00
	V5	5.01	4	317	2.92	109	6.50
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
F1		4.48	2	278	2.48	108	
F2		5.10	1	324	2.98	111	7.72
C.D.(0.05)		0.08		5.99	0.19	1.25	
C.V.(%)		1.06		1.27	4.43	0.73	
Mean of varieties:							
	V1	4.97	1	311	2.83	108	6.63
	V2	4.87	2	305	2.77	107	6.63
	V3	4.52	5	284	2.58	110	9.88
	V4	4.86	3	306	2.77	115	9.00
	V5	4.75	4	298	2.70	108	6.50
C.D.(0.05)		NS		19.19	NS	1.18	
C.V. (%)		7.04		5.22	7.05	0.88	
Expt. Mean		4.79		301	2.73	110	
Soil type		Clay loam					
pH		7.10					
F - levels (kg/ha)							
F1		40:20:20					
F2		80:40:40					
Recommended N:P:K (kg/ha)		80:40:40					
Varieties							
V1		IET 32964					
V2		IET 32990					
V3		BPT 5204(RP)					
V4		Pusa 44(RP)					
V5		Local check - Sujala, 140-145 days					
Available N:P:K of soil (kg/ha)		-					

Table 4.1(p): Contd.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	2.76	8	264	3.10	16.33	109	
	V2	4.83	3	331	5.49	27.47	92	
	V3	1.44	10	309	2.88	16.27	104	
	V4	4.01	6	309	13.00	26.77	95	
	V5	4.10	5	335	4.72	18.20	103	
F2: Optimum input (100% NPK)	V1	3.11	7	279	4.23	16.40	111	3.50
	V2	5.49	2	372	6.04	29.40	92	6.60
	V3	1.65	9	335	3.24	16.07	105	2.10
	V4	4.69	4	335	5.34	27.60	96	6.80
	V5	5.63	1	348	5.35	18.40	104	15.30
Interaction								
F at same V		0.76		NS	NS	NS	NS	
V at same F		0.52		NS	NS	NS	NS	
F1		3.43	2	310	5.84	21.01	101	
F2		4.11	1	334	4.84	21.57	102	6.86
C.D.(0.05)		NS		NS	NS	NS	0.86	
C.V.(%)		12.96		5.16	92.42	5.63	0.54	
Mean of varieties:								
	V1	2.94	4	272	3.67	16.37	110	3.50
	V2	5.16	1	351	5.77	28.44	92	6.60
	V3	1.55	5	322	3.06	16.17	105	2.10
	V4	4.35	3	322	9.17	27.19	96	6.80
	V5	4.87	2	342	5.04	18.30	104	15.30
C.D.(0.05)		0.37		26.43	NS	1.6	0.61	
C.V. (%)		7.98		6.71	89.33	6.12	0.49	
Expt. Mean		3.77		322	5.34	21.29	101	
Soil type		Clay loam						
pH		6.58						
F - levels (kg/ha)								
F1		55:25:20						
F2		110:50:40						
Recommended N:P:K (kg/ha)		110:50:40						
Varieties								
V1		IET 32964						
V2		IET 32990						
V3		BPT 5204(RP)						
V4		Pusa 44(RP)						
V5		Local check - Sabour Pratap, 130-140 days						
Available N:P:K of soil (kg/ha)		329.6:44.1:240.3						

Table 4.1(p): Contd.

F-levels	Varieties	GANGAVATHI					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.74	9	160	1.39	12.20	
	V2	4.39	6	163	3.99	26.10	
	V3	4.68	5	158	2.13	12.93	
	V4	4.71	4	164	3.78	23.73	
	V5	3.13	10	166	2.77	22.37	
F2: Optimum input (100% NPK)	V1	3.86	8	172	2.11	14.60	0.80
	V2	5.19	2	174	4.81	27.13	5.33
	V3	5.13	3	177	2.63	14.77	3.00
	V4	5.25	1	172	4.55	24.87	3.60
	V5	4.26	7	186	3.55	23.80	7.53
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
F1		4.13	2	162	2.81	19.47	
F2		4.74	1	176	3.53	21.03	4.05
C.D.(0.05)		0.24		NS	NS	NS	
C.V.(%)		3.49		6.13	14.59	5.46	
Mean of varieties:							
	V1	3.80	4	166	1.75	13.40	0.80
	V2	4.79	3	168	4.40	26.62	5.33
	V3	4.91	2	167	2.38	13.85	3.00
	V4	4.98	1	168	4.17	24.30	3.60
	V5	3.70	5	176	3.16	23.09	7.53
C.D.(0.05)		0.82		8.66	0.67	1.81	
C.V. (%)		15.17		4.18	17.26	7.31	
Expt. Mean		4.43		169	3.17	20.25	
Soil type		-					
pH		-					
F - levels (kg/ha)							
	F1	75:37.5:37.5					
	F2	150:75:75					
Recommended N:P:K (kg/ha)		150:75:75					
Varieties							
	V1	IET 32964					
	V2	IET 32990					
	V3	BPT 5204(RP)					
	V4	Pusa 44(RP)					
	V5	Local check - GNV1109, 130-135 days					
Available N:P:K of soil (kg/ha)		-					

Table 4.1(p): Contd.

F-levels	Varieties	JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.25	10	161	14.00	17.67	79	
	V2	5.63	5	194	27.00	31.33	71	
	V3	4.86	7	155	18.00	17.33	72	
	V4	5.89	3	264	22.33	22.33	99	
	V5	4.85	8	190	22.00	25.67	74	
F2: Optimum input (100% NPK)	V1	4.53	9	224	14.67	18.00	81	32.34
	V2	6.09	2	226	28.67	32.33	73	52.91
	V3	5.25	6	215	19.67	18.00	74	44.91
	V4	6.45	1	284	26.00	23.33	101	64.00
	V5	5.88	4	221	24.33	26.33	75	118.06
Interaction								
F at same V		NS	NS	NS	NS	NS	NS	
V at same F		NS	NS	NS	NS	NS	NS	
F1		5.10	5.10	193	20.67	22.87	79	
F2		5.64	5.64	234	22.67	23.60	81	62.45
C.D.(0.05)		NS	NS	18.38	0.5	NS	1.25	
C.V.(%)		11.15	11.15	5.48	1.46	2.83	1	
Mean of varieties:								
	V1	4.39	4.39	193	14.34	17.84	80	32.34
	V2	5.86	5.86	210	27.84	31.83	72	52.91
	V3	5.06	5.06	185	18.84	17.67	73	44.91
	V4	6.17	6.17	274	24.17	22.83	100	64.00
	V5	5.36	5.36	206	23.17	26.00	75	118.06
C.D.(0.05)		4.99	0.5	18.23	2.3	1.34	0.72	
C.V. (%)		7.6	7.6	6.98	8.69	4.72	0.73	
Expt. Mean		53.69	5.37	213	21.67	23.23	80	
Soil type		Red sandy loam						
pH		7.04						
F - levels (kg/ha)								
F1		50:25:12.5						
F2		100:50:25						
Recommended N:P:K (kg/ha)		100:50:25						
Varieties								
V1		IET 32964						
V2		IET 32990						
V3		BPT 5204(RP)						
V4		Pusa 44(RP)						
V5		Local check - Sonagthi, 110-115 days						
Available N:P:K of soil (kg/ha)		383.5:72.51:278.5						

Table 4.1(p): Contd.

F-levels	Varieties	MASODHA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.89	4	253	6.02	25.16	111	
	V2	3.60	6	254	5.76	23.43	111	
	V3	3.64	5	250	5.09	24.13	108	
	V4	3.13	8	240	4.09	16.90	109	
	V5							
F2: Optimum input (100% NPK)	V1	5.13	1	285	8.68	28.32	113	11.27
	V2	4.70	2	291	7.83	28.67	115	10.00
	V3	3.54	7	276	6.60	27.75	108	-0.91
	V4	4.27	3	273	6.65	18.63	118	10.36
	V5							#VALUE!
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
F1		3.57	2	249	5.24	22.41	110	
F2		4.41	1	281	7.44	25.84	114	7.68
C.D.(0.05)		0.6		25.73	0.55	NS	NS	
C.V.(%)		8.57		5.52	4.94	12.19	3.17	
Mean of varieties:								
	V1	4.51	1	269	7.35	26.74	112	11.27
	V2	4.15	2	273	6.80	26.05	113	10.00
	V3	3.59	4	263	5.85	25.94	108	-0.91
	V4	3.70	3	256	5.37	17.77	113	10.36
	V5							
C.D.(0.05)		0.55		14.63	0.83	1.46	3.36	
C.V. (%)		10.88		4.38	10.46	4.82	2.4	
Expt. Mean		3.99		265	6.34	24.12	112	
Soil type		Sand 32.2,Silt 48.6 & Clay 16.2						
pH		7.40						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 32964						
V2		IET 32990						
V3		BPT 5204(RP)						
V4		Pusa 44(RP)						
V5		-						
Available N:P:K of soil (kg/ha)		75.4:13.5:22.5						

Table 4.1(p): Contd.

F-levels	Varieties	NAGINA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	2.56	5	240	3.25	26.30	83	
	V2	2.45	6	233	3.19	26.37	103	
	V3	2.22	8	206	2.49	25.77	114	
	V4	2.35		226	2.92	26.31	110	
	V5							
F2: Optimum input (100% NPK)	V1	4.80	1	309	3.33	26.39	85	20.36
	V2	4.77	2	306	3.33	26.42	105	21.09
	V3	4.39	4	320	2.98	25.94	116	19.73
	V4	4.48		290	3.07	26.31	111	19.36
	V5							
Interaction								
F at same V		NS		18.81	0.07	0.02	NS	
V at same F		NS		18.29	0.06	0.03	NS	
F1		2.40	2	226	2.96	26.19	103	
F2		4.61	1	306	3.18	26.27	104	20.14
C.D.(0.05)		0.1		10.51	0.06	0.01	NS	
C.V.(%)		1.56		2.25	1.15	0.01	1.03	
Mean of varieties:								
	V1	3.68	1	275	3.29	26.35	84	20.36
	V2	3.61	2	270	3.26	26.40	104	21.09
	V3	3.31	4	263	2.74	25.86	115	19.73
	V4	3.42	3	258	3.00	26.31	111	19.36
	V5							
C.D.(0.05)		0.16		13.3	0.04	0.02	0.85	
C.V. (%)		3.67		3.97	1.08	0.05	0.65	
Expt. Mean		3.50		266	3.07	26.23	103	
Soil type		Sandy loam						
pH		7.70						
F - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 32964						
V2		IET 32990						
V3		BPT 5204(RP)						
V4		Pusa 44(RP)						
V5		-						
Available N:P:K of soil (kg/ha)		21:18.33:209						

Table 4.1(p): Contd.

F-levels	Varieties	NAVSARI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	5.10	5	225	3.75	27.43	98	
	V2	4.09	10	245	4.17	29.30	96	
	V3	4.18	9	212	4.12	26.81	94	
	V4	5.32	3	230	4.14	28.14	97	
	V5	4.85	6	264	4.03	29.86	91	
F2: Optimum input (100% NPK)	V1	5.45	2	246	3.91	27.75	97	5.38
	V2	4.61	8	258	4.33	29.84	94	8.00
	V3	4.78	7	259	4.64	27.02	92	9.23
	V4	5.63	1	262	4.59	28.36	98	4.77
	V5	5.15	4	276	4.10	30.61	91	4.62
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
F1		4.71	2	235	4.04	28.31	95	
F2		5.12	1	260	4.31	28.72	94	6.40
C.D.(0.05)		NS		NS	0.19	NS	0.86	
C.V.(%)		5.89		7.9	2.91	1.69	0.58	
Mean of varieties:								
	V1	5.28	2	236	3.83	27.59	97	5.38
	V2	4.35	5	252	4.25	29.57	95	8.00
	V3	4.48	4	235	4.38	26.92	93	9.23
	V4	5.48	1	246	4.37	28.25	98	4.77
	V5	5.00	3	270	4.07	30.24	91	4.62
C.D.(0.05)		0.51		26.96	0.34	0.66	0.82	
C.V. (%)		8.41		8.89	6.55	1.9	0.71	
Expt. Mean		4.92		248	4.18	28.51	95	
Soil type		Clayey						
pH		7.85						
F - levels (kg/ha)								
F1		50:15:0						
F2		100:30:0						
Recommended N:P:K (kg/ha)		100:30:0						
Varieties								
V1		IET 32964						
V2		IET 32990						
V3		BPT 5204(RP)						
V4		Pusa 44(RP)						
V5		Local check - GNR-3, 120-125 days						
Available N:P:K of soil (kg/ha)		256.88:36.89:805.52						

Table 4.1(p): Contd.

F-levels	Varieties	TITABAR							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	5.09	5	225	3.75	27.43	98		8.79	10
	V2	4.08	10	245	4.17	29.30	96		10.54	6
	V3	4.17	9	212	4.12	26.81	94		9.13	9
	V4	5.32	3	230	4.14	28.14	97		11.03	5
	V5	4.85	6	264	4.03	29.86	91		11.65	4
F2: Optimum input (100% NPK)	V1	5.45	2	246	3.91	27.75	97	6.00	9.80	8
	V2	4.60	8	258	4.33	29.84	94	8.67	11.93	3
	V3	4.78	7	259	4.64	27.02	92	10.17	10.21	7
	V4	5.62	1	262	4.59	28.36	98	5.00	12.46	2
	V5	5.15	4	276	4.10	30.61	91	5.00	14.00	1
Interaction										
F at same V		NS		NS	NS	NS	NS			
V at same F		NS		NS	NS	NS	NS			
F1		4.70	2	235	4.04	28.31	95		9.80	2
F2		5.12	1	260	4.31	28.72	94	6.97	11.20	1
C.D.(0.05)		NS		NS	0.19	NS	0.86			
C.V.(%)		5.9		7.9	2.92	1.69	0.58			
Mean of varieties:										
V1		5.27	2	236	3.83	27.59	97	6.00	9.29	5
V2		4.34	5	252	4.25	29.57	95	8.67	11.24	3
V3		4.48	4	235	4.38	26.92	93	10.17	9.67	4
V4		5.47	1	246	4.37	28.25	98	5.00	11.74	2
V5		5.00	3	270	4.07	30.24	91	5.00	12.82	1
C.D.(0.05)		0.51		NS	0.34	0.66	0.82			
C.V. (%)		8.43		8.89	6.56	1.9	0.71			
Expt. Mean		4.91		248	4.18	28.51	95		10.50	
Soil type		Clay loam								
pH		5.40								
F - levels (kg/ha)										
F1		30:10:20								
F2		60:20:40								
Recommended N:P:K (kg/ha)		60:20:40								
Varieties										
V1		IET 32964								
V2		IET 32990								
V3		BPT 5204(RP)								
V4		Pusa 44(RP)								
V5		Local check - Numoli, 130-135 days								
Available N:P:K of soil (kg/ha)		-								

4.1(q) AVT 1 - NIL - HT (Herbicide Tolerant Genotypes)

For conducting Advance variety trial 1-NIL (Herbicide Tolerant Genotypes), seed was sent to six locations (**Cuttack, Coimbatore, IIRR Hyderabad, Naira Chinsurah, Nagina**) to evaluate the performance of ten entries with nominated herbicide tolerant lines (NILs) including three susceptible check and one herbicide tolerant check against two herbicides i.e., Imazethapyr and Byspyribac sodium (NC) along with weed free check and weedy check. The results were received from five centers (**Cuttack, Coimbatore Naira, Chinsurah and Nagina**) out of which the data of three centers (**Chinsurah, Nagina and Naira**) were rejected due to recording of high yield with one or more the susceptible entries. The results indicated the superiority of the Byspyribac-sodium (4.77 t/ha at Cuttack, 4.37 t/ha at Coimbatore, 0.81 t/ha at Naira, 5.05 t/ha at **Chinsurah** and 4.32 t/ha at **Nagina**) followed by Imazethapyr (3.17 t/ha at Cuttack, 2.54 t/ha at Coimbatore, 0.48 t/ha at Naira, 3.44 t/ha at **Chinsurah** and 3.58 t/ha at **Nagina**) considering the zero yield in susceptible lines (G7, G8 and G9) by Imazethapyr was observed at **Chinsurah**. Significantly higher mean grain yield (5.05 t/ha) was observed with weed free check. However, in case of imazethapyr treatment, the lines G1 (5.28 t/ha) exhibited significantly superior grain yield over all other entries whereas G4, G5 and G6 showed comparable yield but superior over with G2 (4.80 t/ha) with no or low phytotoxicity to Imazethapyr which might have contributed to higher crop growth and grain yield.

HT- Trial Nominations for 2025 (Trait verification)

	Designation	Cross combination	Code
1.	CR 4700-28-4-11-6#	CR4430-1-3-2-1/ CR Dhan 800	G1
2.	CBHTR 22001	CO51 / Robin	G2
3.	CBHTR 22002	CO51 / Robin	G3
4.	CBMAS22022		G4
5.	CBMAS22033		G5
6.	CBMAS14110		G6
7.	Swarna (Recurrent Parent)		G7
8.	CO 51 (Recurrent parent)		G8
9.	ADT43 (Recurrent parent)		G9
10.	Robin (Herbicide Tolerant Check)		G10

Table 4.1(q): Summary of data on grain yield of selected NIL-HT cultures grown under different weed control management, *Kharif 2025*

Locati on	Cuttack										Coimbatore									
	Grain Yield (t/ha)										Grain Yield (t/ha)									
	Mainplot										Mainplot									
	T1: Imazetha pyr	Ran k	T2: Bispyribacso dium (National Check)	Ran k	T3: Wee d free che ck	Ran k	T4: Wee dy chec k	Ran k	Experim ent Mean	Ran k	T1: Imazetha pyr	Ran k	T2: Bispyribacso dium	Ran k	T3: Wee d free che ck	Ran k	T4: Wee dy chec k	Ran k	Experim ent Mean	Ran k
Sub Plot																				
G1	0	8	4.69	5	4.32	9	2.45	9	3.82	9	3.43	5	5.00	1	5.20	1	1.41	1	3.76	2
G2	5.03	1	5.05	3	5.20	2	2.65	4	4.48	2	3.88	3	3.38	10	3.60	10	1.24	5	3.02	5
G3	4.56	3	4.68	6	4.57	7	2.59	6	4.10	6	3.50	4	3.74	8	3.95	8	1.27	4	3.11	4
G4	3.93	7	3.79	10	3.94	8	2.13	10	3.45	10	4.48	2	3.46	9	3.64	9	1.15	8	3.18	3
G5	4.55	4	4.38	9	4.35	7	2.48	8	3.94	8	0.00		4.32	7	4.59	7	1.29	3	2.55	10
G6	0.00	8	4.76	4	4.95	2	2.82	1	4.17	4	0.00		4.74	4	4.90	4	1.18	7	2.71	8
G7	4.46	5	4.59	8	4.66	5	2.57	7	4.07	7	0.00		4.70	5	4.78	5	1.12	9	2.65	9
G8	4.69	2	5.79	1	4.83	2	2.79	2	4.53	1	0.00		4.88	2	5.03	3	1.02	10	2.73	7
G9	0.00	8	5.26	2	5.23	1	2.60	5	4.36	3	4.98	1	4.62	6	4.75	6	1.20	6	3.89	1
G10	4.46	5	4.67	7	4.81	1	2.65	3	4.15	5	0.32	6	4.81	3	5.05	2	1.34	2	2.88	6
	3.17		4.77		4.68		2.58		4.11		2.54		4.37		4.55		1.22		3.17	
C.D.(0.05)									0.32										0.06	
C.V. %									9.58										2.16	

Table 4.1(q): Summary of data on grain yield of selected NIL-HT cultures grown under different weed control management. *Kharif* 2025

Location	Naira										Chinsurah									
	Grain Yield (t/ha)										Grain Yield (t/ha)									
	Mainplot										Mainplot									
Subplot	T1: Imazethapyr	Rank	T2: Bispyribac sodium (National Check)	Rank	T3: Weed free check (	Rank	T4: Weedy check	Rank	Experiment Mean	Rank	T1: Imazethapyr	Rank	T2: Bispyribac sodium (National Check)	Rank	T3: Weed free check)	Rank	T4: Weedy check	Rank	Experiment Mean	Rank
G1	0.88	2	1.11	2	1.69	1	0.75	1	1.11	1	5.28	1	5.19	1	5.42	1	3.48	1	4.84	1
G2	0.55	5	1.05	3	1.32	3	0.63	2	0.89	2	4.67	6	4.59	9	4.89	9	3.04	7	4.30	6
G3	0.85	3	0.51	8	1.69	1	0.23	7	0.82	3	4.99	5	4.94	7	5.20	2	3.05	6	4.54	3
G4	0.85	4	0.88	5	0.65	6	0.27	6	0.66	5	5.05	3	4.96	6	4.97	8	2.86	9	4.46	5
G5	0.89	1	0.97	4	0.09	9	0.13	8	0.52	7	5.02	4	4.91	8	5.07	7	3.01	8	4.50	4
G6	0.17	7	0.27	10	0.45	7	0.30	4	0.30	9	5.08	2	4.97	5	5.17	3	3.13	5	4.59	2
G7	0.12	9	1.65	1	0.91	5	0.38	3	0.77	4	0.00	8	5.13	2	5.16	4	3.24	3	3.38	8
G8	0.13	8	0.59	7	1.15	4	0.28	5	0.54	6	0.00	8	5.04	4	5.16	5	3.29	2	3.37	9
G9	0.00		0.29	9	0.00	10	0.09	10	0.10	10	0.00	8	5.04	3	5.12	6	3.19	4	3.34	10
G10	0.32	6	0.73	6	0.41	8	0.11	9	0.39	8	4.28	7	4.15	10	4.35	10	2.49	10	3.82	7
	0.48		0.81		0.84		0.32		0.61		3.44		4.89		5.05		3.08		4.11	
C.D.(0.05)									0.53										0.16	
C. V. %									106.02										4.88	

Table 4.1(q): Summary of data on grain yield of selected NIL-HT cultures grown under different weed control management. **Kharif** 2025

Location	Nagina											
Sub otlot	Grain Yield (t/ha)											
	Mainplot											
	T1: Imazethapyr	Rank	T2: Bispyribacsodium (National Check)	Rank	T3: Weed free check	Rank	T4: Weedy check	Rank	Experiment Mean	Rank	Overall Mean	Rank
G1	4.31	4	4.32	4	4.38	4	1.53	5	3.63	4	3.43	1
G2	4.20	7	4.23	8	4.32	7	1.49	7	3.56	7	3.25	3
G3	4.41	2	4.49	2	4.49	2	1.59	2	3.74	2	3.26	2
G4	4.30	5	4.32	5	4.34	6	1.53	4	3.62	5	3.07	5
G5	4.48	1	4.51	1	4.62	1	1.62	1	3.81	1	3.06	6
G6	4.34	3	4.35	3	4.39	3	1.58	3	3.66	3	3.09	4
G7	4.21	6	4.30	6	4.34	5	1.50	6	3.59	6	2.89	9
G8	4.19	8	4.26	7	4.31	8	1.47	8	3.56	8	2.94	8
G9	0.00	10	4.19	10	4.29	10	1.33	10	2.45	10	2.83	10
G10	4.08	9	4.21	9	4.31	8	1.41	9	3.50	9	2.95	7
C.D.(0.05)	3.85		4.32		4.38		1.50		3.51		3.08	
C. V. %									2.47			
									3.51			

4.1(r) AET – AVT 2 BT

Two BT cultures (IET 31299 and IET 32297) were evaluated for its response to nutrient application in terms of grain yield and yield attributes at five locations i.e., **Kaul (90-30-0)**, **Ludhiana (40-30-30)**, **IARI (120-60-40)**, **Nagina (120-60-40)** and **Pantnagar (120-60-40)** under two different nutrient levels (50% and 100% RDF). The details and data received from these locations are summarized and presented in Table 4.1(r).

Application of different RDF doses (50% and 100% RDF) significantly influenced the grain yield at all three locations (**Kaul, Ludhiana, IARI, Nagina** and **Pantnagar**) and the maximum increase in grain yield was observed at most of the locations and higher nutrient response (7.61 to 27.19 kg grain/kg nutrient). Application of 100% RDF recorded significantly higher grain yields at **Kaul** (5.42 t/ha), **Ludhiana** (4.15 t/ha), **IARI** (5.92 t/ha), **Nagina** (4.48 t/ha) and **Pantnagar** (4.50 t/ha). Higher nutrient response was recorded with 100% RDF at **Kaul** (27.19 kg grain /kg nutrient) followed by **Nagina** (17.94 kg grain /kg nutrient).

Grain yield differences among the tested cultures were significant at all locations. Significantly higher maximum grain yield was recorded by IET 31299 (3.79 t/ha) and IET 32297 (3.71 t/ha) at **Nagina** and IET 32297 (4.26 t/ha) at **Pantnagar** over local checks. Among the entries tested at all locations, mean grain yield of IET culture 31299 (4.14 t/ha) was the highest.

Table 4.1(r): Summary of data on grain yield and ancillary characters of selected AET BT cultures grown under transplanted conditions at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	KAUL						LUDHIANA						IARI		
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.13	8	317	1.65	25.9		3.20	13	251	1.92	27.4	106		4.83	
	V2	3.35	13	303	1.59	24.5		4.12	7	273	1.54	27.7	94		5.17	
	V3	3.27	14	305	1.57	26.1		3.30	12	244	2.35	24.3	96		5.31	
	V4	3.71	12	315	1.58	26.3		2.94	14	277	1.31	28.3	95		5.19	
	V5	4.04	10	335	1.79	26.2		4.36	3	271	2.10	24.6	109		4.33	
	V6	4.06	9	347	1.80	25.2		3.31	11	279	2.01	26.6	105		4.46	
	V7	3.94	11	322	1.65	25.9		3.75	8	294	2.03	27.8	104		5.95	
F2	V1	5.78	3	357	1.85	26.9	27.50	4.53	2	330	1.95	27.3	105	26.60	5.69	7.82
	V2	4.84	7	340	1.71	26.1	24.83	4.30	5	356	1.65	27.6	93	3.60	6.48	11.91
	V3	4.87	6	345	1.76	25.6	26.67	3.50	10	384	2.51	24.4	96	4.00	6.13	7.45
	V4	5.19	4	341	1.74	26.4	24.67	3.70	9	378	1.50	28.4	94	15.20	5.67	4.36
	V5	6.01	2	368	1.88	26.0	32.83	4.32	4	352	2.19	24.5	106	-0.80	4.89	5.09
	V6	6.23	1	362	1.95	26.8	36.17	4.15	6	345	2.07	26.6	104	16.80	5.33	7.91
	V7	5.00	5	350	1.81	25.2	17.67	4.55	1	359	2.23	27.8	105	16.00	7.24	11.73
Interaction																
F at same V		0.38		NS	NS	NS		NS		NS	NS	NS	NS		NS	
V at same F		0.4		NS	NS	NS		NS		NS	NS	NS	NS		NS	
F1		3.79	2	321	1.66	25.74		3.57	2	270	1.89	26.67	101		5.04	
	F2	5.42	1	352	1.81	26.14	27.19	4.15	1	358	2.01	26.65	100	11.63	5.92	8.00
C.D.(0.05)		0.09		16	0.05	NS		0.34		17	NS	NS	NS		0.55	
C.V.(%)		1.47		4	2.18	2.4		6.72		4	7.88	0.8	1		2.10	

Table 4.1(r): Contd.

F-levels	Varieties	KAUL					LUDHIANA					IARI				
		Grain Yield (t/ha)	Rank	Panicle/ m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/ m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering g	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:	V1	4.96	3	337	1.75	26.39	27.50	3.87	4	290	1.94	27.38	105	26.60	5.26	7.82
	V2	4.10	6	322	1.65	25.32	24.83	4.21	2	315	1.60	27.64	94	3.60	5.83	11.91
	V3	4.07	7	325	1.67	25.87	26.67	3.40	6	314	2.43	24.35	96	4.00	5.72	7.45
	V4	4.45	5	328	1.66	26.34	24.67	3.32	7	328	1.41	28.35	94	15.20	5.43	4.36
	V5	5.03	2	352	1.84	26.12	32.83	4.34	1	311	2.15	24.56	108	-0.80	4.61	5.09
	V6	5.15	1	355	1.88	26.00	36.17	3.73	5	312	2.04	26.59	104	16.80	4.89	7.91
	V7	4.47	4	336	1.73	25.57	17.67	4.15	3	326	2.13	27.77	105	16.00	6.59	11.73
C.D.(0.05)		0.28		24	0.15	NS		0.48		28	0.12	0.6	2		0.28	
C.V. (%)		5.14		6	7.26	4.1		10.42		7	5.3	2.0	1		3.30	
Expt. Mean		4.60		336	1.74	25.94		3.86		314	1.95	26.66	101		5.48	
Soil type		Clay loam						Sandy loam							Sandy clam loam	
pH		8.00						7.80							7.90	
F - levels (kg/ha)		45:15:0						20:15:15							60:30:40	
F1		0						40:30:30							120:60:40	
F2		0						40:30:30							120:60:40	
Recommended N:P:K (kg/ha)		0						Local Check - PB 1121							Local Check - Punjab Basmati 7	
V7		160:16:360						270:16:133							165:12.6:182	
Available N:P:K of soil (kg/ha)																

Table 4.1(r): Contd.

F- levels	Varieties	NAGINA						PANTNAGAR						Over all mean	Rank		
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)			Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	2.79	8	255	2.77	23.5	103		3.54	11	211	1.94	21.28	96		3.70	11
	V2	2.66	9	251	2.76	23.5	87		4.02	9	226	2.03	22.68	74		3.86	9
	V3	2.45	12	224	2.74	22.1	98		4.59	3	244	2.06	23.15	78		3.78	10
	V4	2.43	13	230	2.72	22.3	92		3.52	12	213	1.85	20.66	72		3.56	12
	V5	2.21	14	223	2.67	22.2	113		2.66	14	187	1.67	21.22	97		3.52	14
	V6	2.48	11	242	2.77	23.2	88		3.31	13	196	2.03	20.15	99		3.52	13
	V7	2.55	10	237	2.77	22.9	104		3.99	10	220	2.08	20.87	96		4.04	8
F2	V1	4.78	1	363	2.86	23.5	104	18.09	4.33	7	227	2.23	20.14	95	7.18	5.02	2
	V2	4.76	2	374	2.84	23.5	88	19.09	4.49	4	228	2.15	22.27	72	4.27	4.97	3
	V3	4.50	5	335	2.84	23.3	99	18.64	5	1	243	2.29	22.35	75	3.73	4.80	5
	V4	4.32	6	328	2.84	22.2	93	17.18	4.75	2	230	2.32	22.38	72	11.18	4.73	6
	V5	3.93	7	316	2.75	22.2	113	15.64	4.13	8	212	2.2	23.2	97	13.36	4.66	7
	V6	4.53	4	363	2.85	23.2	87	18.64	4.43	5	227	2.22	20.12	99	10.18	4.93	4
	V7	4.56	3	372	2.84	22.9	104	18.27	4.36	6	220	2.21	20.87	96	3.36	5.14	1
Interaction F at same V V at same F		NS		17	NS	0.0	NS		0.5		10	0.12	0.36	NS			
		NS		18	NS	0.0	NS		4.08		220	2.09	21.52	87			
F1 F2		2.51	2	237	2.74	22.79	98		3.66	2	214	1.95	21.43	88		3.71	2
		4.48	1	350	2.83	22.98	98	17.94	4.50	1	227	2.23	21.62	87	7.61	4.89	1
C.D.(0.05) C.V.(%)		0.24		12	0.01	0.03	NS		0.42		8	0.11	NS	NS			
		5.16		3	0.34	0.1	1		7.66		3	3.99	0.69	1			

Table 4.1(r): Contd.

F-levels	Varieties	NAGINA						PANTNAGAR						Over all mean	Rank		
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)			Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties: V1 IET 31299 V2 IET 32297 V3 PB1121 V4 PB1 V5 Taroori Basmati V6 Pusa Basmati 1509 V15 Local Check C.D.(0.05) C.V. (%) Expt. Mean Soil type pH F - levels (kg/ha) F1 F2 Recommended N:P:K (kg/ha) V15 Available N:P:K of soil (kg/ha)		3.79	1	309	2.82	23.49	104	18.09	3.94	5	219	2.09	20.71	96	7.18	3	
		3.71	2	312	2.80	23.48	88	19.09	4.26	2	227	2.09	22.48	73	4.27	2	
		3.48	5	280	2.79	22.74	99	18.64	4.80	1	244	2.18	22.75	77	3.73	4	
		3.38	6	279	2.78	22.26	92	17.18	4.14	4	222	2.09	21.52	72	11.18	6	
		3.07	7	270	2.71	22.17	113	15.64	3.40	7	199	1.94	22.21	97	13.36	7	
		3.51	4	303	2.81	23.20	88	18.64	3.87	6	212	2.13	20.14	99	10.18	5	
		3.56	3	305	2.81	22.88	104	18.27	4.18	3	220	2.15	20.87	96	3.36	1	
		0.18		12	0.02	0.0	1		0.29		5	0.06	0.25	3			
		4.34		3	0.54	0.1	1		6		2	2.52	0.97	3			
		3.50		294	2.79	22.89	98		4.08		220	2.09	21.52	87		4.30	
		-							Silt								
		7.70							loan								
									7.40								
			60:30:20						60:30:20								
			120:60:40						120:60:40								
		120:60:40						120:60:40									
		Local Check						Local Check									
		21:18.33:209						231:22:221									

4.1(s) AET – AVT 2 EDS

One cultures (IET 32100) was evaluated for its response to nutrient application in terms of grain yield and yield attributes at five locations i.e., **Coimbatore** (150-50-50), **Jagdarpur** (100-50-30), **Raipur** (120-60-60), **Ranchi** (80-40-30) and **Rewa** (100-60-40) under two different nutrient levels (50% and 100% RDF). The details and data received from these locations are summarized and presented in Table 4.1(s).

Application of different RDF doses (50% and 100% RDF) significantly influenced the grain yield at all the locations except **Jagdarpur and Ranchi**. The maximum increase in grain yield was observed at most of the locations and higher nutrient response (3.41 to 12.0 kg grain/kg nutrient). Application of 100% RDF recorded significantly higher grain yields at Coimbatore (4.87 t/ha), Raipur (4.84 t/ha) and Rewa (4.56 t/ha). Higher nutrient response was recorded with 100% RDF at **Coimbatore** (12.0 kg grain /kg nutrient).

Grain yield differences among the tested cultures were significant at all locations. Significantly higher maximum grain yield was recorded by IET 32100 at Coimbatore (4.25 t/ha), Jagdarpur (5.72 t/ha), Ranchi (4.11 t/ha) and Rewa (5.51 t/ha) over local checks.

4.1(t) AVT-2 E(Rabi)

Two AVT-2 entries (IET 31368 and IET 32072) were evaluated against CO-51, Narendra 97€, MTU 1153(S) and local check BPT 5204 for their response to two fertilizer levels on grain yield at 5 locations viz., **Coimbatore (100-50-50)**, **Dhangain (100-50-30)**, **Gangavathi (150-75-75)**, **Mandya (125-62-62)** and **Warangal (100-60-40)**. The data received from these locations are summarized and presented in Table 4.1(t).

Interaction effects of RDF doses and varieties was found to be non-significant at all the locations except **Coimbatore** where, 100% RDF realised higher grain yield with test cultures.

Different doses of RDF exhibited significant differences on grain yield at all the locations. Application of 100% RDF recorded higher yield at **Coimbatore** (5.59 t/ha), **Dhangain** (7.58 t/ha), **Gangavathi** (6.83 t/ha), **Mandya** (5.39 t/ha) and **Warangal** (6.09 t/ha). Nutrient response (kg grain / kg N) was higher at 100 % RDF over 50% RDF at **Coimbatore** (8.40), **Dhangain** (11.89) and **Warangal** (7.22).

Grain yield of cultures differed significantly at all locations. Among the entries tested, IET 32072 (5.51 t/ha), IET 31368 (5.29 t/ha) recorded higher yield at **Coimbatore**. In other locations the new 2 entries did not perform better than check.

Table 4.1(s): Summary of data on grain yield and ancillary characters of selected AET Early (Direct Seeded) cultures grown under transplanted conditions at low and optimum recommended fertilizer doses, kharif 2025.

F-levels	Varieties	COIMBATORE						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.47	4	244	2.31	20.94	85	
	V2	3.28	6	236	2.04	21.95	80	
	V3	3.36	5	241	2.11	21.64	86	
F2: Medium input (100% NPK)	V1	5.03	1	327	3.15	21.56	85	12.48
	V2	4.76	3	288	2.86	23.06	81	11.84
	V3	4.82	2	303	2.98	22.53	86	11.68
Interaction								
F at same V		NS		1.72	NS	NS	NS	
V at same F		NS		3.56	NS	NS	NS	
Mean of F level								
F1		3.37	2	240	2.15	21.51	84	
F2		4.87	1	306	3.00	22.38	84	12.00
C.D.(0.05)		0.11		4.38	0.41	NS	NS	
C.V.(%)		1.31		0.79	7.91	2.1	2.4	
Mean of varieties:								
V1		4.25	1	286	2.73	21.25	85	12.48
V2		4.02	3	262	2.45	22.51	81	11.84
V3		4.09	2	272	2.55	22.09	86	11.68
C.D.(0.05)		0.14		1.22	0.15	0.92	1.52	
C.V. (%)		2.49		0.33	4.26	3.16	1.36	
Expt. Mean		4.12		273	2.58	21.95	84	
Soil type		Clay loam						
pH		8.10						
F - levels (kg/ha)								
F1		75:25:25						
F2		150:50:50						
Recommended N:P:K (kg/ha)		150:50:50						
Varieties								
V1		IET 32100						
V2		Sahabgaidhan (NC)						
V3		Local check - CO 56, 130 days						
Available N:P:K of soil (kg/ha)		209:21:431						

Table 4.1(s): Contd.

F-levels	Varieties	JAGDALPUR					
		Grain Yield (t/ha)	Rank	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	5.62	2	15.00	20.67	91	
	V2	3.92	6	9.67	28.33	75	
	V3	4.69	4	10.33	27.00	100	
F2: Medium input (100% NPK)	V1	5.81	1	15.33	20.33	92	2.11
	V2	4.17	5	10.33	28.00	77	2.78
	V3	5.17	3	11.00	27.67	102	5.33
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
Mean of F level							
F1		4.74	2	11.67	25.33	89	
F2		5.05	1	12.22	25.33	90	3.41
C.D.(0.05)		NS		NS	NS	NS	
C.V.(%)		5.27		8.6	5.81	2.6	
Mean of varieties:							
V1		5.72	1	15.17	20.50	91	2.11
V2		4.05	3	10.00	28.17	76	2.78
V3		4.93	2	10.67	27.34	101	5.33
C.D.(0.05)		0.46		1.47	0.94	0.91	
C.V. (%)		7.13		9.26	2.79	0.77	
Expt. Mean		4.90		11.94	25.33	89	
Soil type		Alfisols					
pH		6.05					
F - levels (kg/ha)							
F1		50:25:15					
F2		100:50:30					
Recommended N:P:K (kg/ha)		100:50:30					
Varieties							
V1		IET 32100					
V2		Sahabhagidhan (NC)					
V3		Local check - CG DHAN 1919					
Available N:P:K of soil (kg/ha)		235:12.20:350.25					

Table 4.1(s): Contd.

F-levels	Varieties	RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.82	5	201	2.62	25.30	80	
	V2	3.18	6	173	2.17	24.10	81	
	V3	4.41	3	231	3.13	22.70	80	
F2: Medium input (100% NPK)	V1	4.78	2	279	3.46	26.10	81	8.00
	V2	4.11	4	233	3.02	25.40	80	7.75
	V3	5.62	1	324	3.86	23.50	80	10.08
Interaction								
F at same V		NS		NS	NS	NS	1.34	
V at same F		NS		NS	NS	NS	0.63	
Mean of F level								
F1		3.80	2	202	2.64	24.03	80	
F2		4.84	1	279	3.45	25.00	80	8.61
C.D.(0.05)		0.93		61.36	0.64	NS	NS	
C.V.(%)		10.58		12.6	10.29	3.76	1.01	
Mean of varieties:								
V1		4.30	2	240	3.04	25.70	81	8.00
V2		3.65	3	203	2.60	24.75	80	7.75
V3		5.02	1	278	3.50	23.10	80	10.08
C.D.(0.05)		0.6		33.46	0.42	0.78	0.44	
C.V. (%)		10.44		10.46	10.25	2.39	0.41	
Expt. Mean		4.32		240	3.04	24.52	80	
Soil type		Vertisol						
pH		6.90						
F - levels (kg/ha)								
F1		60:30:30						
F2		120:60:60						
Recommended N:P:K (kg/ha)		120:60:60						
Varieties								
V1		IET 32100						
V2		Sahabhagidhan (NC)						
V3		Local check - CG Barani Dhan-2, 122 days						
Available N:P:K of soil (kg/ha)		203.1:22.8:421.5						

Table 4.1(s): Contd.

F-levels	Varieties	RANCHI						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	No. of grains / panicle	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.82	3	228.33	90.9	24.58	87.33	
	V2	3.42	4	205	84.07	23.49	84.33	
	V3	2.93	6	177.33	69.27	23.28	60.67	
F2: Medium input (100% NPK)	V1	4.4	1	262.33	95.27	24.98	90.33	7.73
	V2	3.85	2	240.67	88	23.95	87	5.73
	V3	3.35	5	190.33	79.37	24.05	63.67	5.60
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Mean of F level								
F1		3.39	2	204	81	23.78	77	
F2		3.87	1	231	88	24.33	80	6.36
C.D.(0.05)		NS		NS	NS	0.45	0.48	
C.V.(%)		8.53		6.43	5.65	0.91	0.3	
Mean of varieties:								
V1		4.11	1	245	93	24.78	89	7.73
V2		3.64	2	223	86	23.72	86	5.73
V3		3.14	3	184	74	23.67	62	5.60
C.D.(0.05)		0.33		18.96	4.79	0.53	0.74	
C.V. (%)		6.73		6.55	4.26	1.65	0.7	
Expt. Mean		3.63		217	84	24.06	79	
Soil type		Clay loam						
pH		5.60						
F - levels (kg/ha)								
F1		40:20:15						
F2		80:40:30						
Recommended N:P:K (kg/ha)		80:40:30						
Varieties								
V1		IET 32100						
V2		Sahabgadhyan (NC)						
V3		Local check - BVD 111						
Available N:P:K of soil (kg/ha)		210:34:157						

Table 4.1(s): Contd.

F-levels	Varieties	REWA						Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	5.11	2	477	13.47	25.80		4.37	3
	V2	3.77	5	442	12.87	21.80		3.51	6
	V3	3.46	6	478	13.37	21.83		3.77	5
F2: Medium input (100% NPK)	V1	5.90	1	481	15.37	24.97	10.53	5.18	1
	V2	4.00	3	416	14.17	24.60	3.07	4.18	4
	V3	3.79	4	477	15.20	24.53	4.40	4.55	2
Interaction									
F at same V		NS		NS	NS	1.7			
V at same F		NS		NS	NS	2.02			
Mean of F level									
F1		4.11	2	466	13.24	23.14		3.88	2
F2		4.56	1	458	14.91	24.70	6.00	4.64	1
C.D.(0.05)		0.32		NS	1.54	0.53			
C.V.(%)		3.67		3.3	5.38	1.08			
Mean of varieties:									
V1		5.51	1	479	14.42	25.39	10.53	4.78	1
V2		3.89	2	429	13.52	23.20	3.07	3.85	3
V3		3.63	3	478	14.29	23.18	4.40	4.16	2
C.D.(0.05)		0.51		45.75	NS	1.43			
C.V. (%)		8.8		7.44	10.84	4.49			
Expt. Mean		4.34		462	14.08	23.92		4.26	
Soil type		-							
pH		-							
F - levels (kg/ha)									
F1		50:30:20							
F2		100:60:40							
Recommended N:P:K (kg/ha)		100:60:40							
Varieties									
V1		IET 32100							
V6		Sahabgadhyan (NC)							
V7		Local check - MTU1010, 115 -125 days							
Available N:P:K of soil (kg/ha)		-							

Table 4.1(t): Summary of data on grain yield and ancillary characters of selected AET Early (Rabi) cultures grown under transplanted conditions at low and optimum recommended fertilizer doses, rabi 2024-25.

F-levels	Varieties	COIMBATORE						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.78	8	272	3.68	22.92	83	
	V2	4.89	6	281	3.83	23.41	84	
	V3	4.70	9	267	3.62	24.93	82	
	V4	4.22	11	222	3.57	24.57	79	
	V5	4.65	10	261	3.92	21.64	81	
	V6	4.01	12	213	3.15	16.91	79	
F2: Medium input (100% NPK)	V1	5.80	3	337	3.89	23.11	84	8.16
	V2	6.12	1	345	4.05	23.54	85	9.84
	V3	5.75	4	333	3.91	25.12	82	8.40
	V4	5.20	5	285	3.85	24.72	81	7.84
	V5	5.81	2	327	4.11	21.82	82	9.28
	V6	4.87	7	277	3.31	17.04	80	6.88
Interaction								
F at same V		0.2		NS	NS	NS	NS	
V at same F		0.16		NS	NS	NS	NS	
Mean of F level								
F1		4.54	2	253	3.63	22.40	81	
F2		5.59	1	317	3.85	22.56	82	8.40
C.D.(0.05)		0.18		8.17	0.04	NS	0.41	
C.V.(%)		2.43		2	0.69	1.48	0.35	
Mean of varieties:								
V1		5.29	2	305	3.79	23.02	84	8.16
V2		5.51	1	313	3.94	23.48	84	9.84
V3		5.23	4	300	3.77	25.03	82	8.40
V4		4.71	5	254	3.71	24.65	80	7.84
V5		5.23	3	294	4.02	21.73	82	9.28
V6		4.44	6	245	3.23	16.98	80	6.88
C.D.(0.05)		0.11		4.72	0.11	0.41	0.95	
C.V. (%)		1.87		1.38	2.38	1.5	0.96	
Expt. Mean		5.07		285	3.74	22.48	82	
Soil type		Clay loam						
pH		8.10						
F - levels (kg/ha)								
F1		75:25:25						
F2		150:50:50						
Recommended N:P:K (kg/ha)		150:50:50						
Varieties								
V1		IET 31368						
V2		IET 32072						
V3		CO-51 (NC)						
V4		Narendra 97(E)						
V5		MTU 1153 (S)						
V6		Local check - BPT 5204						
Available N:P:K of soil (kg/ha)		209:21:431						

Table 4.1(t): Contd.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	6.65	7	232	6.81	17.43	123	
	V2							
	V3	6.39	9	203	6.46	19.67	135	
	V4	6.16	10	245	6.19	15.57	132	
	V5	6.43	8	184	5.84	20.93	132	
	V6	6.90	6	266	6.00	17.37	118	
F2: Medium input (100% NPK)	V1	7.48	4	286	7.82	16.17	126	9.22
	V2							
	V3	7.61	3	271	7.01	18.57	131	13.56
	V4	7.79	1	267	8.66	15.07	131	18.11
	V5	7.25	5	261	6.95	21.77	132	9.11
	V6	7.75	2	255	5.97	15.97	124	9.44
Interaction								
F at same V		NS		NS	0.44	NS	3.2	
V at same F		NS		NS	0.33	NS	2.43	
Mean of F level								
F1		6.51	2	226	6.26	18.19	128	
F2		7.58	1	268	7.28	17.51	129	11.89
C.D.(0.05)		0.64		NS	0.41	NS	NS	
C.V.(%)		5.83		11.85	3.89	10.12	1.49	
Mean of varieties:								
V1		7.07	2	259	7.32	16.80	125	9.22
V2								
V3		7.00	3	237	6.74	19.12	133	13.56
V4		6.98	4	256	7.43	15.32	131	18.11
V5		6.84	5	222	6.40	21.35	132	9.11
V6		7.33	1	261	5.99	16.67	121	9.44
C.D.(0.05)		NS		42.29	0.23	1.81	1.72	
C.V. (%)		7.38		13.99	2.79	8.3	1.1	
Expt. Mean		7.04		247	6.77	17.85	128	
Soil type		Clay loam						
pH		6.58						
F - levels (kg/ha)								
F1		50:25:15						
F2		100:50:30						
Recommended N:P:K (kg/ha)		100:50:30						
Varieties								
V1		IET 31368						
V2		-						
V3		CO-51 (NC)						
V4		Narendra 97(E)						
V5		MTU 1153 (S)						
V6		Local check - Sabour Kunwar						
Available N:P:K of soil (kg/ha)		329.6:44.1:240.3						

Table 4.1(t): Contd.

F-levels	Varieties	GANGAVATHI				
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	6.60	4	207	16.67	
	V2	6.28	8	187	13.33	
	V3	6.02	9	205	17.00	
	V4					
	V5	7.43	2	183	23.67	
	V6	5.68	10	203	18.67	
F2: Medium input (100% NPK)	V1	7.21	3	261	19.00	4.07
	V2	6.35	7	235	13.67	0.47
	V3	6.38	5	243	18.00	2.40
	V4					
	V5	7.82	1	233	24.00	2.60
	V6	6.38	5	233	22.67	4.67
Interaction						
F at same V		NS		NS	NS	
V at same F		NS		NS	NS	
Mean of F level						
F1		6.40	2	197	17.87	
F2		6.83	1	241	19.47	2.84
C.D.(0.05)		NS		NS	NS	
C.V.(%)		13.06		15.04	7.38	
Mean of varieties:						
V1		6.91	2	234	17.84	4.07
V2		6.32	3	211	13.50	0.47
V3		6.20	4	224	17.50	2.40
V4						
V5		7.63	1	208	23.84	2.60
V6		6.03	5	218	20.67	4.67
C.D.(0.05)		0.9		25.49	4.83	
C.V. (%)		11.12		9.51	21.15	
Expt. Mean		6.62		219	18.67	
Soil type		Black soil				
pH		-				
F - levels (kg/ha)						
F1		75:37.5:37.5				
F2		150:75:75				
Recommended N:P:K (kg/ha)		150:75:75				
Varieties						
V1		IET 31368				
V2		IET 32072				
V3		CO-51 (NC)				
V4		-				
V5		MTU 1153 (S)				
V6		Local check - Sabour Kunwar				
Available N:P:K of soil (kg/ha)		203.1:22.8:421.5				

Table 4.1(t): Contd.

F-levels	Varieties	MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	No. of grains / panicle	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	5.49	5	325	3.74	18.06	98	
	V2	4.29	9	308	4.45	13.10	100	
	V3	5.77	3	329	4.44	21.23	98	
	V4							
	V5	4.10	10	347	2.73	13.45	117	
	V6	5.05	6	283	4.35	21.96	92	
F2: Medium input (100% NPK)	V1	6.20	2	370	3.88	18.12	99	5.70
	V2	4.50	7	310	4.67	13.36	100	1.69
	V3	6.24	1	350	4.64	21.47	98	3.78
	V4							
	V5	4.50	7	359	3.13	13.75	117	3.21
	V6	5.51	4	335	4.42	22.45	93	3.69
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
Mean of F level								
F1		4.94	2	318	3.94	17.56	101	
F2		5.39	1	345	4.15	17.83	101	3.61
C.D.(0.05)		NS		NS	NS	NS	NS	
C.V.(%)		11.2		12.66	11.3	6.18	0.48	
Mean of varieties:								
V1		5.85	2	348	3.81	18.09	99	5.70
V2		4.40	4	309	4.56	13.23	100	1.69
V3		6.01	1	340	4.54	21.35	98	3.78
V4								
V5		4.30	5	353	2.93	13.60	117	3.21
V6		5.28	3	309	4.39	22.21	92	3.69
C.D.(0.05)		0.62		33.65	0.43	0.88	0.86	
C.V. (%)		9.81		8.29	8.65	4.05	0.69	
Expt. Mean		5.17		332	4.05	17.70	101	
Soil type		Clay loam						
pH		5.60						
F - levels (kg/ha)								
F1		62.5:31:31						
F2		125:62:62						
Recommended N:P:K (kg/ha)		125:62:62						
Varieties								
V1		IET 31368						
V2		IET 32072						
V3		CO-51 (NC)						
V4		-						
V5		MTU 1153 (S)						
V6		Local check - KMP 175, 125-130 days						
Available N:P:K of soil (kg/ha)		210:34:157						

Table 4.1(t): Contd.

F-levels	Varieties	WARANGAL							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	5.47	6	332	3.70	11.50	98		5.80	6
	V2	5.23	8	412	3.30	14.43	104		5.17	12
	V3	5.07	9	286	2.23	13.60	101		5.59	9
	V4								5.19	11
	V5	4.73	10	328	4.47	15.80	124		5.47	10
	V6	6.33	2	296	4.87	20.40	93		5.59	8
F2: Medium input (100% NPK)	V1	6.27	3	352	4.70	12.33	97	8.00	6.59	1
	V2	5.90	5	462	3.50	15.80	105	6.70	5.72	7
	V3	6.00	4	363	4.67	19.03	99	9.30	6.40	3
	V4								6.50	2
	V5	5.27	7	320	2.40	14.27	122	5.40	6.13	5
	V6	7.00	1	326	5.27	20.90	92	6.70	6.30	4
Interaction										
F at same V		NS		NS	0.52	1.63	NS			
V at same F		NS		NS	0.53	1.46	NS			
Mean of F level										
F1		5.37	2	331	3.71	15.15	104		5.55	2
F2		6.09	1	365	4.11	16.47	103	7.22	6.29	1
C.D.(0.05)		NS		NS	0.27	1.24	NS			
C.V.(%)		13.56		10.98	4.45	5	0.98			
Mean of varieties:										
V1		5.87	2	342	4.20	11.92	98	8.00	6.20	1
V2		5.57	3	437	3.40	15.12	105	6.70	5.45	6
V3		5.54	4	325	3.45	16.32	100	9.30	5.99	2
V4									5.84	4
V5		5.00	5	324	3.44	15.04	123	5.40	5.80	5
V6		6.67	1	311	5.07	20.65	93	6.70	5.95	3
C.D.(0.05)		0.6		29.19	0.38	1.03	0.85			
C.V. (%)		8.55		6.86	7.88	5.32	0.67			
Expt. Mean		5.73		348	3.91	15.81	104		5.92	
Soil type		-								
pH		-								
F - levels (kg/ha)										
F1		50:30:20								
F2		100:60:40								
Recommended N:P:K (kg/ha)		100:60:40								
Varieties										
V1		IET 31368								
V2		IET 32072								
V3		CO-51 (NC)								
V4		-								
V5		MTU 1153 (S)								
V6		Local check - WGL 962, 135 days								
Available N:P:K of soil (kg/ha)		132:52:454								

4.1(u) AVT 2 - Rainfed Shallow Lowland

Six AVT-2cultures (IET 32175, IET 31246, IET 31220, IET 31237, IET 33264 and IET 33262) of rainfed shallow land were evaluated for its response to levels RDF on grain yield at **Chinsurah (80:40:40)**, **Dhangain (120:60:40)**, **Ghaghraghat (120:60:40)**, and **Titabar (60:20:40)** under two levels of RDF (50% and 100% RDF). The details and data received are summarized and presented in **Table 4.1(u)**.

RDF doses of nutrient application significantly influenced the grain yield at all the locations except **Ghagharaghat**. The maximum increase in grain yield was recorded with 100% RDF at **Chinsurah** (4.86 t/ha), **Dhangain** (5.33 t/ha) and **Titabar** (5.02 t/ha) with higher nutrient response ranging from 1.81 to 13.89 kg grain/kg nutrient over 50% RDF at different locations.

Grain yield differences among the tested cultures were significant at **Chinsurah, Dhangain, Ghagharaghat, Titabar**. At **Chisurah** (IET 31237(5.45 t/ha) followed by IET 31246 (5.32 t/ha) and IET 32175(5.13 t/ha)), **Dhangain** (IET 31220 (5.82 t/ha) followed by IET 31246 (5.80 t/ha)), **Ghaghraghat** (IET 33264 (3.95 t/ha) IET 32175 (3.74 t/ha) and **Titabar** (IET 31246 (5.57 t/ha), IET 31220 (5.29 t/ha), IET 32175 (4.90 t/ha) recorded significantly higher grain yield over check variety. Interaction effects between cultures and nutrient levels were non-significant at all locations except at **Dhangain**.

In this trial, 100% RDF was found to be promising and also exhibited higher nutrient recovery efficiency. Across locations, among the IET cultures, IET 31246 (4.86t/ha) followed by IET 31220 (4.51 t/ha) were found promising in terms of higher mean grain yield and nutrient response

Table 4.1(u): Summary of data on grain yield and ancillary characters of selected AET RSL cultures grown under transplanted conditions at graded levels of recommended fertilizer doses, kharif 2025.

F-levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input (50% NPK)	V1	4.93	7	296	3.31	126	
	V2	5.07	6	305	3.40	125	
	V3	4.59	11	276	3.07	124	
	V4	5.12	5	307	3.44	123	
	V5	3.64	17	218	2.43	124	
	V6	3.22	18	200	2.16	108	
	V7	4.17	14	250	2.80	123	
	V8	4.72	9	283	3.16	121	
	V9	4.43	13	266	2.97	120	
F2: Optimum input (100% NPK)	V1	5.33	3	321	3.57	128	5.00
	V2	5.57	2	334	3.73	127	6.25
	V3	4.64	10	278	3.10	125	0.62
	V4	5.77	1	346	3.86	125	8.12
	V5	4.10	15	246	2.75	125	5.75
	V6	3.67	16	220	2.46	109	5.63
	V7	4.52	12	272	3.03	124	4.38
	V8	5.33	3	320	3.57	122	7.63
	V9	4.83	8	289	3.23	122	5.00
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
F1		4.43	2	267	2.97	122	
F2		4.86	1	292	3.26	123	5.37
C.D.(0.05)		0.18		12	0.12	1	
C.V.(%)		3.40		4	3.26	1	
Mean of varieties:							
	V1	5.13	3	308	3.44	127	5.00
	V2	5.32	2	320	3.57	126	6.25
	V3	4.62	6	277	3.09	125	0.62
	V4	5.45	1	327	3.65	124	8.12
	V5	3.87	8	232	2.59	125	5.75
	V6	3.45	9	210	2.31	109	5.63
	V7	4.35	7	261	2.92	124	4.38
	V8	5.03	4	302	3.37	122	7.63
	V9	4.63	5	278	3.10	121	5.00
C.D.(0.05)		0.32		19	0.22	1	
C.V. (%)		5.93		6	5.96	1	
Expt. Mean		4.65		279	3.11	122	

Table 4.1(u): Contd.

F-levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Clay loam					
pH		7.20					
N - levels (kg/ha)							
F1		40:20:20					
F2		80:40:40					
Recommended NPK (kg/ha)		80:40:40					
Varieties							
V1		IET 32175					
V2		IET 31246					
V3		IET 31220					
V4		IET 31237					
V5		IET 33264					
V6		IET 33262					
V7		RC: Pooja					
V8		NC: Swarna Sub 1					
V9		Local check - Sujala (140-145 days)					
Available N:P:K of soil (kg/ha)		-					

Table 4.1(u): Contd.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input (50% NPK)	V1	3.99	14	282	3.81	18.9	131	
	V2	4.81	6	327	4.35	23.7	120	
	V3	4.75	7	326	4.15	24.8	120	
	V4	3.98	15	297	2.90	30.3	114	
	V5	3.37	17	279	3.16	18.9	133	
	V6	4.09	12	301	3.93	23.1	121	
	V7	3.70	16	291	3.83	21.0	128	
	V8	2.91	18	274	2.56	20.6	120	
	V9	4.23	11	303	4.40	22.6	126	
F2: Optimum input (100% NPK)	V1	4.59	9	277	3.43	20.6	132	5.45
	V2	6.78	2	333	5.07	23.4	122	17.91
	V3	6.88	1	325	4.94	25.7	122	19.36
	V4	5.02	5	284	3.77	31.9	115	9.45
	V5	4.56	10	272	3.30	19.9	135	10.82
	V6	5.24	4	305	3.82	24.5	123	10.45
	V7	4.65	8	283	3.56	21.9	130	8.64
	V8	4.03	13	270	3.05	21.5	122	10.18
	V9	6.21	3	305	4.45	23.0	127	18.00
Interaction								
F at same V		0.67		NS	NS	NS	NS	
V at same F		0.58		NS	NS	NS	NS	
F1		3.98	2	298	3.68	22.7	124	
F2		5.33	1	295	3.93	23.6	125	12.25
C.D.(0.05)		0.49		NS	NS	NS	1	
C.V.(%)		9.04		6	15.68	5.30	1	
Mean of varieties:								
V1		4.29	6	280	3.62	19.8	131	5.45
V2		5.80	2	330	4.71	23.5	121	17.91
V3		5.82	1	326	4.55	25.2	121	19.36
V4		4.50	5	290	3.34	31.1	115	9.45
V5		3.97	8	275	3.23	19.4	134	10.82
V6		4.67	4	303	3.88	23.8	122	10.45
V7		4.18	7	287	3.70	21.5	129	8.64
V8		3.47	9	272	2.81	21.1	121	10.18
V9		5.22	3	304	4.43	22.8	127	18.00
C.D.(0.05)		0.41		26	0.48	0.87	1	
C.V. (%)		7.49		8	10.80	3.20	0.4	
Expt. Mean		4.66		296	3.80	23.13	125	

Table 4.1(u): Contd.

F-levels	Varieties	DHANGAIN						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Clay loam						
pH		6.58						
N - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended NPK (kg/ha)		120:60:40						
Varieties								
V1		IET 32175						
V2		IET 31246						
V3		IET 31220						
V4		IET 31237						
V5		IET 33264						
V6		IET 33262						
V7		RC: Pooja						
V8		NC: Swarna Sub 1						
V9		Local check - Sabour Heera (150-155 days)						
Available N:P:K of soil (kg/ha)		330:44:240						

Table 4.1(u): Contd.

F-levels	Varieties	GHAGHRAGHAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1: Low input (50% NPK)	V1	3.57	6	158	3.80	22.6	118	
	V2	3.44	10	163	3.70	22.9	119	
	V3	2.89	18	157	3.53	21.4	115	
	V4	3.06	17	159	3.47	22.9	113	
	V5	3.86	3	170	3.80	22.7	117	
	V6	3.15	16	174	3.67	23.2	114	
	V7	3.40	11	150	3.47	22.2	120	
	V8	3.24	15	154	3.53	22.5	112	
	V9	3.62	5	165	3.73	23.3	116	
F2: Optimum input (100% NPK)	V1	3.90	2	169	3.77	22.9	122	3.00
	V2	3.49	8	166	3.73	23.1	119	0.45
	V3	3.29	14	147	3.53	23.6	123	3.64
	V4	3.37	12	153	3.50	23.3	122	2.82
	V5	4.03	1	173	3.73	22.8	119	1.55
	V6	3.51	7	179	3.80	23.2	119	3.27
	V7	3.45	9	152	3.47	22.9	118	0.45
	V8	3.30	13	157	3.63	22.7	119	0.55
	V9	3.68	4	168	3.80	22.4	115	0.55
Interaction								
<i>F at same V</i>		NS		NS	NS	NS	NS	
<i>V at same F</i>		NS		NS	NS	NS	NS	
F1		3.36	2	161	3.63	22.6	116	
F2		3.56	1	163	3.66	23.0	119	1.81
C.D.(0.05)		NS		NS	NS	NS	NS	
C.V.(%)		22.73		10	8.33	5.12	3	
Mean of varieties:								
	V1	3.74	2	164	3.79	22.8	120	3.00
	V2	3.47	4	164	3.72	23.0	119	0.45
	V3	3.09	9	152	3.53	22.5	119	3.64
	V4	3.22	8	156	3.49	23.1	118	2.82
	V5	3.95	1	172	3.77	22.8	118	1.55
	V6	3.33	6	177	3.74	23.2	116	3.27
	V7	3.43	5	151	3.47	22.6	119	0.45
	V8	3.27	7	156	3.58	22.6	116	0.55
	V9	3.65	3	166	3.77	22.9	116	0.55
C.D.(0.05)		0.36		26	NS	NS	NS	
C.V. (%)		8.83		14	10.37	5.52	3	
Expt. Mean		3.46		162	3.65	22.82	118	

Table 4.1(u): Contd.

F-levels	Varieties	GHAGHRAGHAT						
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Sand32.2;Silt:48.6 & Clay:16.2						
pH		7.40						
N - levels (kg/ha)								
F1		60:30:20						
F2		120:60:40						
Recommended NPK (kg/ha)		120:60:40						
Varieties								
V1		IET 32175						
V2		IET 31246						
V3		IET 31220						
V4		IET 31237						
V5		IET 33264						
V6		IET 33262						
V7		RC: Pooja						
V8		NC: Swarna Sub 1						
V9		Local check - BPT 5204						
Available N:P:K of soil (kg/ha)		200:24:234						

Table 4.1(u): Contd.

F-levels	Varieties	TITABAR							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
F1: Low input (50% NPK)	V1	4.63	9	258	3.93	23.3	132		4.28	9
	V2	5.07	7	274	4.13	25.2	126		4.60	7
	V3	4.77	8	246	4.07	24.0	141		4.25	10
	V4	3.63	16	258	3.40	21.7	132		3.95	15
	V5	3.10	18	245	3.13	23.9	124		3.49	18
	V6	3.67	15	255	3.07	22.8	123		3.53	17
	V7	3.40	17	253	4.20	30.7	124		3.67	16
	V8	5.27	4	274	3.07	20.3	126		4.04	14
	V9	4.13	13	277	4.13	23.4	105		4.10	13
F2: Optimum input (100% NPK)	V1	5.17	6	272	5.00	23.9	133	9.00	4.75	4
	V2	6.07	1	278	4.47	24.1	124	16.67	5.48	1
	V3	5.80	3	263	4.33	25.9	139	17.17	5.15	2
	V4	4.27	11	277	3.93	23.1	136	10.67	4.61	6
	V5	4.00	14	265	3.47	22.8	124	15.00	4.17	12
	V6	5.20	5	261	3.67	23.7	121	25.50	4.41	8
	V7	4.23	12	264	5.07	31.5	125	13.83	4.21	11
	V8	5.83	2	282	3.40	21.9	125	9.33	4.62	5
	V9	4.60	10	283	4.67	23.4	105	7.83	4.83	3
Interaction										
F at same V		NS		NS	NS	1.15	2			
V at same F		NS		NS	NS	1.13	2			
F1		4.19	2	260	3.68	23.9	126		3.99	2
F2		5.02	1	272	4.22	24.5	126	13.89	4.69	1
C.D.(0.05)		0.56		8	0.30	0.41	NS			
C.V.(%)		10.46		3	6.57	1.44	1			
Mean of varieties:										
	V1	4.90	4	265	4.47	23.6	133	9.00	4.39	5
	V2	5.57	1	276	4.30	24.6	125	16.67	4.86	1
	V3	5.29	3	254	4.20	24.9	140	17.17	4.51	2
	V4	3.95	7	267	3.67	22.4	134	10.67	4.39	4
	V5	3.55	9	255	3.30	23.3	124	15.00	3.93	7
	V6	4.44	5	258	3.37	23.3	122	25.50	3.81	9
	V7	3.82	8	259	4.64	31.1	125	13.83	3.98	6
	V8	5.55	2	278	3.24	21.1	125	9.33	3.92	8
	V9	4.37	6	280	4.40	23.4	105	7.83	4.50	3
C.D.(0.05)		0.79		16	0.60	0.82	1			
C.V. (%)		14.62		5	13.10	2.89	1			
Expt. Mean		4.60		266	3.95	24.19	126		4.25	

Table 4.1(u): Contd.

F-levels	Varieties	TITABAR							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
Soil type		Clay loam								
pH		5.40								
N - levels (kg/ha)										
F1		30:10:20								
F2		60:20:40								
Recommended NPK (kg/ha)		60:20:40								
Varieties										
V1		IET 32175								
V2		IET 31246								
V3		IET 31220								
V4		IET 31237								
V5		IET 33264								
V6		IET 33262								
V7		RC: Pooja								
V8		NC: Swarna Sub 1								
V9		LC: Numoli (130-135 Days)								
Available N:P:K of soil (kg/ha)		200:24:234								

4.1(v) Grain Yield Efficiency Index values (GYEI):

Grain yield is the best measure for evaluation of given genotype in the screening experiments for its efficiency. Further, field screening results can be interpreted using the grain yield efficiency index (GYEI) for identifying efficient, stable, suitable and promising cultures at various levels of nutrient application.

Grain yield efficiency Index (GYEI) was computed for genotype evaluation using the following formula in the present Nitrogen variety evaluation trial.

$$\text{GYEI} = \frac{(\text{Yield at low nutrient level}) \times (\text{Yield at high nutrient level})}{(\text{Experimental mean yield at low nutrient level}) \times (\text{Experimental mean yield at high nutrient level})}$$

Tolerant genotypes have a (GYEI) of 1 or higher and the susceptible ones have a GYEI in the range of 0 to 0.50 and the genotypes between these two limits (0.50 to 1.00) are considered intermediate types. The results of these trials, if utilized meticulously not only aid to develop promising cultivars but also to reduce the cost of cultivation in rice production.

GYEI based promising cultivars identified in different groups are furnished below:

Based on the Grain yield efficiency index GYEI values (stable and efficient genotypes), the identified cultures were viz., IET 31381 (1.08), IET 31386 (1.01), IET 31389 (1.07) in **AVT-2 EH**; IET 31413 (1.04) in **AVT-2 MH**; IET 31431 (1.19) in **AVT-2 Japonica**; IET 31436(H) (1.20), IET 31501(1.21) in **AVT-2 ETP**; IET 30692 (1.08), IET 30713 (1.03), IET 31448 (1.26), IET 31452 (1.14), IET 31456 (1.12), IET 31466 (1.06), IET 31589 (1.05) and IET 31603 (1.00) in **AVT-2 IME (TP)**; IET 29860 (1.09), IET 29877 (1.06), IET 31478(H) (1.03), IET 31479(H) (1.02), IET 31480(H) (1.20), IET 31481(H) (1.05), IET 31492(H) (1.08), IET 31637 (1.02), IET 31638 (1.09), IET 31639 (1.00), IET 31641 (1.02), IET 31643 (1.04) and IET 31659 (1.03) in **IM (TP)**; IET 30882 (1.25), IET 31686 (1.12), IET 31709 (1.12) and IET 31714 (1.11) in **AVT-2 Late**; IET 30045 (1.20), IET 30919 (1.08), IET 31740 (1.20), IET 31741 (1.08), IET 31757 (1.03) and IET 31765 (1.17) in **AVT-2 Aerobic**; IET 31494(H) (1.29) in **AVT-2 MS**; IET 31925 (1.16), IET 31927 (1.18), IET 31938 (1.12) and IET 31947 (1.15) in **AVT-2 Biofortified**; IET 31858 (1.01), IET 31861 (1.10) and IET 31862 (1.05) in **AVT-2 AL&ISTVT**; IET 31877 (1.26) and IET 31878 (1.18) in **AVT-2 CSTVT**; IET 31909 (1.23) in **AVT-2 AGT**; IET 32990 (1.15) in **AVT-2 NIL GEL**; 1805 (1.06), 1814 (1.04) and 1822 (1.01) in **AVT-2 BT**; IET 32100 (1.26) in **AVT-2 EDS**; IET 31368 (1.09) in **AVT-2 Early Rabi**; IET 32175 (1.09), IET 31246 (1.35) and IET 31220 (1.17) in **AVT-2 RSL**; IET 31966 (1.09), IET 31968 (1.06), IET 31975 (1.20), IET 31979 (1.15), IET 31980 (1.06) and IET 31985 (1.04) in **AVT-2 LPT**; IET 29577 (1.09), IET 30261 (1.01), IET 31990 (1.17), IET 31994 (1.07), IET 31998 (1.12), IET 32009 (1.11) and IET 32010 (1.00) in **AVT-2 LNT** were identified as higher nutrient use and efficient cultures during Kharif 2024. These cultures can be recommended for low input management.

Promissing IET cultures



Table. 4.1(v): Identification of cultures based on the GYEI values in different groups of cultivars.

AVT-2 EH (Irrigated)			AVT-2 MH 9(Irrigated)			AVT-2 Japonica			AVT-2 E-TP		
Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI
F2	IET 31381	1.08	F2	IET 31413	1.04	F2	IET 31431	1.19	F2	IET 30637	0.98
	IET 31386	1.10		Vivekdhan 62	1.20		Bhrigudhan	1.25		IET 31436(H)	1.20
	IET 31389	1.07		V L Dhan 68(N)	0.78		Varundhan	1.26		IET 31501	1.21
	Shalimar Rice 3	0.95		Local Check	1.49		Shalimar Rice 5	0.44		CO-51 (NC)	1.09
	Vivekdhan 86	0.18					Local Check	1.01		PR 124 (N)	0.75
	VL Dhan 86(N)	1.81								Narendra 97(E)	0.81
	Local Check	1.03								Luit (NE)	0.83
										Sahbhagidhan (C&W)	0.91
										MTU 1153 (S)	1.10
										US 314 (Hybrid)	0.97
	Mean	1.03		Mean	1.13		Mean	1.03		Local Check	1.00
										Mean	0.99

Table. 4.1(v): Cntd...

AVT-2-IME (TP)			AVT-2 IM (TP)			AVT-2 Late			AVT-2 Aerobic		
Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI
F2	IET 30692	1.08	F2	IET 29860	1.09	F2	IET 30882	1.25	F2	IET 30045	1.20
	IET 30713	1.03		IET 29877	1.06		IET 31686	1.12		IET 30919	1.08
	IET 31448	1.26		IET 31478(H)	1.03		IET 31709	1.12		IET 31740	1.20
	IET 31452	1.14		IET 31479(H)	1.02		IET 31714	1.11		IET 31741	1.08
	IET 31456	1.12		IET 31480(H)	1.20		Swarna	0.98		IET 31757	1.03
	IET 31466	1.06		IET 31481(H)	1.05		Pusa - 44	0.72		IET 31760	0.90
	IET 31589	1.05		IET 31492(H)	1.08		NDR 8002	0.86		IET 31765	1.17
	IET 31603	1.00		IET 31618	0.95		Ranjeet	0.90		IET 31775	0.99
	Gondhra Bidhan-3	1.10		IET 31633	0.96		Salivahana	0.79		CR Dhan 201(NC)	0.84
	PR 113	0.91		IET 31637	1.02		Pushyami	0.81		CR Dhan 202 (N, E, NE & C)	1.06
	Lalat	0.76		IET 31638	1.09		Local check	0.93		AAUDR-1 (W)	0.85
	Karjat - 7	0.71		IET 31639	1.00					MAS 946-1 (S)	0.68
	MTU 1010	0.81		IET 31640	0.72					DRR Dhan 54	0.91
	US 312	1.06		IET 31641	1.02					Local check	1.12
	Local check	0.89		IET 31643	1.04						
				IET 31659	1.03						
				NC- NDR 359	0.83						
				PR121 (N)	0.77						
				CR Dhan 300 (E & NE)	0.83						
				Karma Mahsuri (C)	0.84						
				Akshaydhan (W)	0.87						
				Jaya (S)	0.81						
				HRI 174	0.95						
				Hybrid check	0.96						
				Local check	1.37						
	Mean	1.00		Mean	0.98		Mean	0.96		Mean	1.01

Table. 4.1(v): Cntd...

AVT-2 MS			AVT-2 Biofortified			AVT-2 AL&ISTVT			AVT-2 CSTVT		
Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI
F2	IET 31494(H)	1.29	F2	IET 31925	1.16	F2	IET 31858	1.01	F2	IET 31877	1.26
	WGL 14 (NC 1)	0.98		IET 31927	1.18		IET 31861	1.10		IET 31878	1.18
	BPT 5204 (NC 2)	0.90		IET 31938	1.12		IET 31862	1.05		Bhootnath	1.36
	Improved Samba Mahsuri (N, E & C)	1.06		IET 31939	0.76		CSR 36	1.11		FL 478	0.80
	Ketekejoha (NE)	0.93		IET 31947	1.15		CSR 10	0.92		Pusa 44	0.78
	Karijat-6 (W)	0.73		IET 31961	0.96		FL 478	0.86		CSR-10	0.74
	Local Check	1.27		BPT 5204	0.99		CSR 23	0.85		Local check	0.97
				IR 64	1.01		Pusa 44 (Sensitive)	1.18			
				DRR Dhan 45	1.03		Local check	1.19			
				DRR Dhan 48	0.94						
				Chittimuthyalu	0.37						
				Local check	1.00						
Mean		1.02	Mean		0.97	Mean		1.03	Mean		1.01

Table. 4.1(v): Cntd...

AVT-2 AGT			AVT-2 NIL- GEL			AVT-2 BT			AVT-2 EDS		
Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI
F2	IET 31909	1.23	F2	IET 32964	0.78	F2	1805	1.06	F2	IET 32100	1.26
	Shodini	1.56		IET 32990	1.15		1814	1.04		Sahabhagidhan (NC)	0.82
	Badshadhog Sel - 1	0.78		BPT 5204(RP)	0.85		1818	0.97		Local check	0.95
	CR Sugandh Dhan - 907	0.92		Pusa 44(RP)	1.25		1819	0.90			
	GAR 14	0.99		Local check	1.49		1820	0.97			
	Sugandh Sambha	0.99					1822	1.01			
	Dubraj Sel - 1	0.87					Local Check	1.05			
	Katekejotha	1.16									
	RNR 15435	0.89									
	Local check	1.65									
Mean	1.10		Mean	1.10		Mean	1.00		Mean	1.01	

Table. 4.1(v): Cntd...

AVT-2 Early Rabi			AVT-2 RSL		
Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI
F2	IET 31368	1.09	F2	IET 32175	1.09
	IET 32072	0.85		IET 31246	1.35
	CO-51 (NC)	1.02		IET 31220	1.17
	Narendra 97(E)	0.96		IET 31237	0.97
	MTU 1153 (S)	0.96		IET 33264	0.78
	Local check	1.01		IET 33262	0.83
				RC: Pooja	0.83
				NC: Swarna Sub 1	1.00
				Local check	1.06
	Mean			Mean	1.01

Table. 4.1(v): Cntd...

AVT-2 LPT					Mean GYEI of P2 & P3	Rank
Nutrient-Level	Varieties	GYEI 50% over 0%	Nutrient-Level	Varieties		
P2	IET 31107	0.99	P3	IET 31107	0.95	8
	IET 31966	1.13		IET 31966	1.05	3
	IET 31968	1.06		IET 31968	1.05	4
	IET 31969	0.98		IET 31969	1.01	7
	IET 31973	0.91		IET 31973	0.89	12
	IET 31975	1.19		IET 31975	1.21	1
	IET 31976	0.95		IET 31976	0.95	9
	IET 31979	1.11		IET 31979	1.18	2
	IET 31980	1.04		IET 31980	1.07	5
	IET 31982	0.88		IET 31982	0.90	13
	IET 31985	1.07		IET 31985	1.02	6
	IET 31986	0.89		IET 31986	0.88	15
	Swarna	0.90		Swarna	0.87	14
	Improved Samba Mahsuri	0.93		Improved Samba Mahsuri	0.96	10
	BPT 5204	0.69		BPT 5204	0.87	16
	Local check	0.87		Local check	0.93	11
	Mean	0.98		Mean	0.99	

Table. 4.1(v): Cntd...

AVT-2 LNT						Mean GYEI of N2 & N3	Rank
Nutrient- Level	Varieties	GYEI 50% over 0%	Nutrient- Level	Varieties	GYEI 100% over 50%		
N2	IET 29577	1.09	N3	IET 29577	1.09	1.09	4
	IET 30261	1.01		IET 30261	1.01	1.01	6
	IET 31124	0.92		IET 31124	0.90	0.91	10
	IET 31990	1.17		IET 31990	1.16	1.17	1
	IET 31993	0.93		IET 31993	0.92	0.92	9
	IET 31994	1.09		IET 31994	1.06	1.07	5
	IET 31998	1.09		IET 31998	1.14	1.12	2
	IET 32009	1.11		IET 32009	1.12	1.11	3
	IET 32010	1.01		IET 32010	0.99	1.00	7
	Varadhan	0.79		Varadhan	0.76	0.78	14
	Swarna	1.01		Swarna	0.95	0.98	8
	Improved Samba Mahsuri	0.90		Improved Samba Mahsuri	0.84	0.87	11
	BPT 5204	0.89		BPT 5204	0.81	0.85	12
	Local check	0.78		Local check	0.81	0.80	13
	Mean	0.99		Mean	0.97	0.98	

Table. 4.1(w): Identification of cultures performing better with low level of Nutrients application based on the % yield reduction at 50 % of RDN and 100% of RDN

Group	Group	Entry No	50	100	Diffrence -50	(%) Reduction
EH	V1	IET 31381	5.30	6.55	1.25	19.10
	V2	IET 31386	5.60	6.31	0.71	11.26
	V3	IET 31389	5.41	6.30	0.90	14.21
	V4	Shalimar Rice 3	5.11	5.96	0.85	14.19
	V5	Vivekdhan 86	2.27	2.55	0.28	10.98
	V6	VL Dhan 86(N)	6.93	8.37	1.44	17.20
	V7	Local Check	5.41	6.07	0.66	10.88

MH	V1	IET 31413	3.61	4.21	0.60	14.32
	V2	Vivekdhan 62	4.07	4.33	0.26	6.01
	V3	V L Dhan 68(N)	3.08	3.68	0.60	16.21
	V4	Local Check	4.29	5.08	0.79	15.49

JAPONICA	V1	IET 31431	3.81	4.51	0.70	15.58
	V2	Bhrigudhan	3.77	4.77	1.00	20.89
	V3	Varundhan	3.82	4.75	0.93	19.57
	V4	Shalimar Rice 5	2.39	2.64	0.25	9.36
	V5	Local Check	3.71	3.94	0.22	5.67

E(TP)	V1	IET 30637	4.28	4.95	0.68	13.66
	V2	IET 31436(H)	4.73	5.51	0.78	14.21
	V3	IET 31501	4.82	5.45	0.63	11.61
	V4	CO-51 (NC)	4.67	5.07	0.41	7.99
	V5	PR 124 (N)	3.78	4.32	0.54	12.50
	V6	Narendra 97(E)	3.90	4.51	0.61	13.50
	V7	Luit (NE)	3.94	4.56	0.62	13.61
	V8	Sahbhagidhan (C&W)	4.14	4.77	0.63	13.19
	V9	MTU 1153 (S)	4.52	5.26	0.73	13.93
	V10	US 314 (Hybrid)	4.22	4.97	0.75	15.00
	V11	Local Check	4.27	5.08	0.81	15.97

Group	Group	Entry No	50	100	Diffrence -50	(%) Reduction
IME (TP)	V1	IET 30692	4.65	5.49	0.84	15.26
	V2	IET 30713	4.50	5.40	0.90	16.61
	V3	IET 31448	5.09	5.87	0.79	13.39
	V4	IET 31452	4.85	5.58	0.72	13.00
	V5	IET 31456	4.71	5.61	0.90	15.97
	V6	IET 31466	4.65	5.40	0.75	13.93
	V7	IET 31589	4.50	5.50	1.00	18.16
	V8	IET 31603	4.47	5.28	0.80	15.22
	V9	Gondhra Bidhan-3	4.67	5.55	0.87	15.77
	V10	PR 113	4.17	5.16	0.98	19.06
	V11	Lalat	3.80	4.72	0.91	19.37
	V12	Karjat - 7	3.67	4.60	0.94	20.36
	V13	MTU 1010	3.97	4.84	0.87	17.90
	V14	US 312	4.60	5.45	0.85	15.55
	V15	Local check	4.11	5.13	1.01	19.79

Table. 4.1(w): Cntd....

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
IM (TP)	V1	IET 29860	4.38	5.51	1.13	20.47
	V2	IET 29877	4.33	5.39	1.06	19.66
	V3	IET 31478(H)	4.16	5.46	1.30	23.79
	V4	IET 31479(H)	4.29	5.26	0.98	18.58
	V5	IET 31480(H)	4.65	5.70	1.05	18.37
	V6	IET 31481(H)	4.35	5.35	1.00	18.69
	V7	IET 31492(H)	4.55	5.27	0.72	13.66
	V8	IET 31618	4.12	5.11	0.99	19.46
	V9	IET 31633	4.09	5.17	1.08	20.94
	V10	IET 31637	4.26	5.32	1.07	20.02
	V11	IET 31638	4.38	5.49	1.11	20.21
	V12	IET 31639	4.24	5.20	0.96	18.47
	V13	IET 31640	3.45	4.62	1.17	25.34
	V14	IET 31641	4.30	5.26	0.96	18.24
	V15	IET 31643	4.30	5.37	1.07	19.85
	V16	IET 31659	4.29	5.30	1.01	19.12
	V17	NC- NDR 359	3.86	4.78	0.92	19.28
	V18	PR121 (N)	3.67	4.65	0.98	21.14
	V19	CR Dhan 300 (E & NE)	3.87	4.73	0.86	18.16
	V20	Karma Mahsuri (C)	3.84	4.83	0.99	20.49
	V21	Akshaydhan (W)	3.91	4.94	1.03	20.79
	V22	Jaya (S)	3.85	4.65	0.79	17.09
	V23	HRI 174	4.16	5.06	0.90	17.71
	V24	Hybrid check	4.11	5.19	1.08	20.81
	V25	Local check	5.15	5.88	0.73	12.41

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
Late	V1	IET 30882	5.07	5.86	0.79	13.51
	V2	IET 31686	4.80	5.52	0.72	13.04
	V3	IET 31709	4.84	5.47	0.63	11.49
	V4	IET 31714	4.81	5.46	0.65	11.95
	V5	Swarna	4.40	5.28	0.88	16.72
	V6	Pusa - 44	3.74	4.59	0.85	18.59
	V7	NDR 8002	4.05	5.06	1.02	20.07
	V8	Ranjeet	4.25	5.01	0.76	15.17
	V9	Salivahana	4.01	4.67	0.66	14.18
	V10	Pushyami	3.90	4.96	1.06	21.42
	V11	Local check	4.17	5.30	1.13	21.27

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
Aerobic	V1	IET 30045	4.45	5.15	0.70	13.54
	V2	IET 30919	4.07	5.07	1.00	19.77
	V3	IET 31740	4.53	5.08	0.55	10.80
	V4	IET 31741	4.24	4.86	0.62	12.78
	V5	IET 31757	3.96	4.98	1.02	20.52
	V6	IET 31760	3.79	4.56	0.77	16.78
	V7	IET 31765	4.44	5.06	0.62	12.27
	V8	IET 31775	4.05	4.69	0.64	13.55
	V9	CR Dhan 201(NC)	3.63	4.46	0.83	18.67
	V10	CR Dhan 202 (N, E, NE & C)	4.16	4.90	0.74	15.16
	V11	AAUDR-1 (W)	3.75	4.36	0.61	13.91
	V12	MAS 946-1 (S)	3.22	4.06	0.84	20.72
	V13	DRR Dhan 54	3.74	4.68	0.94	20.13
	V14	Local check	4.25	5.05	0.80	15.87

Table. 4.1(w): Cntd....

Group	Group	Entry No	50	100	Difference -50	(%) Reduction
MS	V1	IET 31494(H)	4.51	5.85	1.34	22.83
	V2	WGL 14 (NC 1)	3.96	5.04	1.08	21.44
	V3	BPT 5204 (NC 2)	3.98	4.63	0.65	14.11
	V4	Improved Samba Mahsuri (N, E & C)	4.43	4.89	0.46	9.34
	V5	Ketekejoha (NE)	4.01	4.76	0.75	15.77
	V6	Karjat-6 (W)	3.51	4.26	0.75	17.60
	V7	Local Check	4.58	5.64	1.06	18.84

Group	Group	Entry No	50	100	Difference -50	(%) Reduction
Biofortified	V1	IET 31925	4.19	5.53	1.34	24.17
	V2	IET 31927	4.20	5.61	1.41	25.16
	V3	IET 31938	4.15	5.36	1.21	22.55
	V4	IET 31939	3.38	4.49	1.11	24.76
	V5	IET 31947	4.24	5.40	1.17	21.56
	V6	IET 31961	3.94	4.83	0.89	18.44
	V7	BPT 5204	3.83	5.17	1.35	26.00
	V8	IR 64	3.86	5.20	1.34	25.82
	V9	DRR Dhan 45	4.04	5.07	1.03	20.35
	V10	DRR Dhan 48	3.80	4.94	1.13	22.97
	V11	Chittimuthyalu	2.34	3.18	0.84	26.39
	V12	Local check	3.86	5.18	1.32	25.45

Group	Group	Entry No	50	100	Difference -50	(%) Reduction
AL&ISTVT	V1	IET 31858	2.49	3.30	0.81	24.57
	V2	IET 31861	2.61	3.41	0.80	23.56
	V3	IET 31862	2.48	3.45	0.98	28.28
	V4	CSR 36	2.65	3.39	0.73	21.65
	V5	CSR 10	2.42	3.10	0.68	21.96
	V6	FL 478	2.28	3.07	0.79	25.65
	V7	CSR 23	2.25	3.07	0.82	26.79
	V8	Pusa 44 (Sensitive)	2.68	3.56	0.88	24.61
	V9	Local check	2.76	3.49	0.73	20.82

Group	Group	Entry No	50	100	Difference -50	(%) Reduction
CSTVT	V1	IET 31877	3.99	4.65	0.66	14.10
	V2	IET 31878	3.75	4.65	0.90	19.41
	V3	Bhootnath	4.39	4.55	0.16	3.52
	V4	FL 478	3.36	3.53	0.17	4.89
	V5	Pusa 44	3.08	3.72	0.64	17.15
	V6	CSR-10	3.07	3.54	0.47	13.14
	V7	Local check	3.45	4.13	0.68	16.55

Group	Group	Entry No	50	100	Difference -50	(%) Reduction
AGT	V1	IET 31909	3.41	4.22	0.81	19.22
	V2	Shodini	3.98	4.62	0.65	13.96
	V3	Badshadhog Sel - 1	2.66	3.43	0.77	22.46
	V4	CR Sugandh Dhan - 907	2.92	3.69	0.77	20.91
	V5	GAR 14	3.15	3.71	0.56	15.10
	V6	Sugandh Sambha	3.12	3.71	0.59	15.85
	V7	Dubraj Sel - 1	2.92	3.49	0.57	16.36
	V8	Katekejoha	3.32	4.11	0.80	19.41
	V9	RNR 15435	2.84	3.66	0.82	22.40
	V10	Local check	4.05	4.79	0.75	15.60

Table. 4.1(w): Cntd....

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
NIL GEL	V1	IET 32964	8.79	9.80	1.00	10.23
	V2	IET 32990	10.54	11.93	1.39	11.61
	V3	BPT 5204(RP)	9.13	10.21	1.08	10.60
	V4	Pusa 44(RP)	11.03	12.46	1.43	11.46
	V5	Local check	11.65	14.00	2.35	16.80

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
BT	V1	1805	3.42	4.86	1.44	29.66
	V2	1814	3.54	4.60	1.06	23.06
	V3	1818	3.40	4.47	1.07	23.84
	V4	1819	3.15	4.49	1.34	29.84
	V5	1820	3.32	4.60	1.28	27.84
	V6	1822	3.29	4.84	1.55	31.95
	V7	Local Check	3.56	4.62	1.06	22.96

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
EDS	V1	IET 32100	4.37	5.18	0.82	15.74
	V2	Sahabgadhyan (NC)	3.51	4.18	0.66	15.89
	V3	Local check	3.77	4.55	0.78	17.14

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
Erabi	V1	IET 31368	5.80	6.59	0.79	12.04
	V2	IET 32072	5.17	5.72	0.54	9.53
	V3	CO-51 (NC)	5.59	6.40	0.81	12.60
	V4	Narendra 97(E)	5.19	6.50	1.31	20.09
	V5	MTU 1153 (S)	5.47	6.13	0.66	10.80
	V6	Local check	5.59	6.30	0.71	11.23

Group	Group	Entry No	50	100	Difference - 50	(%) Reduction
RSL	V1	IET 32175	4.28	4.75	0.47	9.85
	V2	IET 31246	4.60	5.48	0.88	16.07
	V3	IET 31220	4.25	5.15	0.90	17.52
	V4	IET 31237	3.95	4.61	0.66	14.32
	V5	IET 33264	3.49	4.17	0.68	16.30
	V6	IET 33262	3.53	4.41	0.87	19.81
	V7	RC: Pooja	3.67	4.21	0.55	12.94
	V8	NC: Swarna Sub 1	4.04	4.62	0.59	12.71
	V9	Local check	4.10	4.83	0.73	15.06

Table. 4.1(w): Cntd....

Group	Group	Entry No	0% RDP	50% RDP	100% RDP	0-50% difference	Reduction %	50-100% difference	Reduction %	Mean Grain Yield difference	Mean Reduction %
AVT 2 LPT	V1	IET 31107	3.77	3.95	4.63	0.18	4.66	0.68	14.71	0.43	9.69
	V2	IET 31966	3.98	4.27	4.72	0.29	6.74	0.45	9.53	0.37	8.14
	V3	IET 31968	3.83	4.15	4.86	0.32	7.68	0.71	14.63	0.52	11.15
	V4	IET 31969	3.59	4.08	4.76	0.49	11.92	0.68	14.38	0.59	13.15
	V5	IET 31973	3.51	3.87	4.42	0.36	9.37	0.55	12.44	0.46	10.90
	V6	IET 31975	3.84	4.65	4.98	0.81	17.42	0.33	6.63	0.57	12.02
	V7	IET 31976	3.53	4.03	4.51	0.50	12.38	0.48	10.67	0.49	11.53
	V8	IET 31979	3.81	4.36	5.19	0.55	12.55	0.83	15.96	0.69	14.26
	V9	IET 31980	3.59	4.35	4.73	0.77	17.62	0.37	7.92	0.57	12.77
	V10	IET 31982	3.46	3.82	4.52	0.36	9.36	0.70	15.47	0.53	12.41
	V11	IET 31985	3.98	4.04	4.83	0.06	1.46	0.79	16.39	0.43	8.93
	V12	IET 31986	3.52	3.80	4.42	0.28	7.30	0.62	13.99	0.45	10.65
	V13	Swarna	3.63	3.72	4.50	0.10	2.60	0.77	17.19	0.43	9.90
	V14	Improved Samba Mahsuri	3.54	3.95	4.67	0.41	10.34	0.72	15.36	0.56	12.85
	V15	BPT 5204	2.93	3.52	4.71	0.60	16.90	1.19	25.32	0.89	21.11
	V16	Local check	3.44	3.79	4.72	0.34	9.03	0.93	19.72	0.64	14.38

Table. 4.1(w): Cntd....

Group	Group	Entry No	0% RDP	50% RDP	100% RDP	0-50% difference	Reduction %	50-100% difference	Reduction %	Mean Grain Yield difference	Mean Reduction %
AVT 2 LNT	V1	IET 29577	3.09	4.14	4.84	1.06	25.49	0.70	14.48	0.88	19.98
	V2	IET 30261	2.93	4.04	4.57	1.10	27.35	0.53	11.62	0.82	19.49
	V3	IET 31124	2.85	3.78	4.38	0.93	24.50	0.61	13.86	0.77	19.18
	V4	IET 31990	3.17	4.34	4.92	1.16	26.84	0.58	11.82	0.87	19.33
	V5	IET 31993	2.83	3.83	4.42	0.99	25.99	0.59	13.40	0.79	19.70
	V6	IET 31994	3.07	4.18	4.63	1.11	26.50	0.45	9.81	0.78	18.15
	V7	IET 31998	2.97	4.31	4.84	1.35	31.23	0.53	10.97	0.94	21.10
	V8	IET 32009	2.97	4.37	4.70	1.40	32.08	0.34	7.16	0.87	19.62
	V9	IET 32010	2.93	4.04	4.49	1.10	27.36	0.45	10.12	0.78	18.74
	V10	Varadhan	2.69	3.42	4.10	0.73	21.35	0.68	16.59	0.71	18.97
	V11	Swama	2.97	3.98	4.39	1.01	25.46	0.41	9.42	0.71	17.44
	V12	Improved Samba Mahsuri	2.90	3.63	4.22	0.73	20.12	0.59	14.00	0.66	17.06
	V13	BPT 5204	2.75	3.79	3.93	1.04	27.44	0.14	3.56	0.59	15.50
	V14	Local check	2.59	3.54	4.20	0.95	26.88	0.66	15.67	0.81	21.27

[illegible]

4.2. RESOURCE CONSERVATION TECHNOLOGIES TRIALS (RCT's)

4.2.1. Water management (IoT based sensors) for enhancing water use efficiency and productivity of mechanical transplanted rice (*Kharif 2025*)

Increasing water scarcity has emerged as a serious challenge to sustainable rice cultivation, demanding the development of water-efficient technologies that are not only economically viable but also supportive of soil health. In this context, strategies that reduce water use without compromising yield are highly desirable. Innovative crop establishment methods such as mechanical transplanting and wet direct seeding (DSR) offer promising alternatives to conventional practices by enhancing productivity while minimizing water demand. Additionally, alternate wetting and drying (AWD)—also known as intermittent or controlled irrigation—has gained attention as an effective water-saving technique, capable of reducing irrigation water use by up to 30% in rice systems. Together, these approaches provide a sustainable pathway to address water scarcity while maintaining crop productivity. To evaluate the suitable and promising irrigation management practices in different crop establishment methods a trial was conducted at five **locations** in four **Zones (Chiplima, Gangavathi, Khudwani, Ludhiana and Mandya)**. Split plot design was adopted with four main plots of crop establishment methods {M₁: Dry Direct Seeded Rice (DSR), M₂: Direct Seeded Rice (DSR) Semi Dry, M₃: Wet Direct Seeded Rice (DSR), M₄: Transplanting/Mechanised TP and three subplots of irrigation management {I₁: Flooding throughout crop growth (3 + / - 2 cm) after 15 days, I₂: Irrigation at Saturation (No flooding) and I₃: Alternate wetting and drying (IoT based) replicated three times. The results are summarized and presented in **Table 4.2.1** and the salient findings are given below.

In **Zone I, at Khudwani**, on silty clay loam soils, grain and straw yield were comparable in the tested crop establishment methods, irrigation practices and their interaction, indicating stable performance of treatments under adequate moisture conditions. Plant height was significantly influenced by crop establishment methods, but not by irrigation practices and the interaction, indicating that plant stature was mainly governed by establishment methods. Among establishment methods, Semi Dry DSR and saturation method recorded the higher plant height, tiller number. Panicle weight was significantly influenced by Dry DSR and transplanting. Test weight was higher in Wet DSR and semi Dry DSR. Total water input was significantly high in Wet DSR, while alternate wetting and drying (IoT based) recorded the lowest, highlighting the water-saving advantage of AWD. Cost of cultivation was also significantly low in semidry Rice, dry DSR with alternate wetting and drying (IoT based).

In **Zone II, at Ludhiana**, on sandy loam soil, only two crop establishment methods were evaluated and no significant difference was recorded in grain yield, straw yield and yield attributes. Among irrigation treatments, alternate wetting and drying (IoT based) recorded the lowest total water input followed by saturation, demonstrating the water-saving potential of alternate wetting and drying (IoT based).

In **Zone III, at Chiplima**, on sandy clay loam soil, wet DSR recorded higher grain yield and straw yield followed by transplanting. Among irrigation practices, alternate wetting and drying (IoT based) recorded higher grain yield and straw yield. The interaction effect

showed that, Wet DSR with alternate wetting and drying (IoT based) recorded the maximum plant height, tillers/m², panicles/m², panicle weight, test weight. Among establishment methods, Semi Dry DSR recorded the lowest water use and transplanting recorded higher water use. Among irrigation practices, alternate wetting and drying (IoT based) recorded the lowest. The wet DSR system under alternate wetting and drying (IoT based) recorded the lowest cost of cultivation.

In **Zone VII, at Gangavathi**, on black soil, wet DSR and transplanting/mechanised TP recorded comparable and higher grain yields. Plant height was not significantly influenced by crop establishment methods, but was significantly affected by irrigation practices. The saturation method and alternate wetting and drying (IoT based) recorded higher Tillers/m². Alternate wetting and drying (IoT based) recorded higher panicle weight, test weight. Cost of cultivation was significantly influenced by both crop establishment methods and irrigation practices and the interaction effect. The dry DSR system with Alternate wetting and drying (IoT based) recorded lowest cost followed by dry DSR system with saturation. At **Mandya**, on red sandy loam soils, mechanised TP recorded higher grain yield followed by wet DSR and semidry rice. Among irrigation practices, saturation and alternate wetting and drying (IoT based) recorded higher grain yield. Straw yield, plant growth parameters, panicle weight and test weight were not significantly influenced by treatments or combinations. However, saturation and flooding recorded higher values. Dry DSR and semi dry DSR were comparable and recorded higher panicles/m². Semi Dry rice system recorded higher total water input, whereas, alternate wetting and drying (IoT based) recorded the lowest. Wet DSR and transplanting recorded higher water use efficiency. Alternate wetting and drying (IoT based) recorded the highest water use efficiency and was significantly superior. Production efficiency was higher with saturation method. Cost of cultivation was lower under wet DSR with alternate wetting and drying (IoT based) and dry DSR with saturation.

Across the five locations in four Zones, crop establishment methods and irrigation practices influenced productivity, water use and economics significantly. Wet DSR in Zone III (**Chiplima**) and transplanting, wet DSR in Zone VII (**Gangavathi** and **Mandya**) recorded higher yields, while Dry DSR performed well under favourable conditions in Zone I (**Khudwani**) and Zone II (**Ludhiana**). Irrespective of establishment method, irrigation scheduling of alternate wetting and drying (IoT based) consistently reduced water use and cost of cultivation while maintaining comparable yields.

Table 4.2.1: Productivity of DSR (Wet and Dry) through Water management (IoT based sensors), Kharif-2025.

Treatment		ZONE-III CHIPLIMA					
Main Plot- Crop establishment methods	Irrigation management practices	Grain yield (t/ha)	Straw yield (t/ha)	No. of hills/m ² after 15 days	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)
M1 - Direct Seeded Rice (DSR) dry	I1	3.03	3.87	95	82.30	152	210
	I2	3.13	4.03	96	80.33	152	216
	I3	3.30	4.17	97	90.13	155	220
M2 - Direct Seeded Rice (DSR) semi dry	I1	3.37	4.30	99	84.60	165	218
	I2	3.70	4.57	100	83.47	167	224
	I3	3.87	4.70	112	91.33	181	232
M3 - Direct Seeded Rice (DSR) wet	I1	4.77	5.53	123	92.67	274	274
	I2	5.10	6.17	124	81.93	271	276
	I3	5.43	6.33	128	104.47	293	295
M4 - Transplanting/Mechanised TP	I1	4.43	5.27	29	92.07	262	262
	I2	4.77	5.70	30	97.70	266	266
	I3	5.10	6.07	32	100.53	285	285
Method of Methods							
M1		3.15	4.02	96	84.25	153	215
M2		3.65	4.52	104	86.47	171	225
M3		5.10	6.01	125	93.02	280	282
M4		4.77	5.68	31	96.77	271	271
C.D. (0.05)		0.21	0.31	3.31	4.04	7.18	6.09
C.V. (%)		4.45	5.24	3.23	3.88	2.85	2.13
Mean of Irrigation							
I1		3.90	4.74	87	87.91	213	241
I2		4.18	5.12	88	85.86	214	246
I3		4.42	5.32	92	96.62	228	258
CD (0.05)		0.12	0.16	1.8	2.85	3.91	3.15
C.V. (%)		3.41	3.62	2.34	3.66	2.06	1.47
Interaction							
I and M		NS	NS	3.6	5.57	8.33	6.86
M and I		NS	NS	3.84	5.71	7.81	6.3
Experimental Mean		4.17	5.06	89	90.13	219	248
Soil type		Sandy clay loam					
pH		5.40					
EC		-					
Variety		Swarna (MTU-7029), 145 days					
RDF NPK kg/ha		150:50:50:25					
Available NPK kg/ha		162:20:117					

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

Table 4.2.1: Contd.

Treatment		ZONE-III CHIPLIMA (Contd.)					
		Panicle wt (g)	Test wt (g)	No of grains/ panicle	Days to 50% flowering	Total water input (mm)	Cost of cultivation (Rs/ha)
M1 - Direct Seeded Rice (DSR) dry	I1	2.27	20.17	83	115	1260.00	79324
	I2	2.73	20.47	85	115	1073.33	77986
	I3	3.13	21.57	86	116	890.00	75887
M2 - Direct Seeded Rice (DSR) semi dry	I1	2.60	20.23	85	117	1076.67	77019
	I2	2.90	20.80	89	118	910.00	75507
	I3	3.17	21.67	91	119	826.67	73332
M3 - Direct Seeded Rice (DSR) wet	I1	3.17	22.33	98	126	1346.67	66001
	I2	3.87	22.70	96	138	1146.67	65295
	I3	4.73	23.57	96	162	1016.67	61576
M4 - Transplanting/Mechanised TP	I1	2.70	22.43	110	125	1513.33	90519
	I2	3.57	22.67	108	130	1350.00	86182
	I3	4.10	23.07	105	155	1183.33	84220
Method of Methods							
M1		2.71	20.74	85	115	1074.44	77732
M2		2.89	20.90	88	118	937.78	75286
M3		3.92	22.87	97	142	1170.00	64291
M4		3.46	22.72	108	137	1348.89	86974
C.D. (0.05)		0.23	0.57	1.62	5.61	77.27	583.79
C.V. (%)		6.18	2.26	1.48	3.8	5.91	0.67
Mean of Irrigation							
I1		2.68	21.29	94	121	1299.17	78216
I2		3.27	21.66	95	125	1120.00	76243
I3		3.78	22.47	94	138	979.17	73754
CD (0.05)		0.25	0.75	NS	3.33	39.74	518.07
C.V. (%)		8.93	4	1.33	3	4.05	0.79
Interaction							
I and M		NS	NS	2.16	6.87	NS	955.8
M and I		NS	NS	2.18	6.65	NS	1036.14
Experimental Mean		3.25	21.81	94	128	1132.78	76071
Soil type							
pH							
EC							
Variety							
RDF NPK kg/ha							
Available NPK kg/ha							

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

Table 4.2.1: Contd.

Treatment		ZONE-VII GANGAVATHI							
Main Plot- Crop establishment methods	Irrigation management practices	Grain yield (t/ha)	Straw yield (t/ha)	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Cost of cultivation (Rs/ha)
M1 - Direct Seeded Rice (DSR) dry	I1	2.18	3.71	100.33	171	170	1.72	1.72	47380
	I2	2.99	4.57	104.00	177	172	2.20	2.20	44380
	I3	2.80	3.98	101.33	174	165	2.80	2.80	43380
M2 - Direct Seeded Rice (DSR) semi dry	I1	3.10	4.68	96.33	152	158	2.02	2.02	48180
	I2	3.10	6.36	101.67	192	190	2.30	2.30	47180
	I3	3.34	6.32	99.67	187	187	2.44	2.44	46847
M3 - Direct Seeded Rice (DSR) wet	I1	4.15	6.24	92.33	161	189	2.28	2.28	53730
	I2	4.88	6.76	97.33	195	181	2.36	2.36	50730
	I3	4.73	6.30	95.00	191	181	2.68	2.68	49730
M4 - Transplanting/Mechanised TP	I1	4.59	6.99	92.33	194	246	2.22	2.22	65417
	I2	4.93	7.57	100.33	254	189	3.02	3.02	62417
	I3	4.88	7.38	96.00	229	221	2.28	2.28	61417
Method of Methods									
M1		2.66	4.09	101.89	174	169	2.24	2.24	45047
M2		3.18	5.79	99.22	177	178	2.25	2.25	47402
M3		4.59	6.43	94.89	182	183	2.44	2.44	51397
M4		4.80	7.31	96.22	225	219	2.51	2.51	63084
C.D. (0.05)		0.72	0.75	NS	22.56	19.26	0.01	0.01	1345.73
C.V. (%)		16.33	11	5.16	10.31	8.91	0.42	0.42	2.26
Mean of Irrigation									
I1		3.50	5.40	95.33	169	191	2.06	2.06	53677
I2		3.98	6.32	100.83	205	183	2.47	2.47	51177
I3		3.94	6.00	98.00	195	189	2.55	2.55	50343
CD (0.05)		NS	NS	3.78	16.9	NS	0.01	0.02	520.07
C.V. (%)		17.86	21.54	4.46	10.29	9.41	0.73	1.12	1.16
Interaction									
I and M		NS	NS	NS	NS	28.89	0.03	0.04	1302.88
M and I		NS	NS	NS	NS	30.52	0.03	0.05	1040.14
Experimental Mean		3.81	5.91	98.05	190	187	2.36	2.36	51732
Soil type		Black soil							
pH		-							
EC		-							
Variety		-							
RDF NPK kg/ha		-							
Available NPK kg/ha		-							

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

Table 4.2.1: Contd.

Treatment		ZONE-I KHUDWANI						
		Grain yield (t/ha)	Straw yield (t/ha)	No. of hills/m ² after 15 days	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)
M1 - Direct Seeded Rice (DSR) dry	I1	7.10	8.91	99	133.33	650	542	3.87
	I2	7.05	8.78	97	134.00	663	547	3.77
	I3	6.98	8.67	100	133.33	648	531	3.80
M2 - Direct Seeded Rice (DSR) semi dry	I1	6.65	9.05	14	137.00	684	551	3.43
	I2	6.69	8.81	15	136.33	687	556	3.47
	I3	6.63	8.95	14	135.00	600	520	3.73
M3 - Direct Seeded Rice (DSR) wet	I1	6.91	8.61	87	132.33	644	528	3.87
	I2	6.87	8.57	87	132.33	641	514	3.67
	I3	6.59	8.26	86	132.33	639	519	3.73
M4 - Transplanting/Mechanised TP	I1	6.90	8.48	86	131.67	675	539	4.07
	I2	6.90	8.56	86	130.67	650	521	3.93
	I3	6.71	8.40	86	132.00	614	525	3.80
Method of Methods								
M1		7.04	8.79	99	133.55	653	540	3.81
M2		6.66	8.94	14	136.11	657	542	3.54
M3		6.79	8.48	87	132.33	641	520	3.76
M4		6.84	8.48	86	131.45	646	528	3.93
C.D. (0.05)		NS	NS	5.43	2.43	NS	NS	0.21
C.V. (%)		3.93	3.69	6.6	1.58	5.43	4.47	4.77
Mean of Irrigation								
I1		6.89	8.76	72	133.58	663	540	3.81
I2		6.88	8.68	71	133.33	660	534	3.71
I3		6.73	8.57	71	133.16	625	523	3.76
CD (0.05)		NS	NS	6.13	NS	32.04	NS	NS
C.V. (%)		4.08	3.96	9.93	1.44	5.7	4.79	5.09
Interaction								
I and M		NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS
Experimental Mean		6.83	8.67	71	133.36	650	533	3.76
Soil type		Silty clay loam						
pH		6.60						
EC		0.45						
Variety		-						
RDF NPK kg/ha								
Available NPK kg/ha		12.39						

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

Table 4.2.1: Contd.

Treatment		ZONE-I KHUDWANI (Contd.)					
		Test wt (g)	Days to 50% flowering	No of grains/panicle	Total water input (mm)	Cost of cultivation (Rs/ha)	Production Efficiency (kg/day)
M1 - Direct Seeded Rice (DSR) dry	I1	29.00	86	100	1356.67	65177	54.63
	I2	29.33	87	96	1181.67	64767	54.10
	I3	29.67	87	99	1116.33	62743	53.43
M2 - Direct Seeded Rice (DSR) semi dry	I1	30.33	94	89	1294.67	63677	47.17
	I2	30.00	94	92	1119.67	63267	47.33
	I3	30.00	95	91	1054.33	61243	46.83
M3 - Direct Seeded Rice (DSR) wet	I1	30.00	85	93	1629.67	67109	53.53
	I2	31.00	85	95	1454.67	66699	53.13
	I3	30.67	85	98	1389.33	64657	50.83
M4 - Transplanting/Mechanised TP	I1	29.33	97	99	1391.67	76510	49.20
	I2	29.00	97	97	1206.33	75150	49.40
	I3	28.67	96	94	1143.33	74407	47.97
Method of Methods							
M1		29.33	87	98	1218.22	64229	54.05
M2		30.11	94	91	1156.22	62729	47.11
M3		30.56	85	95	1491.22	66155	52.50
M4		29.00	97	97	1247.11	75356	48.86
C.D. (0.05)		0.85	1.49	4	5.67	397.17	2.41
C.V. (%)		2.48	1.42	3.64	0.38	0.51	4.12
Mean of Irrigation							
I1		29.66	91	95	1418.17	68118	51.13
I2		29.83	91	95	1240.58	67471	50.99
I3		29.75	91	96	1175.83	65763	49.76
CD (0.05)		NS	NS	NS	5.67	511.46	NS
C.V. (%)		3.09	0.91	5.69	0.51	0.88	4.11
Interaction							
I and M		NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS
Experimental Mean		29.75	91	95	1278.19	67117	50.63
Soil type							
pH							
EC							
Variety							
RDF NPK kg/ha							
Available NPK kg/ha							

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

Table 4.2.1: Contd.

Treatment		ZONE-II LUDHIANA										
		Grain yield (t/ha)	Straw yield (t/ha)	No. of hills/m ² after 15 days	Plant height (cm)	Tillers/ m ² (No.)	Panicle/ m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	No of grains/ panicle	Total water input (mm)
M1 - Direct Seeded Rice (DSR) dry	I1	5.65	7.31	41	95.60	305	293	2.79	21.53	86	121.00	150.00
	I2	5.80	7.30	42	95.90	293	292	2.87	21.60	85	128.33	134.00
	I3	5.85	7.22	41	94.07	293	287	2.89	21.63	84	128.33	110.00
M2 - Direct Seeded Rice (DSR) semi dry	I1	-	-	-	-	-	-	-	-	-	-	-
	I2	-	-	-	-	-	-	-	-	-	-	-
	I3	-	-	-	-	-	-	-	-	-	-	-
M3 - Direct Seeded Rice (DSR) wet	I1	-	-	-	-	-	-	-	-	-	-	-
	I2	-	-	-	-	-	-	-	-	-	-	-
	I3	-	-	-	-	-	-	-	-	-	-	-
M4 - Transplanting/ Mechanised TP	I1	5.77	7.44	32	99.77	220	210	3.52	21.60	94	139.33	156.00
	I2	5.85	7.28	32	97.63	211	215	3.55	21.57	92	147.00	128.00
	I3	5.88	7.25	33	96.50	202	199	3.57	21.57	92	146.67	100.00
Method of Methods												
M1		5.77	7.28	42	95.19	297	291	2.85	21.59	85	125.89	131.33
M2		-	-	-	-	-	-	-	-	-	-	-
M3		-	-	-	-	-	-	-	-	-	-	-
M4		5.83	7.32	32	97.97	211	208	3.55	21.58	93	144.33	128.00
C.D. (0.05)		NS	NS	3.35	1.84	44.54	65.99	0.19	NS	0.96	7.69	
C.V. (%)		4.94	3.25	4.45	0.94	8.64	13.05	2.99	0.39	0.53	2.81	
Mean of Irrigation												
I1		5.71	7.38	37	97.68	263	252	3.16	21.56	90	130.16	153.00
I2		5.82	7.29	37	96.76	252	253	3.21	21.58	89	137.66	131.00
I3		5.86	7.24	37	95.28	248	243	3.23	21.60	88	137.50	105.00
CD (0.05)		NS	NS	2.06	1.48	10.27	NS	NS	NS	1.06	NS	
C.V. (%)		4	3.38	4.17	1.15	3.03	4.09	2.76	0.99	0.9	3.93	
Interaction												
<i>I and M</i>		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
<i>M and I</i>		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Experimental Mean		5.80	7.30	37	96.58	254	249	3.20	21.58	89	135.11	129.67
Soil type		Sandy loam										
pH		7.70										
EC		0.29										
Variety		-										
RDF NPK kg/ha		-										
Available NPK kg/ha		270;28.2:193										

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

Table 4.2.1: Contd.

Treatment		ZONE-VII MANDYA								
Main Plot- Crop establishment methods	Irrigation management practices	Grain yield (t/ha)	Straw yield (t/ha)	Plant height (cm)	Tillers /m ² (No.)	Panicle/ m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	No of grains/pa nicle
M1 - Direct Seeded Rice (DSR) dry	I1	5.12	7.86	77.53	412	399	3.40	14.63	86	210
	I2	5.31	8.57	75.29	413	403	3.33	14.15	87	212
	I3	5.30	8.15	73.31	415	406	3.31	14.28	88	209
M2 - Direct Seeded Rice (DSR) semi dry	I1	5.26	8.30	75.62	389	380	3.54	14.57	86	211
	I2	6.11	8.37	75.74	381	373	3.56	14.84	88	209
	I3	6.01	8.74	75.33	431	418	3.56	14.83	88	212
M3 - Direct Seeded Rice (DSR) wet	I1	5.84	8.35	77.64	368	360	3.64	15.22	84	213
	I2	5.91	8.76	77.37	400	389	3.65	14.45	86	232
	I3	5.90	8.66	74.98	394	385	3.32	14.17	87	213
M4 - Transplanting/Mechanised TP	I1	5.76	8.29	78.19	367	357	3.81	13.79	91	248
	I2	6.42	9.00	76.89	381	373	3.42	14.88	91	207
	I3	6.38	9.18	76.43	350	343	3.51	14.44	92	211
Method of Methods										
M1		5.24	8.19	75.38	413	403	3.35	14.35	87	210
M2		5.79	8.47	75.56	400	390	3.55	14.75	87	211
M3		5.88	8.59	76.66	387	378	3.54	14.61	86	219
M4		6.19	8.82	77.17	366	357	3.58	14.37	91	222
C.D. (0.05)		0.26	NS	NS	24.37	23.15	NS	NS	1.37	NS
C.V. (%)		3.98	9.92	4.78	5.39	5.25	7.61	5.49	1.36	8.45
Mean of Irrigation										
I1		5.50	8.20	77.24	384	374	3.60	14.55	87	221
I2		5.94	8.68	76.32	394	384	3.49	14.58	88	215
I3		5.90	8.68	75.01	397	388	3.42	14.43	89	211
CD (0.05)		0.34	NS	2.02	NS	NS	NS	NS	1.32	NS
C.V. (%)		6.71	6.04	3.06	4.75	4.58	10.99	6.82	1.74	12.75
Interaction										
I and M		NS	NS	NS	32.06	30.24	NS	NS	NS	NS
M and I		NS	NS	NS	32.19	30.27	NS	NS	NS	NS
Experimental Mean		5.78	8.52	76.19	392	382	3.50	14.52	88	216
Soil type		Red sandy loam								
pH		7.97								
EC		0.36								
Variety		RNR 15048, 125-130 days								
RDF NPK kg/ha		125:62:62								
Available NPK kg/ha		298:75:258.5								

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

Table 4.2.1: Contd.

Treatment		ZONE-VII MANDYA (Contd.)				Over all Mean Grain yield
		Total water input (mm)	Cost of cultivation (Rs/ha)	Water use efficiency (Kg/ ha-cm)	Production Efficiency (kg/day)	
Main Plot- Crop establishment methods	Irrigation management practices					
M1 - Direct Seeded Rice (DSR) dry	I1	1884.67	69148	27.18	38.90	4.64
	I2	1530.33	68686	34.88	40.01	4.87
	I3	1309.33	67769	40.54	39.69	4.85
M2 - Direct Seeded Rice (DSR) semi dry	I1	2068.67	70047	25.39	40.09	4.60
	I2	1699.33	69559	35.99	45.92	4.90
	I3	1424.33	68929	42.26	45.18	4.96
M3 - Direct Seeded Rice (DSR) wet	I1	2005.67	71761	29.13	45.17	5.42
	I2	1576.33	70816	37.56	44.87	5.69
	I3	1333.67	70046	44.36	44.50	5.66
M4 - Transplanting/Mechanised TP	I1	2031.67	78655	28.37	42.37	5.47
	I2	1581.67	78211	40.64	47.19	5.76
	I3	1359.00	77653	46.97	46.41	5.78
Method of Methods						
M1		1574.78	68534	34.20	39.53	4.78
M2		1730.78	69511	34.55	43.73	4.82
M3		1638.56	70875	37.02	44.85	5.59
M4		1657.45	78173	38.66	45.32	5.67
C.D. (0.05)		14.61	594.22	2.1	1.92	
C.V. (%)		0.77	0.72	5.05	3.84	
Mean of Irrigation						
I1		1997.67	72403	27.52	41.63	5.10
I2		1596.92	71818	37.27	44.50	5.36
I3		1356.58	71099	43.53	43.94	5.37
CD (0.05)		47.34	409.65	2.77	2.35	
C.V. (%)		3.31	0.66	8.88	6.25	
Interaction						
I and M		NS	NS	NS	NS	
M and I		NS	NS	NS	NS	
Experimental Mean		1650.39	71773	36.11	43.36	5.28
Soil type						
pH						
EC						
Variety						
RDF NPK kg/ha						
Available NPK kg/ha						

I1- Flooding throughout crop growth (3 +/- 2cm) after 15 days

I2- Irrigation at Saturation (No flooding)

I3- Alternate wetting and drying (IoT based)

4.2.2. Suitable package of practices for higher yield in Dry DSR

4.2.2.1 Development of suitable sowing method of Dry DSR for higher productivity in different rice zones, *Kharif-2025*.

The sustainability and profitability of conventional transplanted rice are increasingly threatened by the imminent water crisis, labour scarcity and climate change. In this context, direct-seeded rice (DSR) has emerged as a promising alternative due to its potential to reduce water consumption, less labour requirements, facilitate mechanization and minimize greenhouse gas emissions. DSR includes three principal methods, namely dry seeding, wet seeding and water seeding, of which dry DSR is gaining greater importance owing to its comparatively higher productivity and resource-use efficiency. Despite its advantages, the adoption of dry DSR in India faces several challenges such as poor crop establishment, severe weed infestation, lodging susceptibility, yield decline under continuous cropping and lack of suitable varieties. Addressing these constraints is essential for enhancing the performance and wider adoption of dry DSR. Keeping this in view, the present study was undertaken with the objectives of (i) identifying suitable and cost-effective agronomic practices for enhancing the productivity of dry DSR and (ii) maximizing resource-use efficiency. The experiment was conducted during *Kharif*, 2025 in six zones, at 12 locations, namely **Khudwani, Chatha, Ludhiana, Pantnagar, Pusa, Varanasi, Jagdalpur, Raipur, Rewa, Nawagam, Gangavathi and Mandya**. The trial was laid out in a randomized block design (RBD) with seven treatments and three replications. The treatments included S1: broadcasting of seeds; S2: mechanized line sowing of seeds; S3: raised bed sowing; S4: semi-dry system (sowing in dry soil and wet after one month of sowing); S5: any improved system in that particular location; S6: location-specific high-yielding dry DSR method; and S7: farmers practice of dry DSR of the region. The results obtained from the study are summarized in Table 4.2.2.1, and the salient findings are presented below.

In **Zone –I**, in silty clay loam soils of **Khudwani**, raised bed sowing, mechanised line sowing and location-specific method were recorded the highest grain yield. The higher yield under raised bed sowing was mainly attributed to higher tillers, panicles, grains per panicle and superior dry matter accumulation. Weed population and weed biomass were lower under Semi-Dry system at critical stages. Plant nutrient uptake was maximum under Semi-Dry system. The cost of cultivation was the lowest in broadcasting method, but the highest gross returns were obtained in raised bed sowing.

In **Zone II**, in sandy clay loam soil of **Chatha**, the improved system, semi-dry system recorded higher grain yield. Higher yield was associated with higher plant height, tillers, panicles and grains per panicle, dry matter accumulation was highest under improved system. The weed population and weed biomass were significantly reduced at panicle initiation under improved system. At **Ludhiana**, sowing methods did not show significant differences in grain yield; however, mechanized line sowing recorded comparatively higher yield along with lowest weed population and weed biomass, indicating better weed suppression. In silt loam soil of **Pantnagar**, location-specific method recorded significantly higher grain yield and supported by higher tillers, panicles and grains per panicle. The lowest weed population and weed biomass was observed at panicle initiation under farmer's practice. The cost of cultivation was

recorded lowest in farmers practice; however, the highest gross return was obtained from location specific high yielding dry DSR method.

In **Zone III**, in sandy loam soil of **Pusa**, sowing methods did not significantly influence grain yield; however, mechanized line sowing recorded the highest tillers, panicles and dry matter accumulation. Weed population and weed biomass were significantly lower under brown manuring. The cost of cultivation was the lowest in broadcasting and farmers practice, however, the highest gross return was obtained under mechanized line sowing. In loam soils of **Varanasi**, differences among sowing methods were non-significant, but mechanized line sowing recorded higher grain yield and semi dry system recorded the lowest weed population and weed biomass.

In **Zone V**, at **Jagdalpur**, raised bed sowing recorded higher grain yield, panicles, grains per panicle and dry matter accumulation, higher gross return and net return. The cost of cultivation was the lowest in farmers practice. Benefit-cost ratio was higher in mechanized line sowing and semi dry system and on par with raised bed sowing. In vertisols of **Raipur** although differences among sowing methods were statistically non-significant, raised bed sowing recorded higher grain yield. At **Rewa**, yield differences were non-significant among sowing methods, however mechanized line sowing recorded the highest grain yield. while lowest was observed in broadcasting.

In **Zone VI**, at **Nawagam**, sowing methods showed significant influence on yield, yield attributes and growth parameters. Location-specific method recorded the highest grain yield. Higher yield was associated with higher tillers, panicles and grains per panicle. Weed population and biomass was lower under raised bed sowing. The cost of cultivation was lower in mechanized line sowing, however, higher gross return was obtained under location specific high yielding dry DSR method.

In **Zone VII**, in black soil of **Gangavathi**, differences among sowing methods were non-significant; however, raised bed sowing recorded higher grain yield. The cost of cultivation was lower in semi dry system. However, the highest gross return was obtained under raised bed sowing. In red sandy loam soils of **Mandya**, sowing methods did not show a significant influence on grain yield and yield attributes. However, farmers' practice recorded higher grain yield numerically, while raised bed sowing produced higher straw yield.

Across 12 locations in six zones, sowing methods of raised bed, mechanized line sowing, improved and location-specific methods were better, while at six locations sowing methods did not show significant impact on growth and yield performance in Dry DSR.

Table 4.2.2.1: Development of suitable sowing method of Dry DSR for higher productivity in different zones , Kharif-2025.

Methods of Sowing	ZONE-I KHUDWANI										
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
			At 10 DAS	At 20 DAS							
S1	6.53	9.17	89	103	130.33	566	453	85	2.74	28.30	84
S2	8.07	11.27	77	91	128.00	453	430	109	3.20	29.30	87
S3	8.43	12.03	68	85	129.00	590	472	108	3.11	29.30	84
S4	7.20	10.73	15	21	135.00	586	509	95	2.74	28.93	96
S5	7.67	11.13	59	79	136.67	627	481	96	2.97	29.30	92
S6	8.07	10.87	82	96	132.33	574	481	108	3.17	29.30	86
S7											
C.D. (0.05)	1.1	1.72	7.75	8.42	4.38	103.82	85.64	13.72	0.39	1.43	1.15
C.V. (%)	7.88	8.72	6.58	5.86	1.82	10.08	9.99	7.54	7.19	2.71	0.72
Soil type	Silty caly loam										
pH	6.7										
EC	0.46										
OC	0.89										
Variety & Duration	Shalimar Rice-1 136-139days										
Applied NPK kg/ha	120:60:30										
Available NPK kg/ha	359:18.:278.6										

- S1: Broadcasting of seeds
S2: Mechanized line sowing of seeds
S3: Raised bed sowing
S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
S5- Any improved system in that particular location
S6- Location specific high yielding Dry DSR method
S7- Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-I KHUDWANI										ZONE-II KHUDWANI					
	Dry matter accumulation (g/m ²)			Weed population (no/m ²)		Weed biomass (g/m ²)		Total nutrient uptake (kg/ha)			Soil available nutrient (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C RATIO
	45 DAS	75 DAS	105 DAS	At Active Tillering	At Panicle Initiation	At Active Tillering	At Panicle Initiation	N	P	K	N	P	K			
S1	353.67	880.67	1246.77	4.00(2.06)	2.67(1.77)	1.68	2.36	99.80	18.60	99.00	282.97	20.27	269.37	63597	209067	2.29
S2	536.33	1144.67	1535.40	3.67(2.02)	2.33(1.66)	1.77	1.69	127.83	23.27	126.73	284.17	22.03	271.67	67717	258133	2.81
S3	633.33	1258.33	1624.80	4.00(2.11)	1.67(1.46)	1.32	1.36	135.97	24.10	131.07	275.67	21.00	265.13	68530	269867	2.94
S4	314.67	1220.00	1722.00	2.00(1.56)	1.67(1.46)	1.07	1.14	143.07	25.90	137.10	280.90	21.03	272.87	67550	230400	2.41
S5	411.00	1244.33	1641.73	2.33(1.64)	2.33(1.68)	1.08	1.87	133.13	25.23	132.87	270.20	21.83	282.63	67190	245333	2.65
S6	540.00	1145.33	1504.63	3.00(1.86)	2.33(1.68)	1.69	2.01	126.57	23.47	119.27	277.57	21.50	271.50	68783	258133	2.75
S7																
C.D. (0.05)	102.41	245.67	214.37	0.64	0.33	0.97	0.91	20.53	2.48	17.8	13.38	3.52	20.36			
C.V. (%)	12.11	11.75	7.62	18.73	11.12	37.15	28.66	8.83	5.82	7.87	2.64	9.09	4.11			
Soil type																
pH																
EC																
Variety & Duration																
Applied NPK kg/ha																
Available NPK kg/ha																

(Values in parentheses are transformed values)

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-II CHATHA																	
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/ Panicle (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Dry mater accumulation (g/m ²)			Weed population (no/m ²)		Weed biomass (g/m ²)	
												45 DAS	75 DAS	105 DAS	Active tillering stage	Panicle Initiation stage	AT stage	PI stage
S1	2.66	5.59	76	113	109.00	223	198	54.33	1.36	20.53	108	138.47	337.00	645.00	13.33(3.72)	62.00(7.91)	5.73	79.67
S2	3.12	6.56	88	122	138.33	238	207	64.33	1.45	21.33	105	166.33	346.07	678.33	9.33(3.13)	46.33(6.84)	4.38	57.00
S3	2.65	5.57	69	98	103.67	220	184	56.33	1.35	20.60	109	128.97	327.33	633.67	9.33(3.13)	50.00(7.11)	4.99	57.67
S4	3.16	6.63	95	128	147.00	268	216	64.33	1.54	21.57	103	171.50	384.33	709.00	12.67(3.63)	39.67(6.34)	5.49	47.33
S5	3.22	6.77	100	139	150.00	275	221	67.33	1.58	21.67	109	180.67	395.67	717.00	11.00(3.39)	37.33(6.15)	5.12	42.50
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)	0.06	0.13	2.21	8.89	5.06	7.74	4.06	8.08	0.04	0.11	1.93	8.22	8.8	7.71	0.18	0.27	0.17	6.35
C.V. (%)	1.1	1.12	1.37	3.94	2.07	1.68	1.05	6.99	1.45	0.27	0.96	2.78	1.3	0.61	2.76	2.09	1.78	5.94
Soil type	Sandy clay loam																	
pH	8.03																	
EC	-																	
Variety & Duration	Basmati 370, 140-150 days																	
Applied NPK kg/ha	30:20:10																	
Available NPK kg/ha	245.15:1434:146.31																	

(Values in parentheses are transformed values)

- S1: Broadcasting of seeds
- S2: Mechanized line sowing of seeds
- S3: Raised bed sowing
- S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
- S5- Any improved system in that particular location
- S6- Location specific high yielding Dry DSR method
- S7- Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-II LUDHIANA													
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ² _{AT} _{20DAS}	Plant height (cm)	Panicle/m2 (No.)	Panicle length (cm)	Grains/Panicle (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Dry matter accumulation (g/m2) AT 105DAS	Weed population (no/m ²) at PI	Weed biomass (g/m2) at PI	
S1	4.01	7.88	38	104.17	220	19.80	65	2.19	27.22	82	1167.00	2.00(1.56)	4.8	
S2	4.33	7.68	48	106.20	227	20.33	68	2.35	27.60	80	1217.67	0.67(1.00)	1.32	
S3	4.20	7.29	41	106.27	227	20.67	70	2.40	27.70	80	1191.00	1.67(1.46)	2.65	
S4	-	-	-	-	-	-	-	-	-	-	-	-	-	
S5	4.30	7.56	43	107.07	212	20.63	71	2.42	27.73	83	1200.67	0.67(1.00)	1.16	
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	
S7	-	-	-	-	-	-	-	-	-	-	-	-	-	
C.D. (0.05)	0.56	0.89	5.83	2.65	26.59	0.5	4.41	0.3	0.64	1.1	74.73	0.49	2.1	
C.V. (%)	6.61	5.89	6.92	1.25	6.01	1.23	3.23	6.51	1.16	0.68	3.13	19.45	42.37	
Soil type	-													
pH	7.7													
EC	0.24													
Variety & Duration	Pusa Basmati 1509, 115 days													
Applied NPK kg/ha	60:30:30													
Available NPK kg/ha	270:26.4:193													

(Values in parentheses are transformed values)

- S1: Broadcasting of seeds
- S2: Mechanized line sowing of seeds
- S3: Raised bed sowing
- S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
- S5- Any improved system in that particular location (Tar Wattar -DSR)
- S6- Location specific high yielding Dry DSR method
- S7- Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-II PANTNAGAR											
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²		Plant height (cm)	Tillers/m ² (No.)	Panicle/m2 (No.)	Grains/Panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
			At 10 DAS	At 20 DAS								
S1	3.88	4.19	85	120	122.60	243	191	151	29	2.27	26.09	91
S2	4.99	5.27	99	134	127.67	249	240	140	26	2.27	26.18	90
S3	5.01	5.81	77	113	121.95	236	217	138	27	2.51	26.63	93
S4	5.01	5.82	85	113	127.30	215	195	150	26	2.90	25.59	90
S5	4.72	5.56	91	118	126.67	248	240	152	27	2.15	25.93	92
S6	5.24	5.46	113	147	122.33	270	258	158	27	2.25	25.89	89
S7	4.64	5.32	96	117	124.33	245	230	164	26	2.23	25.82	91
C.D. (0.05)	0.18	0.73	7.71	13.64	4.22	11.82	11.1	13.08	1.48	0.14	0.38	5.37
C.V. (%)	2.07	7.65	4.69	6.23	1.9	2.73	2.78	4.88	3.12	3.22	0.82	3.32
Soil type	Silt Loam											
pH	7.3											
EC	1.2											
OC												
Variety & Duration	PD-24 & 135 days											
Applied NPK kg/ha	120:60:40											
Available NPK kg/ha	222.3:38.5:212.3											

S1: Broadcasting of seeds
S2: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
S3: Raised bed sowing
S4: Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
S5: Any improved system in that particular location (Tar Vatar Method of sowing)
S6: Location specific high yielding Dry DSR method (Zero days irrigation after sowing)

Table 4.2.2.1: Contd.

ZONE-II -PANTNAGAR Contd.																	
Methods of Sowing	Dry matter accumulation (g/m2)	Weed population (no/m ²)		Weed biomass (g/m ²)		Total nutrients uptake (kg/ha)			Soil available nutrients (kg/ha) initial			Soil available nutrients (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C RATIO
		At Active Tillering	At Panicle Initiation	At Active Tillering	At Panicle Initiation	N	P	K	N	P	K	N	P	K			
	75 DAS																
S1	120.33	10.67(3.24)	41.33(6.36)	3.65	41.63	54.97	16.69	77.81	175.67	21.29	180.20	198.17	29.50	207.50	39135	81664	1.09
S2	132.20	12.00(3.33)	26.67(5.17)	5.49	27.37	46.13	14.49	76.92	180.67	21.86	187.30	204.23	30.90	207.30	38911	104609	1.69
S3	95.67	14.67(3.84)	21.33(4.64)	5.78	21.63	44.51	13.21	66.14	178.33	21.62	185.33	204.87	28.67	200.30	42384	105197	1.48
S4	154.23	13.33(3.66)	88.00(9.41)	5.79	88.33	52.59	15.45	84.14	180.00	21.87	183.53	196.63	25.30	198.00	39211	105764	1.70
S5	135.77	16.00(4.01)	61.33(7.82)	7.66	61.67	54.14	16.03	84.36	181.00	21.57	185.57	203.37	29.27	199.70	39123	100189	1.56
S6	155.70	20.00(4.27)	26.67(5.08)	6.52	27.03	63.65	19.23	94.52	183.00	22.26	188.07	195.30	32.53	192.00	39273	110170	1.81
S7	169.90	26.67(5.21)	13.33(3.68)	9.15	13.83	68.53	21.24	89.69	184.67	22.60	189.50	190.63	31.23	192.60	34951	97845	1.80
C.D. (0.05)	33.76	2	1.62	4.31	20.09	13.2	3.71	22.51	6.72	0.67	2.37	9.26	2.23	3.51			
C.V. (%)	13.78	28.62	15.12	38.48	28.07	13.51	12.55	15.44	2.09	1.72	0.72	2.61	4.24	0.99			
Soil type																	
pH																	
EC																	
OC																	
Variety & Duration																	
Applied NPK kg/ha																	
Available NPK kg/ha																	

(Values in parentheses are transformed values)

Table 4.2.2.1: Contd.

ZONE-III PUSA														
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Dry matter accumulation (g/m ²)		
			At 10 DAS	At 20 DAS								45 DAS	75 DAS	105 DAS
S1	3.17	4.23	42	44	99.00	223	218	92	2.48	21.42	79	211.67	494.00	792.67
S2	4.79	6.28	38	51	114.00	290	285	121	2.67	21.53	81	232.67	602.00	901.00
S3	4.37	5.66	39	50	111.33	276	270	105	2.63	21.37	80	221.00	550.33	846.00
S4	4.38	5.78	38	48	111.33	262	255	107	2.32	21.44	82	222.33	557.00	846.33
S5	4.40	5.87	38	49	109.33	270	263	105	2.48	21.15	82	227.33	564.33	863.00
S6	4.42	5.84	39	50	110.00	272	265	111	2.44	21.36	81	226.00	554.33	851.67
S7	3.50	4.60	44	48	105.33	243	238	101	2.42	21.15	81	211.00	503.67	804.67
C.D. (0.05)	0.64	0.85	4.12	4.12	8.48	33.23	31.07	6.41	0.27	0.41	2.38	25.1	49.94	59.87
C.V. (%)	8.71	8.75	5.82	4.77	4.39	7.12	6.81	3.4	6.11	1.08	1.66	6.36	5.14	3.99
Soil type	Sandy-loam													
pH	8.3													
EC	0.39													
OC														
Variety & Duration	Rajendra Nilam (110-115 days)													
Applied NPK kg/ha	120:60:40:10													
Available NPK kg/ha														

S1: Broadcasting of seeds
S2: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
S3: Raised bed sowing
S4: Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
S5: Tar-Vattar
S6: Brown manuring
S7: Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-III PUSA Cntd.												
	Weed population (no/m ²)		Weed biomass (g/m ²)		Soil available nutrients (kg/ha)			Soil available nutrients (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C RATIO
	At active tillering	At panicle initiation	At active tillering	At panicle initiation	N	P	K	N	P	K			
S1	23.67(4.89)	26.67(5.20)	5.18	24.60	212.67	11.20	111.00	210.67	11.17	110.33	55380	79252	0.43
S2	9.33(3.09)	10.00(3.24)	2.62	8.75	210.00	11.17	108.00	209.00	11.13	107.00	57772	119758	1.07
S3	11.33(3.42)	12.67(3.62)	3.76	14.21	209.00	11.07	109.00	209.00	11.02	108.67	59800	109103	0.82
S4	13.67(3.70)	12.67(3.54)	3.30	14.25	208.33	11.07	108.67	206.33	11.02	107.67	57460	109625	0.91
S5	12.33(3.57)	12.33(3.57)	3.12	12.66	206.67	10.77	110.67	205.00	10.73	108.67	57460	110182	0.92
S6	7.67(2.84)	8.67(3.00)	2.05	6.70	210.00	11.20	109.67	209.33	11.18	108.67	57720	110629	0.92
S7	19.00(4.36)	25.00(5.01)	5.26	24.76	209.67	11.27	110.67	208.33	11.22	111.00	55380	87591	0.58
C.D. (0.05)	1.07	1.02	1.15	6.28	6.3	0.46	6.15	6.65	0.46	5.76			
C.V. (%)	16.25	14.74	17.83	23.34	1.69	2.33	3.15	1.8	2.35	2.97			
Soil type													
pH													
EC													
Variety & Duration													
Applied NPK kg/ha													
Available NPK kg/ha													

(Values in parentheses are transformed values)

Table 4.2.2.1: Contd.

ZONE-III VARANASI										
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²	Plant height (cm)	Tillers/m ² (No.)	Panicle length (cm)	Test wt (g)	Weed population (no/m ²)		Weed biomass (g/m ²)
								At Active Tillering	At Panicle Initiation	
S1	3.34	10.52	179	100.13	227	24.38	25.58	187.67(13.51)	106.33(10.25)	82.54
S2	4.54	12.42	185	103.80	235	26.03	24.78	89.00(9.25)	60.33(7.69)	34.16
S3	3.04	9.18	188	106.53	259	25.67	26.02	62.67(7.94)	38.33(6.20)	28.63
S4	2.86	9.41	185	100.40	225	24.50	23.36	50.33(7.09)	20.00(4.52)	18.58
S5	3.87	12.67	169	100.67	228	25.00	24.84	139.67(11.78)	74.00(8.43)	52.30
S6	3.79	11.77	175	102.20	239	24.68	24.43	119.67(10.73)	65.67(8.06)	38.04
S7	3.96	9.96	167	103.00	236	24.30	24.37	162.00(12.74)	80.67(8.99)	94.76
C.D. (0.05)	1.03	3.97	13.39	1.06	33.92	1.31	1.27	3.16	2.47	68.25
C.V. (%)	15.96	20.55	4.22	0.58	8.09	2.96	2.89	17.04	17.96	76.94
Soil type	Loam soil									
pH	7.3									
EC										
OC	0.37									
Variety & Duration										
Applied NPK kg/ha										
Available NPK kg/ha										

(Values in parentheses are transformed values)

- S1: Broadcasting of seeds
- S2: Mechanized line sowing of seeds (Dibbler)
- S3: Raised bed sowing
- S4: Semi-Dry system (Sowing in dry soil and Wetflooding after one month of sowing)
- S5: Line sowing by kudali with tillage
- S6: Line sowing by kudali without tillage
- S7: Sprouted seeds in line sowing

Table 4.2.2.1: Contd.

ZONE-V JAGDALPUR													
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²			Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
			At 10 DAS	At 20 DAS	DAS								
S1	3.43	4.67	101	108	108	96.73	117	113	122	20.00	3.60	24.20	75
S2	6.64	8.99	58	60	60	99.39	197	243	129	25.43	4.03	26.07	76
S3	6.91	8.87	54	57	57	93.77	209	251	132	26.98	4.52	25.10	78
S4	6.27	7.90	53	56	56	93.57	187	200	133	24.63	4.13	25.21	76
S5	6.13	7.98	53	55	55	99.38	195	198	126	28.13	4.23	24.91	77
S6	6.25	8.21	61	63	63	98.72	183	177	136	27.47	4.37	25.08	76
S7	3.06	4.01	110	113	113	88.33	112	108	110	19.80	3.35	24.88	75
C.D. (0.05)	0.83	1.2	4.87	5.63	5.63	8.08	19.87	38.26	15.95	2.74	0.79	1.31	0.87
C.V. (%)	8.41	9.3	3.92	4.33	4.33	4.75	6.52	11.67	7.06	6.26	11.01	2.95	0.64
Soil type	-												
pH	-												
EC	-												
Variety & Duration	Samleshwari, 115 days to maturity												
Applied NPK kg/ha	100:50:30												
Available NPK kg/ha	245:12.20:350.25												

- S1: Broadcasting of seeds
- S2: Mechanized line sowing of seeds
- S3: Raised bed sowing
- S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
- S5- Any improved system in that particular location
- S6- Location specific high yielding Dry DSR method
- S7- Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

ZONE-V JAGDALPUR Contd.																	
Methods of Sowing	Dry mater accumulation (g/m2)			Harvest Index (%)	Total nutrients uptake (kg/ha)			Soil available nutrients (kg/ha) initial			Soil available nutrients (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha	Net returns Rs/ha	B:C Ratio
					N	P	K	N	P	K	N	P	K				
	45 DAS	75 DAS	at 105 DAS														
S1	428.29	713.82	951.76	42.44	46.73	26.35	57.12	216.00	18.33	340.00	225.33	21.00	384.67	51200	86011	34811	1.68
S2	1395.41	2325.68	3100.90	42.57	75.57	43.03	92.35	217.67	17.00	333.00	234.33	18.33	380.00	53560	166426	112866	3.11
S3	1483.86	2473.11	3297.47	43.85	84.90	52.09	105.80	214.33	19.00	343.33	226.00	19.00	370.00	58500	172502	114002	2.95
S4	1190.35	1983.91	2645.22	44.25	72.37	40.43	89.07	220.67	18.33	343.33	224.33	19.00	363.67	50750	156506	105756	3.08
S5	1236.35	2060.58	2747.44	43.40	94.12	59.30	120.83	218.67	17.33	352.67	225.33	16.00	349.67	54300	153074	98774	2.82
S6	1193.31	1988.84	2651.79	43.20	72.78	42.06	89.70	223.33	18.00	333.00	229.33	18.67	384.33	52360	156314	103954	2.99
S7	356.79	594.65	792.87	43.20	59.70	33.26	71.31	218.33	17.00	338.00	223.33	18.00	374.67	47800	76570	28770	1.60
C.D. (0.05)	240.8	401.32	535.1	2.93	7.98	3.81	9.9	6.94	4.23	13.2	5.93	2.87	9.6				0.39
C.V. (%)	13.01	13.01	13.01	3.81	6.21	5.05	6.22	1.79	13.3	2.18	1.47	8.7	1.45				8.52
Soil type																	
pH																	
EC																	
Variety & Duration																	
Applied NPK kg/ha																	
Available NPK kg/ha																	

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-V RAIPUR									
	Grain yield (t/ha)	Straw yield (t/ha)	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days to 50% flowering
S1	3.45	4.65	118.48	226	196	129	22.86	4.09	32.53	95
S2	4.33	5.83	120.39	284	247	154	23.29	4.16	33.20	95
S3	4.90	6.55	127.87	317	283	164	24.15	4.62	33.47	95
S4	4.50	6.06	121.41	289	254	158	23.49	4.33	32.97	95
S5	4.36	5.88	122.61	279	249	156	23.57	4.56	33.53	95
S6	4.77	6.41	123.52	309	277	160	23.78	4.64	33.57	96
S7	4.64	6.20	123.03	290	257	158	23.93	4.60	33.43	95
C.D. (0.05)	0.79	1.07	8.26	48.94	45.84	19.75	1.86	1.07	2.31	1.01
C.V. (%)	10.08	10.1	3.79	9.66	10.23	7.2	4.43	13.64	3.91	0.6
Soil type	Vertisols									
pH	6.90									
EC										
OC	0.5									
Variety & Duration	IGKV R1 (125 days)									
Applied NPK kg/ha	100:60:40									
Available NPK kg/ha	208.3:18.8:361.7									

- S1: Broadcasting of seeds
- S2: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
- S3: Raised bed sowing
- S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
- S5- Any improved system in that particular location
- S6- Location specific high yielding Dry DSR method
- S7- Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-V REWA													
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Dry matter accumulation (g/plant)		
			At 20 DAS	30 DAS								60 DAS	at harvest	
S1	3.49	5.24	172	83.09	234	199	149	25.36	4.04	22.10	2.05	12.13	34.17	
S2	4.55	6.83	182	87.06	243	209	141	23.79	3.67	22.87	2.35	13.63	36.10	
S3	2.63	3.94	145	89.65	230	206	154	25.55	4.25	23.63	2.30	13.13	35.60	
S4	3.71	5.56	178	91.72	233	205	130	25.79	3.58	24.33	2.61	14.00	37.33	
S5	3.37	5.06	168	90.38	234	205	131	23.86	3.55	25.20	2.56	13.07	36.40	
S6	3.74	5.60	181	89.22	239	208	136	24.65	3.76	26.33	2.37	14.47	38.20	
S7	4.05	6.07	168	82.79	234	208	133	24.01	3.72	22.83	2.47	14.23	37.47	
C.D. (0.05)	0.87	1.31	8.24	5.19	11.83	11.72	44.58	3.13	1.27	0.51	0.14	0.62	0.91	
C.V. (%)	13.41	13.44	2.72	3.33	2.83	3.2	18.02	7.12	18.84	1.2	3.34	2.59	1.4	
Soil type														
pH														
EC														
OC														
Variety & Duration														
Applied NPK kg/ha														
Available NPK kg/ha														

- S1: Broadcasting of seeds
S2: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
S3: Raised bed sowing
S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
S5- Any improved system in that particular location (lehi)
S6- Location specific high yielding Dry DSR method (high seed rate 25%)
S7- Farmers practice of the Dry DSR method of the region (line sowing)

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-VI NAWAGAM															
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²			Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/ panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Dry mater accumulation (g/m ²)		
			At 10 DAS	At 20 DAS										45 DAS	75 DAS	105 DAS
S1	4.86	5.78	60	88	100.60	206	167	224	24.07	4.19	18.00	75	210.67	434.73	645.07	
S2	5.87	6.28	63	92	101.20	227	208	259	24.60	4.33	18.37	77	200.00	403.18	603.18	
S3	5.89	6.43	65	92	101.80	245	198	271	24.53	4.68	19.17	76	195.33	390.84	590.84	
S4	5.62	6.01	64	92	91.93	251	226	262	24.07	4.55	19.80	75	180.67	369.24	569.24	
S5	5.18	5.59	67	90	93.53	251	194	274	25.27	4.96	19.40	75	189.67	459.76	659.76	
S6	5.99	6.47	67	89	102.67	256	227	282	25.40	4.96	19.37	77	219.67	470.22	658.94	
S7	4.69	5.24	66	86	96.13	203	159	237	24.40	4.34	19.03	76	213.67	382.07	612.47	
C.D. (0.05)	0.78	0.98	8.7	13.57	6.5	38.56	29.97	35.12	0.87	0.42	1.59	2.87	31.39	52.28	62.82	
C.V. (%)	8.08	9.18	7.6	8.49	3.72	9.26	8.56	7.64	1.99	5.19	4.69	2.12	8.76	7.07	5.7	
Soil type	-															
pH	7.88															
EC	0.61															
OC	0.77															
Variety & Duration	Mahisagar, 115-120 days															
Applied NPK kg/ha	-															
Available NPK kd/ha	-															

S1 - Broadcasting of seeds
 S2 - Mechanized line sowing of seeds (Dibbler, Happy seeder or any Drum seeder: Spacing as per the equipment specifications)
 S3 - Raised bed sowing (1 m raised bed and 4 rows of 20 cm spacing) (Details to be included)
 S4 - Semi-Dry system (Sowing in dry soil and Wet/flooding after one month of sowing)
 S5 - Any improved system like Tar Vattar method of DSR may be followed wherever feasible
 S6 - Location specific high yielding Dry DSR method
 S7 - Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-VI NAWAGAM Cntd.									
	Weed population (no/m ²)		Weed biomass (g/m ²)		Soil available nutrients (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C Ratio
	At active tillering	At panicle initiation	At active tillering	At panicle initiation	N	P	K			
S1	52.00(7.03)	101.67(10.10)	22.49	40.77	291.00	98.67	259.33	47843	134032	1.80
S2	61.00(7.70)	76.00(8.65)	27.12	42.20	276.33	96.33	259.33	47448	159650	2.36
S3	38.00(6.09)	64.00(7.83)	17.32	32.46	296.00	96.33	259.67	49077	160775	2.28
S4	44.33(6.53)	66.00(8.01)	23.81	27.67	289.33	99.67	259.00	48100	152857	2.18
S5	53.67(7.32)	90.67(9.45)	24.95	42.00	294.33	96.67	255.67	48284	141058	1.92
S6	49.33(6.94)	75.00(8.55)	22.84	45.71	291.67	97.67	258.00	47891	163258	2.41
S7	54.67(7.16)	102.67(10.13)	21.33	50.94	287.33	99.67	256.33	49093	128172	1.61
C.D. (0.05)	3.39	3.02	19.73	29.81	14.13	8.23	5.45			
C.V. (%)	27.31	18.93	48.55	41.62	2.74	4.73	1.19			
Soil type										
pH										
EC										
Variety & Duration										
Applied NPK kg/ha										
Available NPK kg/ha										

(Values in parentheses are transformed values)

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-VII GANGAVATHI										
	Grain yield (t/ha)	Straw yield (t/ha)	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle wt (g)	Test wt (g)	Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C RATIO
S1	3.08	3.58	88.60	172	158	170	2.76	14.20	49745	77083	0.55
S2	3.71	4.82	95.40	164	144	179	2.98	15.80	48220	92708	0.92
S3	4.15	5.22	89.00	151	148	185	3.08	16.20	50020	103750	1.07
S4	3.52	4.37	88.20	146	138	167	2.72	14.00	47820	88044	0.84
S5	-	-	-	-	-	-	-	-	-	-	-
S6	-	-	-	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)	1.26	2.45	0.31	35.7	28.44	0.75	0.01	0.1			
C.V. (%)	17.41	27.23	0.17	11.3	9.69	0.22	0.2	0.34			
Soil type	Black soil										
pH	-										
EC	-										
OC											
Variety & Duration	Tunghabhadra sona, 130-135 days										
Applied NPK kg/ha	-										
Available NPK kd/ha	-										

S1: Broadcasting of seeds

S2: Mechanized line sowing of seeds

S3: Raised bed sowing

S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)

S5- Any improved system in that particular location

S6- Location specific high yielding Dry DSR method

S7- Farmers practice of the Dry DSR method of the region

Table 4.2.2.1: Contd.

Methods of Sowing	ZONE-VII MANDYA										
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ² At 10 DAS	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
S1	3.92	8.98	68	102.19	451	425	175	24.52	4.41	24.18	84
S2	4.60	8.32	50	97.87	346	324	204	24.09	4.88	23.91	84
S3	4.42	10.53	47	106.49	357	335	209	23.08	4.45	23.14	84
S4	4.24	7.75	49	99.37	345	320	210	24.89	5.31	22.85	84
S5	4.52	8.67	22	98.71	396	374	206	24.85	5.13	22.11	85
S6	4.35	8.27	46	100.43	313	298	179	24.18	4.64	22.80	84
S7	4.90	9.24	44	99.96	330	310	197	23.68	4.82	23.67	84
C.D. (0.05)	0.72	1.83	5.72	9.01	80.99	70.03	30.74	1.69	1.46	1.83	0.78
C.V. (%)	9.11	11.67	6.92	5.03	12.56	11.56	8.76	3.92	17.1	4.42	0.52
Soil type	Red Sandy Loam										
pH	7.35										
EC	0.31										
OC	0.85										
Variety & Duration	KMP 175,115-120 days										
Applied NPK kg/ha	125:62:62										
Available NPK kg/ha	283.5:79:274										

S1: Broadcasting of seeds
S2: Mechanized line sowing of seeds - Happy weeder
S3: Raised bed sowing
S4- Semi-Dry system (Sowing in dry soil and Wet after one month of sowing)
S5- Any improved system in that particular location - Aerobic rice spacing at 25 cm X 25 cm
S6- Location specific high yielding Dry DSR method - Seed drill sowing at 25 cm row
S7- Farmers practice of the Dry DSR method of the region - Hand line sowing at 25 cm row

4.2.2.2 Evaluation of varieties for their suitability and enhancement of the productivity in Dry Direct Seeded Rice (Un-puddled soil), *kharif-2025*

One of the major challenges confronting the development of Dry DSR in India is poor choice of suitable varieties and variety breeding. Hence, the present trial is constituted to enhance the productivity of the Dry DSR with the following objectives 1) To identify the suitable and promising rice cultivars in dry direct seeded rice and 2) To assess the various agronomic parameters for suitability of rice cultivars in dry direct seeded rice establishment methods. The trial was conducted in three Zones, at four locations (**Nawagam, Rajendranagar, Raipur and Ranchi**). The trial was laid out in RBD with 13 treatments and replicated thrice. Treatments are T₁: DRRDhan 44 (early), T₂: Sabhagidhan (very early), T₃: DRRDhan 60, T₄: DRRDhan 42 (mid early), T₅: Vandana (rainfed upland), T₆: Anjali, T₇: Varalu, T₈: IRRI 1, T₉: IRRI 2, T₁₀: IRRI 3, T₁₁: Local check 1, T₁₂: Local check 2, T₁₃: Local check 3. The results are summarized and presented in **Table 4.2.2.2.** and the salient findings are given below.

In **Zone III**, at **Ranchi**, Naveen (mid early), other varieties recorded higher grain yields and comparable except BVD 111 (early). Similarly, higher straw yield was recorded in Naveen (mid early) Sabhagidhan (very early) and DRRDhan 42 (mid early). Naveen (mid early), DRR Dhan 42 (mid early) recorded higher number of panicles/m² and test weight. There was no significant difference among all varietal treatments in germination percentage.

In **Zone V**, at **Raipur**, CG Baraki Dhan-2, DRR Dhan 60 recorded higher grain and straw yield. Similarly, DRR Dhan60, CG Baranki Dhan-2 recorded higher number of tillers and panicles/m², panicle weight. DRRDhan44 (early) and Anjali recorded higher test weight. Anjali variety attained 50 % flowering at the earliest among all varietal treatments.

In **Zone VI**, at **Nawagam**, higher grain yield was recorded with Sabhagidhan (very early), DRRDhan44 (early), IRRI1, IRRI3, Mahisagar and GAR201. The Mahisagar variety recorded higher straw yield and comparable with other varietal treatments except DRRDhan 60, DRRDhan 42 (mid early) and Vandana (rainfed upland). Sabhagidhan (very early) variety attained higher percentage of germination, number of tillers/m², panicles and on par with DRR Dhan 44 (early) and DRRDhan 60. GAR 201 variety recorded highest test weight. Vandana (rainfed upland) variety attained 50 % flowering at the earliest, followed by Sabhagidhan (very early) variety.

In **Zone VII**, at **ARI-Rajendranagar**, IRRI1, DRRDhan 60 and Anjali recorded higher grain yields. Higher straw yield was recorded with DRRDhan 60, Vandana (rainfed upland), Anjali, Varalu, IRRI1 and A28433DT(Hybrid). KPS10329 variety recorded higher germination percentage and it was comparable with other varietal treatments except IRRI1 variety. There was no significant difference among all varietal treatments in plant population at 20 DAS. Higher number of tillers/m², panicles/m² were recorded in IRRI1, DRRDhan 60, Anjali, A2 8433DT (Hybrid) and KPS10329. DRR Dhan44 (early), IRRI1 recorded higher panicle weight variety. Higher test weight was recorded with IRRI1 DR Dhan 42 (mid early), Vandana (rainfed upland) and KPS10329. Vandana (rainfed upland) variety attained 50 % flowering at the earliest among all varietal treatments.

In four Zones (four locations), under dry Direct Seeded Rice System, varieties Naveen, CG Baraki Dhan 2, DRRDhan42, DRRDhan60, DRRDhan44 and IRRI1 were found suitable and high yielders.

Table 4.2.2.2: Evaluation of varieties for suitability and enhancement of productivity in Dry direct seeded rice (Un -Puddle soil), Kharif-2025.

Cultivars	ZONE-IV-NAWAGAM									
	Grain yield (t/ha)	Straw yield (t/ha)	Germination %	Plant population no/m ² (20 DAS)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle weight (g)	Test weight (g)	Days to 50% flowering	Cost of cultivation (Rs/ha)
1. DRR Dhan 44 (Early)	4.58	5.19	75.00	60.67	245	218	3.3	21.23	85.67	47650
2. Sabhagidhan (Very Early)	4.65	5.24	78.33	53.33	255	228	2.6	23.5	75	47650
3. DRR Dhan 60	3.97	4.56	75.33	61.33	236	204	2.61	24.2	86	47650
4. DRR Dhan 42 (Mid Early)	3.87	4.38	73.00	55.67	215	173	3.22	23.43	89.33	47650
5. Vandana (rainfed upland)	3.73	4.44	71.00	51.67	223	181	3.69	24.03	72.67	47650
6. Anjali	4.05	5.16	71.33	56.00	211	190	2.46	26.4	89.33	47650
7. Varalu (Upland-western zone)	4.08	5.22	73.67	54.00	222	200	2.91	19.93	94.67	47650
8. IRRI 1	4.38	5.26	72.00	56.67	240	208	2.47	25.5	107.33	47650
9. IRRI 2	3.93	5.04	71.33	52.33	201	176	4.24	21.5	102.33	47650
10. IRRI 3	4.28	5.26	71.00	58.67	237	211	3.82	24.7	99.33	47650
11. LC 1	4.61	5.55	72.67	53.33	230	205	3.09	18.47	98.33	47650
12. LC 2	4.53	5.33	71.33	61.67	225	196	3.53	31	87	47650
13. LC 3										
Expt. Mean	4.22	5.05	73	56.28	228	199	3.16	23.66	90.58	
C.D. (0.05)	0.47	0.75	4.64	9.22	32	32	0.37	0.84	2.77	
C.V. (%)	6.57	8.72	3.76	9.68	8	10	6.98	2.1	1.81	
Soil type										
pH	7.88									
EC	0.61									
Soil Organic Carbon	0.77 %									
Applied N:P:K:Zn kg/ha	80:25:00:25									
Available NPK kg/ha	297:102:262									
										Local Check 1 - Mahisagar (115-120 days)
										Local Check 2 - GAR 201 (115-120 days)

Table 4.2.2.2: Contd.

Cultivars	ZONE-VII-ARI-RAJENDRANAGAR									
	Grain yield (t/ha)	Straw yield (t/ha)	Germination %	Plant population no/m ²	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle weight (g)	Test weight (g)	Days to 50% flowering	Cost of cultivation (Rs/ha)
				At 20 DAS						
1. DRR Dhan 44 (Early)	3.78	5.84	94	33	439	376	4.95	22.57	97	44250
2. Sabhagidhan (Very Early)	4.22	6.27	95.67	31.67	495	506	2.65	22.37	82	44250
3. DRR Dhan 60	5.47	8.73	95	33.67	529	516	2.41	14.47	110.67	44250
4. DRR Dhan 42 (Mid Early)	4.53	5.28	95.33	33	514.67	476	2.52	24.43	83.67	44250
5. Vandana (rainfed upland)	4.81	7.14	96.33	32.67	488.33	423	2.96	23.53	74	44250
6. Anjali	5.89	8.07	96	32	561.67	443	3.16	18.9	78	44250
7. Varalu (Upland-western zone)	4.45	7.27	92.33	33	497	419	3.09	19.1	92	44250
8. IRRI 1	6.1	7.49	87.67	32.33	593.33	566	4.23	24.57	96	44250
9. IRRI 2	-	-	-	-	-	-	-	-	-	-
10. IRRI 3	-	-	-	-	-	-	-	-	-	-
11. LC 1	4.48	5.99	94.67	33.67	518.67	496	3.18	13.67	96	44250
12. LC 2	3.99	8.67	96	32.67	544.67	476	4.04	18.8	110.67	44250
13. LC 3	4.89	5.56	96.67	33.33	549	464	4.14	24.53	92	44250
Expt. Mean	4.78	6.94	94.52	32.82	520.94	469.21	3.39	20.63	92	
C.D. (0.05)	0.85	1.74	4.65	2.06	68.87	76.59	0.74	1.07	1.94	
C.V. (%)	10.45	14.74	2.89	3.68	7.76	9.58	12.78	3.05	1.23	
Soil type										
pH										
EC										
Soil Organic Carbon										
Applied NPK kg/ha										
Available NPK kg/ha										

Table 4.2.2.2: Contd.

Cultivars	ZONE-V-RAIPUR						
	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle weight(g)	Test weight(g)	Days to 50% flowering
1. DRR Dhan 44 (Early)	3.77	5.85	242	217	3.30	26.7	81
2. Sabhagidhan (Very Early)	3.57	5.76	245	204	3.50	24.3	78
3. DRR Dhan 60	4.42	6.45	296	272	4.05	16.77	88
4. DRR Dhan 42 (Mid Early)	3.56	5.63	236	213	3.46	23.8	81
5. Vandana (rainfed upland)	-	-	-	-	-	-	-
6. Anjali	1.72	3.16	220	194	2.64	26.43	71
7. Varalu (Upland-western zone)	-	-	-	-	-	-	-
8. IRRI 1	-	-	-	-	-	-	-
9. IRRI 2	-	-	-	-	-	-	-
10. IRRI 3	-	-	-	-	-	-	-
11. LC 1	3.92	6.26	250	223	3.67	24.4	82
12. LC 2	3.86	6.21	252	225	3.97	22.2	79
13. LC 3	5.1	7.41	285	246	4.39	23.13	81
Expt. Mean	3.74	5.84	253	224	3.62	23.47	80.13
C.D. (0.05)	0.83	1.13	38	40	0.66	1.14	1.67
C.V. (%)	12.65	11.02	9	10	10.46	2.77	1.19
Soil type	Vertisols						
pH	7.0						
EC	Lock Check1 - Bastar Dhan-1 (105-110days)						
OC	Lock Check2 - Danteshwari (100-105 days)						
Soil Organic Carbon	0.51						
Applied NPK kg/ha	Lock Check3 -CG Barani Dhan-2 (110-115 days)						
Available NPK kg/ha	100:60:40						
	209.5:20.1:348.8						

Table 4.2.2.2: Contd.

Cultivars	ZONE-III-RANCHI				
	Grain yield (t/ha)	Straw yield (t/ha)	Panicle/m ² (No.)	Test weight (g)	Germination %
1. DRR Dhan 44 (Early)	-	-	-	-	-
2. Sabhagidhan (Very Early)	4.47	6.56	234.00	24.35	85.67
3. DRR Dhan 60	-	-	-	-	-
4. DRR Dhan 42 (Mid Early)	4.99	7.24	261.33	25.35	90
5. Vandana (rainfed upland)	-	-	-	-	-
6. Anjali	-	-	-	-	-
7. Varalu (Upland-western zone)	-	-	-	-	-
8. IRRI 1	-	-	-	-	-
9. IRRI 2	-	-	-	-	-
10. IRRI 3	-	-	-	-	-
11. LC 1	5.04	7.55	264.00	25.86	87.33
12. LC 2	4.30	6.26	222.00	24.64	86.33
13. LC 3	3.45	5.54	178.67	23.35	89.33
Expt. Mean	4.45	6.63	232.00	24.71	87.73
C.D. (0.05)	0.79	1.24	24.72	0.60	3.98
C.V. (%)	9.42	9.93	5.66	1.30	2.41
Soil type					
pH					
EC	Lock Check1 -Naveen (Mid Early)				
OC	Lock Check2 - Lalat (mid Early)				
Soil Organic Carbon	Lock Check3 -BVD 111 (Early)				
Applied NPK kg/ha	80:40:30 kg NPK/ha				
Available NPK kg/ha					

4.2.3. Suitable package of practices for higher yield in Wet DSR

4.2.3.1. Identification of suitable sowing method of Wet DSR for higher productivity in different zones (Puddled) Soil

Direct wet seeding offers the advantage of faster and easier planting, reduced labour and less drudgery, 7-10 days earlier crop maturity, more efficient water use and higher tolerance to water deficit, less methane emission, and often higher profit in areas with assured water supply. This method of seeding in the past has received relatively less attention than transplanting. Sowing of sprouted rice seed or wet-seeded rice in puddled soil though becoming increasingly important as a method of crop establishment under lowland rice is beset with weed problems, particularly grassy weeds besides other management practices. Weeds emerge at about the same time that the rice seeds germinate, and therefore the yield losses caused by weeds will become greater with the trend towards wet seeding. Effective weed control is one of the key issues and major requirements to ensure a successful wet-seeded rice crop. Furthermore, varieties must be improved for early seeding vigour, weed competitiveness, submergence tolerance to survive untimely rainfall during stand establishment and drought tolerance to survive dry conditions during germination and later growth stages, and for lodging resistance at maturity. Hence the present trial is constituted to enhance the productivity of the wet DSR with the following objectives 1) To identify suitable and cost-effective agronomic management practices to enhance the productivity of wet-DSR) To maximize the resource use efficiency. The trial was conducted at 15 locations in six Zones (**Aduthurai, Chatha, Chiplima, Coimbatore, Karjat, Mandya, Maruteru, Navasari, Nawagam, Pattambi, Puducherry, Pusa, Rewa, Titabar and Varanasi,**). The trial was conducted in RBD and replicated thrice. The treatments were S₁: Broadcasting of seeds and S₂: Manual line sowing, S₃: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum seeder, spacing as per the equipment specifications) S₄: Raised bed sowing, S₅: Any improved system in that particular location and S₆: Location specific high yielding wet DSR method, and S₇: Farmers' practice of the wet DSR method of the region. The results are summarized and presented in **Table 4.2.3.1** and the salient findings are as given below.

In **Zone II**, at **Chatha**, in Sandy clay loam soils, broadcasting of seeds and manual line sowing were significantly superior in grain yield and straw yield of Basmati 370. The plant population, growth parameters viz., plant height, tillers/m², yield attributes viz., panicles/m², grains/panicle, panicle weight, test weight, dry matter production were also higher in broadcasting and manual line sowing. The weed population and weed biomass were lowest in line sowing method both at Active Tillering and Panicle Initiation.

In **Zone III** at **Chiplima**, line sowing (manual/mechanical), pre-germinated seed sowing are promising in terms of grain yield and straw yield of variety Hasanta. The crop growth and yield parameters viz., plant height, panicle length, test weight, grains/panicle, dry matter accumulation at 45, 75 and 105 DAS. The weed population and weed biomass at Active Tillering and Panicle initiation stage showed lowest in mechanized line sowing and pre-soaked seed sowing. The analysis of economics showed significantly high B:C Ratio of 2.63 with mechanical line sowing followed by manual line sowing. AT **Chinsurah**, manual or

mechanical line sowing and dibbling at 25 cm x 25 cm recorded higher grain yield of CR Dhan 312 yield attributes of panicle/m² and panicle weight are in support of grain yield in clay loam soils. In sandy loam soils of **Pusa**, Rajendra Nilam recorded significantly high grain yield with manual or mechanical line sowing, raised bed system, Tar-vattar or brown manuring method. Straw yield reflected similar trend. The plant population, growth parameters, yield attributes except panicle weight and test weight were significantly higher with the above methods except broadcasting and farmers practice. The dry matter accumulation at 45, 105 DAS was not significant among sowing methods, whereas at 75 DAS, the line sowing, raised bed, Tar-vattar and brown manuring were significant. Similar trend was observed in weed population and weed biomass at Active Tillering and Panicle Initiation with lowest in brown manuring and manual line sowing. The soil nutrient status before sowing and post-harvest was not influenced by sowing methods. The analysis of economics showed higher B:C ratio of line sowing method at Varanasi,

In **Zone IV**, at **Titabar**, variety Numoli in clay loams showed best performance and recorded higher grain yield and straw yield under mechanized line sowing followed by raised bed system. The plant population, plant height, Tillers/m², grains/panicle, panicle weight and test weight were significantly higher in mechanized line sowing and raised bed system. The dry matter accumulation at 45, 75 and 105 DAS followed similar trend of growth parameters. The weed population and weed biomass at Active Tillering and Panicle Initiation were lowest in mechanized line sowing followed by manual sowing methods. The soil available nutrient status at pre-sowing and post-harvest stages was not influenced by sowing methods, but the plant nutrient uptake of N,P and K was significantly high in mechanized line sowing method.

In **Zone V**, at **Rewa**, the beushening method, lehi method and manual line sowing methods were found promising and superior over other methods, The growth and yield attributes also exhibited similar trend in support of yield parameters except plant height, dry matter accumulation and panicle weight.

In **Zone VI**, at **Karjat**, 8 row drum seeder (20 cm lines), dibbling (20 cm x 20 cm), raised bed system recorded higher grain yield, straw yield and superior over others. The growth, dry matter accumulation and yield attributes contributed to the higher grain yield in these sowing methods. The weed population and weed biomass were significantly low in drum seeder (20 cm), dibbling 20 cm x 20 cm and raised bed systems. The B:C ratio was also higher with these methods indicating the economic feasibility of adopting drum seeder method. At **Navsari**, in clayey soils, the aerobic system recorded highest grain yield and straw yield of GNR-3 and superior over others. Line sowing, raised bed system and farmers method were comparable. All the growth parameters, yield attributes, soil available nutrient status of pre-sowing and post-harvest were comparable and not influenced by sowing methods except panicle weight. The weed biomass was significantly low in aerobic method. The analysis of economics reported higher B:C ratio with line sowing and raised bed system. At **Nawagam**, in clay loam soils, variety Mahisagar exhibited superior performance with mechanized line sowing, raised bed sowing, drum seeder 30 cm line sowing method regarding grain yield, panicle number, panicle weight. The dry matter accumulation at 75 and 105 DAS was highest

in drum seeder sowing (30 cm lines). Sowing methods did not influence weed population, weed biomass, soil available nutrient status at harvest stage. The economics of the field trials showed higher B:C ratio in mechanized line sowing.

At **Zone VII**, at **Aduthurai**, line sowing, semi dry system recorded higher grain yield. The mechanized line sowing (drum seeding) recorded higher growth and yield attributes, contributed to higher yield. The total weed population and sedges population at Panicle initiation stage was significantly low with the above methods. The weed biomass at both AT and PI stage was significantly low with line sowing i.e., with mechanized sowing at Active Tillering stage & manual line sowing at Panicle Initiation stage respectively. At **Coimbatore**, drum seeder sowing and paddy+daicha sowing by drum seeder were promising methods with higher grain yield and straw yield. The growth and yield attributes, dry matter accumulation at 105 DAS were higher in drum seeder method with minimum weed population at both Active Tillering and Panicle Initiation stages. The cost of cultivation and returns obtained showed higher B:C ratio with the drum seeder sowing method. At **Mandya**, in red sandy loam soils, all sowing methods were comparable and superior over farmers method of broadcasting dry seed of variety KMP 220. At **Maruteru**, MTU 1262 showed promising grain yield in line sowing and raised bed methods. The yield attributes were higher in these methods with lower weed population and weed biomass both at Active Tillering and Panicle Initiation stages. At **Pattambi**, the broadcasting method and Drum seeder (with all open holes) method were found promising and recorded higher growth yield attributes and grain yield except panicle weight, test weight, panicle length, grains/panicle. The B:C ratio was highest with manual line sowing followed by drum seeder sowing. At **Puducherry**, the drum seeder sowing recorded significantly superior performance in terms of grain yield, yield attributes, B:C ratio with lowest weed population and weed biomass at both AT and PI stages.

Rabi 2024-25

In **Zone VII**, at **Puducherry**, higher grain yield was recorded in mechanized line sowing and superior over others. The straw yield was comparable in all sowing methods. Mechanized line sowing recorded highest number of tillers/m², yield attributes viz., panicle/m², panicle weight and test weight; reduced weed population and weed biomass at vegetative and panicle initiation stage. Mechanized line sowing also recorded the highest B:C ratio.

At **Pattambi**, higher grain yield was recorded with drum seeder (all holes open) and comparable with broadcasting method. Whereas, higher straw yield was recorded with broadcasting and raised bed system. Broadcasting, raised bed system and drum seeder method recorded the highest plant population at 15 DAS, of tillers/m² and panicles/m², grains/panicle. The panicle length, panicle weight, test weight and days to 50% flowering etc were comparable in all sowing methods. At 105 DAS, the raised bed system recorded higher dry matter accumulation followed by broadcasting method.. At Active Tillering and Panicle Initiation stages, drum seeder (all holes open) method significantly reduced the weed population and weed biomass.

Based on the results, it was concluded that, mechanized line sowing (drum seeder) consistently recorded higher grain yield followed by manual line sowing and raised bed sowing. At several locations (e.g., **Chiplima, Titabar, Chinsurah** and **Nawagam**), line sowing and improved methods achieved peak yields of 5.3–5.9 t/ha, along with better growth and weed suppression, whereas at **Puducherry**, the highest grain yield of 6.62 t/ha was recorded, highlighting its superior productivity under favourable conditions. However, at a few locations (e.g., **Mandya** and **Pattambi**), yield differences among methods were non-significant, indicating comparable performance under specific conditions.

Table 4.2.3.1: Identification of suitable sowing method of Wet DSR for higher productivity in different zones (Puddle soil), kharif 2025.

Methods of crop Sowing	ZONE-II CHATHA																
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²	Plant height (cm)	Tillers/m ² (No.)	Panicle/ m ² (No.)	Grains/ panicle (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Dry mater accumulation (g/m2)			Weed population (no/m ²)		Weed biomass (g/m ²)	
											45 DAS	75 DAS	105Das	At Active Tillering	At Panicle Initiation	AT stage	PI stage
S1	2.76	5.95	81.33	111.67	224	200	56.33	1.35	20.67	107.67	137.33	341.33	539.67	13.67(3.76)	60.33(7.80)	5.77	78.33
S2	3.19	6.96	102.00	149.67	269	221	66.33	1.53	21.57	103.33	175.00	374.67	579.00	9.33(3.13)	37.00(6.12)	5.31	41.92
S3	3.17	6.69	95.00	139.33	238	210	63.00	1.45	21.30	105.33	168.67	360.00	567.00	10.33(3.29)	43.33(6.62)	5.53	54.32
S4	2.69	5.89	74.67	104.00	217	186	54.00	1.33	20.37	109.33	133.33	326.33	537.00	10.67(3.34)	48.67(7.01)	5.54	57.3
S5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)	0.03	0.07	3.14	10.31	3	5	7.02	0.01	0.11	1.00	7.90	5.61	7.20	0.33	0.37	0.27	7.51
C.V. (%)	0.53	0.56	1.78	4.09	1	1	5.87	0.42	0.27	0.47	2.58	0.80	0.65	4.88	2.67	2.42	6.49
Soil type	Sandy clay loam																
pH	8.03																
Soil organic carbon	0.57																
OC	Basmati 370, 145-150 days																
Variety	30/20:10																
Applied NPK kg/ha	245:14:146																
Available NPK kg/ha																	

- S1: Broadcasting of seeds
- S2: Manual line sowing
- S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
- S4: Raised bed sowing
- S5- Any improved system in that particular location
- S6- Location specific high yielding Wet DSR method
- S7- Farmers practice of the Wet DSR method of the region

Table 4.2.3.1: Contd.

	ZONE-III CHIPLIMA										
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ² at 10DAS	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Panicle length(cm)	Test wt (g)	Days for 50% flowering	Grains/ panicle (No.)
S1	3.53	4.53	196.67	111.93	269	251	5.70	26.17	23.33	89.67	115.00
S2	5.00	5.83	131.00	118.67	275	262	5.67	27.17	22.67	96.33	121.00
S3	5.27	5.83	145.67	119.97	280	274	5.90	27.50	23.33	97.33	126.67
S4	3.70	4.40	125.67	113.83	238	230	5.67	26.50	21.00	92.00	117.33
S5	-	-	-	-	-	-	-	-	-	-	-
S6	-	-	-	-	-	-	-	-	-	-	-
S7	3.57	4.20	201.00	110.87	219	207	5.40	26.03	22.00	89.00	122.33
C.D. (0.05)	0.40	0.44	9.47	5.33	15	21	1.05	1.49	2.44	4.26	6.03
C.V. (%)	5.12	4.83	4.66	2.59	3	5	10.33	3.15	6.09	2.45	2.78
Soil type											
pH	5.5										
EC											
OC	0.7										
Variety & Duration	HASANTA (145-150 DAYS)										
Applied NPK kg/ha	80:40:40										
Available NPK kg/ha	165-19-121										

S1: Broadcasting of seeds

S2: Manual line sowing

S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)

S4: Raised bed sowing

S5:-

S6:-

S7- Farmers practice of the Wet DSR method of the region (Pre germinated seed sowing)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-III CHIPLIMA (Contd.)									
	Dry mater accumulation (g/m ²)			Cost of Cultivation (Rs/ ha)	Gross returns (Rs/ ha)	B:C Ratio	Weed population (no/m ²)		Weed biomass (g/m ²)	
							At Active Tillering	At Panicle Initiation	At Active Tillering	At Panicle Initiation
	45DAS	75DAS	105DAS							
S1	131.87	208.47	306.30	75886	90505	1.53	36.67(6.09)	6.67(2.68)	65.20	15.20
S2	156.93	238.2	332.77	77213	127200	2.13	24.67(5.01)	5.33(2.41)	53.00	12.00
S3	163.53	254.27	365.13	65047	133517	2.63	21.33(4.66)	4.00(2.11)	49.80	8.07
S4	148.17	235.33	323.40	72905	94253	1.67	30.67(5.58)	7.00(2.73)	63.13	16.73
S5	-	-	-	-	-	-	-	-	-	-
S6	-	-	-	-	-	-	-	-	-	-
S7	145.47	227.17	320.00	75353	90794	1.57	40.33(6.39)	7.67(2.85)	68.77	17.40
C.D. (0.05)	14.05	21.8	19			0.2	0.59	0.2	8.52	2.77
C.V. (%)	5.24	5.26	3.73			5.85	6.93	4.69	9.79	13.33
Soil type										
pH										
EC										
OC										
Variety & Duration										
Applied NPK kg/ha										
Available NPK kg/ha										

(Values in parentheses are transformed values)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-III CHINSURAH			
	Grain yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)
S1	4.6	314	272	2.80
S2	5.18	354	307	3.16
S3	5.2	355	308	3.17
S4	4.81	328	285	2.94
S5	5.32	363	314	3.25
S6	-	-	-	-
S7	4.84	331	290	2.95
C.D. (0.05)				
C.V. (%)				
Soil type				
pH	0.57	39	32	0.35
EC	6.4	6	6	6.39
OC	Clay loam			
Variety	CR Dhan 312			
Applied NPK kg/ha	80-40-40			
Available NPK kg/ha				

- S1: Broadcasting of seeds (Broadcast Wet-DSR)
S2: Manual line sowing (Manual Line-sown Wet-DSR)
S3: Mechanized line sowing of seeds (Drum Seeder Wet-DSR)
S4: Raised bed system (Sowing in 1 m beds raised to height of 15 cm)
S5: Dibbling at 25 cm x 25 cm spacing (Wet-DSR)
S6:
S7-Farmers wet DSR Method

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-III PUSA									
	Grain yield (t/ha)	Straw yield (t/ha)	Plant		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle wt (g)	Test wt (g)
			population no/m ²	AT 15 DAS						
S1	3.26	4.38	42.00	101.67	226	217	98.67	2.46	21.33	
S2	4.93	6.46	43.00	117	294	286.33	125	2.62	21.52	
S3	4.40	5.85	44.00	117.33	285.67	282	116.67	2.71	21.39	
S4	4.53	5.99	41.67	116	266.33	256.67	114.67	2.33	21.46	
S5	4.52	6.01	41.33	116.67	280.33	271	116	2.47	21.19	
S6	4.51	6.01	40.00	113.33	273	266	117.67	2.41	21.26	
S7	3.70	4.91	46.33	107.67	251.33	239	108.33	2.43	21.21	
C.D. (0.05)	0.66	0.81	4.09	6.7	35.59	35.13	8.15	0.26	0.51	
C.V. (%)	8.74	8.00	5.39	3.34	7.46	7.6	4.02	5.9	1.35	
Soil type	Sandy loam									
pH	8.31									
EC	0.39%									
OC	Rajendra Nilam (110-115 days)									
Variety & Duration	120:60:40:10									
Applied NPK kg/ha										
Available NPK kg/ha										

S1: Broadcasting of seeds

S2: Manual line sowing

S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)

S4: Raised bed sowing

S5- Any improved system in that particular location (Tar-vattar)

S6- Location specific high yielding Wet DSR method (Brown manuring)

S7- Farmers practice of the Wet DSR method of the region

Table 4.2.3.1: Contd.

ZONE-III PUSA (Contd.)																
Methods of Sowing	Dry mater accumulation (g/m2)			Weed population (no/m ²)		Weed biomass (g/m ²)		Soil available nutrients (kg/ha) at Presowing			Soil available nutrients (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C Ratio
	45 DAS	75 DAS	105 DAS	At Active Tillering	At Panicle Initiation	AT stage	PI stage	N	P	K	N	P	K			
S1	221.33	520.67	817.33	18.00(4.28)	22.67(4.79)	4.42	23.6	215	11.97	116.33	214.3	11.94	115.6	55380	81688	0.48
S2	251.67	628	927.33	4.00(2.11)	6.67(2.65)	1.51	8.11	213.67	11.6	114	209.83	11.57	113.27	59540	123252	1.07
S3	238.67	583.33	869.33	7.00(2.70)	8.67(2.99)	2.73	13.33	214	11.6	115.67	210.97	11.57	114.93	56420	110083	0.95
S4	235	585	878.33	10.33(3.20)	12.33(3.50)	2.55	12.92	211.33	11.77	114.67	207.64	11.74	113.93	59800	113381	0.9
S5	241.67	588.67	888.33	9.33(3.07)	12.00(3.47)	2.35	12.64	213.33	11.77	113.67	208.83	11.74	112.93	56420	113085	1.00
S6	237.33	576	874.33	3.00(1.86)	4.00(2.11)	1.21	6.08	215.33	11.73	116.33	210.5	11.7	115.6	56680	112934	0.99
S7	229.67	532.67	838.67	11.00(3.30)	15.67(3.97)	4.03	16.31	214.33	11.87	116.33	210.14	11.84	115.6	55380	92566	0.67
C.D. (0.05)	26.63	51.52	69.13	1.14	1.05	1.25	4.08	6.7	0.42	5.04	6.79	0.42	5.04			
C.V. (%)	6.33	5.05	4.46	21.78	17.58	26.12	17.28	1.76	2.01	2.46	1.81	2.02	2.47			
Soil type																
pH																
EC																
OC																
Variety & Duration																
Applied NPK kg/ha																
Available NPK kg/ha																

(Values in parentheses are transformed values)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-III VARANASI											
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population		Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population (no/m ²)			
			no/m ²	At 15 DAS					At Active tillering	At panicle initiation	Weed biomass (g/m ²)	
											AT stage	PI stage
S1	3.21	9.39	188.83	243.00	243	1.3	24.92	96.67(9.85)	32.86(5.74)	29.72	12.02	
S2	3.79	10.11	191.67	284.00	263	1.45	28.42	84.33(9.19)	44.48(6.67)	47.7	13.35	
S3	4.27	10.44	195.00	283.67	284	1.67	22.64	51.00(7.14)	87.39(9.34)	24.22	42.78	
S4	5.17	11.18	192.67	309.67	310	1.82	26.15	23.67(4.87)	41.96(6.42)	14.75	14.43	
S5	4.45	10.52	178.50	300.67	301	1.68	27.2	35.00(5.92)	19.80(4.49)	22.37	11.49	
S6	3.88	9.64	181.33	283.67	284	1.55	20.61	76.67(8.65)	32.80(5.62)	30.08	24.48	
S7	3.13	9.38	174.00	237.33	228	1.43	16.15	157.00(12.53)	73.47(8.59)	49.03	31.51	
C.D. (0.05)	0.53	0.70	12.34	34.80	32.64	0.14	2.39	1.64	1.38	30.69	10.16	
C.V. (%)	7.52	3.88	3.73	7.05	6.72	5.09	5.65	11.1	11.61	55.42	26.63	
Soil type												
pH	7.1											
EC												
OC	0.39%											
Variety & Duration Applied	HUR 156 (130-135)											
NPK kg/ha												
Available NPK kg/ha												

(Values in parentheses are transformed values)

S1: Broadcasting of seeds

S2: Manual line sowing

S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)

S4: Raised bed sowing

S5- Any improved system in that particular location

S6- Location specific high yielding Wet DSR method

S7- Farmers practice of the Wet DSR method of the region

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-IV TITABAR													
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Dry mater accumulation (g/m2)		
			no/m ²	At 30 DAS								45 DAS	75 DAS	105 DAS
S1	4.37	9.03	126.67		132.17	261	249.33	170.67	4.53	24.37	106	153	360	962.33
S2	5.00	10.40	166.67		130.93	268.67	261	210	5.00	23.93	105	153.33	376.67	1046
S3	5.87	14.23	174.33		142	319	306	256	6.47	24.53	105	176.67	427.67	1172
S4	5.60	12.10	160.67		130.33	286.67	276.67	243.33	5.60	24.8	104.33	166.67	408	1048
S5	-	-	-		-	-	-	-	-	-	-	-	-	-
S6	4.73	9.63	149.67		133.57	263.67	247.33	186	4.80	24.43	105	155.67	361.67	976.67
S7	3.70	8.17	137.67		135.03	255.33	236.33	151.67	3.80	24.27	104.67	143	346.67	879
C.D. (0.05)														
C.V. (%)														
Soil type														
pH	0.61	2.06	26.5		12.13	26.5	24.55	44.81	0.71	1.49	1.85	11.24	33.47	81.3
EC	6.84	10.69	9.54		4.98	5.28	5.14	12.14	7.78	3.35	0.97	3.91	4.84	4.41
OC	Clay loam													
	5.4													
	0.56%													
Variety & Duration														
Applied NPK kg/ha														
Available NPK kg/ha														

S1: Broadcasting of seeds(Soaked & sprouted)

S2: Manual line sowing

S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)

S4: Raised bed sowing

S5:

S6- Location specific high yielding Wet DSR method(Drum seeding)

S7- Farmers practice of the Wet DSR method of the region (broadcasting)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-IV TITABAR												
	Weed population (no/m ²)		Weed biomass (g/m ²)		Plant Nutrients Uptake(kg/ha)			Soil available nutrients (kg/ha) at Pre sowing			Soil available nutrients (kg/ha) at Post harvest		
	At Active Tillering	At Panicle Initiation	AT stage	PI stage	N	P	K	N	P	K	N	P	K
S1	26.67(5.19)	22.67(4.79)	11.03	5.53	141.37	21.23	123.2	253.33	17.73	129.77	239.37	19.53	124.9
S2	27.00(5.20)	24.33(4.98)	11.17	4.83	164.8	27.6	146	250.13	18.37	126.9	235.2	18.3	123.77
S3	26.00(5.07)	19.00(4.40)	10	4.37	202.47	37.63	211.3	242.2	18.33	129.4	233.9	20	124.47
S4	27.67(5.30)	21.67(4.68)	10.8	5.5	179.53	32.1	166.63	231.23	19.9	126.9	220.57	19.43	124.93
S5	-	-	-	-	-	-	-	-	-	-	-	-	-
S6	27.33(5.25)	23.00(4.82)	10.53	7.27	150.3	27.7	135.4	254	19.6	130.9	242.1	19.9	126.47
S7	26.00(5.11)	22.33(4.76)	8.67	5.83	120.43	23.67	112.37	247.7	19.13	130.7	236.8	19.7	128.7
C.D. (0.05)													
C.V. (%)	1.31	1.04	5.96	3.11	19.25	6.41	42.14	28.47	4.25	9.78	23.49	4.42	14.72
Soil type	13.89	12.02	31.59	30.79	6.62	12.45	15.53	6.35	12.39	4.17	5.5	12.48	6.44
pH													
EC													
OC													
Variety & Duration Applied NPK kg/ha													
Available NPK kg/ha													

(Values in parentheses are transformed values)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-V REWA												
	Grain yield (t/ha)	Plant population no/m ²		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Dry matter accumulation (g/m2)		
		At 15 DAS									45 DAS	75 DAS	105 DAS
S1	2.23	130.67		92.44	324	324	133.55	25.00	4.34	21.01	184.01	465.45	1737.97
S2	2.52	133.00		91.00	323	308	133.00	26.92	4.23	23.37	153.37	390.61	1602.89
S3	2.20	136.00		91.44	357	335	155.33	26.74	3.64	21.78	136.47	431.03	1389.8
S4	1.00	130.00		92.30	319	298	151.11	26.92	3.81	21.84	169.23	389.76	1698.25
S5	2.93	132.00		93.00	317	301	146.11	24.82	4.81	22.15	186.49	330.43	1766.95
S6	2.55	132.67		95.11	325	303	125.89	25.88	4.12	22.02	145.68	314.51	1452.99
S7	2.58	134.33		90.89	343	319	126.62	21.70	4.41	22.7	178.23	302.86	1775.41
C.D. (0.05)	0.90	4.86		2.35	9	9	12.52	2.32	0.96	0.47	49.56	190.18	496.28
C.V. (%)	22.18	2.06		1.43	1	2	5.07	5.12	12.87	1.19	16.9	28.51	17.09
Soil type													
pH													
EC													
OC													
Variety & Duration													
Applied NPK kg/ha													
Available NPK kg/ha													

- S1: Broadcasting of seeds
- S2: Manual line sowing
- S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
- S4: Raised bed sowing
- S5- Any improved system in that particular location (Baisi Method)
- S6- Location specific high yielding Wet DSR method (Skip row planting)
- S7- Farmers practice of the Wet DSR method of the region (Lehi method)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VI KARJAT									
	Grain yield (t/ha)	Straw yield (t/ha)	Plant height (cm)	Grains/panicle (No.)	Panicle/m ² (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	
	S1	3.32	4.69	92.49	129.47	316	21.86	2.44	23.74	83.67
	S2	3.82	5.38	98.47	124.55	333	23.17	2.52	24.15	83.33
	S3	4.5	6.04	96.6	153.26	363	23.91	2.91	24.33	84
	S4	4.55	6.34	103.63	152.17	373	24.43	3.08	23.93	82.67
	S5	3.81	5.33	104.53	132.89	328	23.09	2.47	24.93	82.67
	S6	4.07	5.47	103.7	136.56	342	23.2	2.7	23.84	83
	S7	2.24	3.55	97.87	113.16	280	21.25	2.21	23.51	83.67
	C.D. (0.05)	0.76	1.29	7.22	22.57	34	1.63	0.49	0.89	1.36
C.V. (%)	11.35	13.83	4.07	9.43	6	3.99	10.45	2.08	0.92	
Soil type										
pH										
EC										
OC										
Variety & Duration	Karjat 3	115-120 DAYS								
Applied NPK kg/ha	100:50:50									
Available NPK kg/ha										

S1: Broadcasting of seeds

S2: Manual line sowing

S3: Mechanized line sowing of seeds (Drum Seeder)

S4: Raised bed sowing

S5- Any improved system in that particular location

S6- Location specific high yielding Wet DSR method(Dibbling 20cm x 20cm))

S7- Farmers practice of the Wet DSR method of the region (Broadcasting@75kg/ha-1)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VI KARJAT Contd.							
	Dry matter accumulation (g/m ²)		Cost of Cultivation Rs/ha	Gross returns (Rs/ha)	B.C Ratio	Weed population (no/m ²)		Weed biomass (g/m ²)
	45 DAS	105 DAS				At Active Tillering Stage	At Panicle Initiation Stage	
S1	25.78	27.89	86700	90416	1.04	66.33(8.17)	20.37(4.57)	20.36
S2	26.43	28.86	90759	103991	1.15	65.00(8.09)	18.08(4.31)	18.16
S3	27.33	31.73	93182	121622	1.31	44.00(6.50)	19.05(4.42)	13.67
S4	33.06	34.6	93452	123583	1.32	40.00(6.35)	18.24(4.33)	14.19
S5	25.81	28.51	91842	103553	1.13	53.00(7.29)	17.57(4.25)	17.54
S6	27.03	30.66	92987	110107	1.18	50.67(7.14)	19.29(4.45)	15.12
S7	24.54	26.06	95962	62093	0.65	73.00(8.56)	22.74(4.82)	21.87
C.D. (0.05)	4.28	2.84				1.16	0.26	3.04
C.V. (%)	8.87	5.36				8.79	3.23	9.9
Soil type								
pH								
EC								
OC								
Variety & Duration								
Applied NPK kg/ha								
Available NPK kg/ha								

(Values in parentheses are transformed values)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VI NAVSARI										
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
			At 15 DAS								
S1	3.61	4.81	98.67	97.33	326	298	230	20.43	3.46	26.07	90.33
S2	3.97	5.17	103.67	109.57	349	328	242	22.53	3.79	26.78	90.33
S3	3.96	5.16	112.67	118.4	358	338	259	22.27	4.1	28.56	91
S4	3.74	4.94	96.33	106.8	321	302	234	22.75	4.49	29.01	90
S5	4.57	5.77	95	105.7	358	336	253.33	22.03	3.73	26.84	90.67
S6	-	-	-	-	-	-	-	-	-	-	-
S7	3.74	4.94	107.33	110.43	338	318	247	21.87	3.6	25.53	91
C.D. (0.05)	0.57	0.57	15.56	14.57	46	47	31.22	2.53	0.54	4.67	1.95
C.V. (%)	8.05	6.19	8.58	7.51	8	8	7.13	6.46	7.87	9.6	1.21
Soil type	Clayey										
pH	7.92										
EC	0.45										
OC	52.00%										
Variety & Duration	GNR-3 120-125 days										
Applied NPK kg/ha	100-30-0-0										
Available NPK kg/ha	253.36-38.48-854.22										

S1: Broadcasting of seeds

S2: Manual line sowing

S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)

S4: Raised bed sowing

S5- Any improved system in that particular location

S6- Location specific high yielding Wet DSR method

S7- Farmers practice of the Wet DSR method of the region

Table 4.2.3.1: Contd.

ZONE-VI NAVSARI Contd.																		
Methods of Sowing	Dry mater accumulation (g/m ²)			Weed population (no/m ²)		Weed biomass (g/m ²)		Plant available nutrients Uptake(kg/ha)			Soil available nutrients (kg/ha) at Pre sowing			Soil available nutrients (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha
	45 DAS	75 DAS	105 DAS	At Active tillering	At panicle initiation	AT stage	PI stage	N	P	K	N	P	K	N	P	K		
S1	401.91	817.85	885.67	13.33(3.72)	43.33(6.62)	26.01	66.27	47.95	14.38	63.93	250.72	39.06	659.18	246.62	37.61	664.85	76848	79907
S2	421.53	845.41	879.18	12.67(3.63)	40.33(6.39)	26.15	62.4	56.68	15.88	72.72	253.38	37.69	662.72	251.06	34.46	664.77	76705	87905
S3	432.17	830.38	867.17	12.67(3.62)	38.33(6.23)	26.91	54.86	52.09	15.55	74.2	257.01	38.92	674.23	252.06	36.58	675.74	76738	87541
S4	401.19	781.82	851.28	13.33(3.72)	40.33(6.39)	25.88	61	65.81	17.78	80.02	262.69	41.37	683.26	259.96	39.37	684.92	77222	98638
S5	404.37	809.69	864.21	12.33(3.58)	37.00(6.12)	25.94	53.39	53.89	15.56	69.95	256.98	35.46	656.9	254.9	32.94	661.92	76661	82724
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S7	417.89	858.58	898.91	14.33(3.85)	40.00(6.36)	25.95	61.1	53.51	14.89	69.14	254.55	35.97	664.77	251.16	35.36	667.43	76705	82742
C.D. (0.05)																		
C.V. (%)																		
Soil type																		
pH																		
EC																		
OC																		
Variety & Duration																		
Applied NPK																		
kg/ha																		
Available NPK																		
kg/ha																		
	58.4	118.43	123.61	0.25	0.46	4.19	9.82	9.95	2.78	12.23	36.77	5.92	71.43	36.7	5.45	77.73		
	7.92	8.04	7.91	3.89	4.15	9.35	9.48	10.04	9.86	9.47	8.06	8.81	6	8.14	8.57	6.5		

(Values in parentheses are transformed values)

Table 4.2.3.1: Contd.

ZONE- VI NAWAGAM												
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
			no/m ²	At 15 DAS								
S1	4.87	5.60	53.00		108.67	209	179	246.67	24.13	3.83	18.34	77.00
S2	5.23	5.86	57.00		120.67	212	188	263.00	23.93	4.45	18.93	78.33
S3	5.52	5.84	57.33		116.33	207	158	272.00	24.47	4.10	18.38	78.00
S4	5.57	5.87	56.67		112.67	218	178	254.00	24.00	4.46	18.43	76.33
S5	5.9	6.14	54.33		122.00	239	210	274.33	24.27	4.74	19.10	76.33
S6	5.59	5.93	56.00		123.33	237	214	275.00	24.00	4.70	19.05	77.67
S7	4.98	5.64	54.67		105.67	233	205	250.33	24.73	4.00	19.14	77.67
C.D. (0.05)	0.62	0.94	10.76		11.91	42	31	18.44	2.74	0.45	1.12	1.68
C.V. (%)	6.46	9.05	10.88		5.79	11	9	3.95	6.35	5.83	3.35	1.22
Soil type	Clay loam											
pH	7.88											
EC	0.61											
OC	0.77											
Variety & Duration	Mahisagar, 115-120 days											
Applied NPK kg/ha	80:25:00:25											
Available NPK kg/ha												

S1: Broadcasting of seeds

S2: Manual line sowing

S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)

S4: Raised bed sowing

S5- Any improved system in that particular location

S6- Location specific high yielding Wet DSR method

S7- Farmers practice of the Wet DSR method of the region (Broadcasting dry seed)

Table 4.2.3.1: Contd.

ZONE- VI NAWAGAM Cntd.													
Methods of Sowing	Dry mater accumulation (g/m2)			Weed population (no/m ²)		Weed biomass (g/m ²)		Soil available nutrients (kg/ha) at harvest			Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C RATIO
	45 DAS	75 DAS	105 DAS	At Active tillering	At panicle initiation	AT stage	PI stage	N	P	K			
	S1	214.00	403.55	767.39	56.00(7.43)	98.33(9.91)	18.96	26.77	287.33	94.67	253.53	47874	133616
S2	211.00	405.65	718.58	58.00(7.57)	80.67(8.86)	19.5	21.46	289.33	93.00	248.95	48276	143137	1.96
S3	227.67	416.33	728.33	46.33(6.56)	82.00(8.99)	17.67	20.59	282.67	87.67	251.56	49080	149909	2.05
S4	221.00	438.33	750.33	60.00(7.72)	92.00(9.55)	19.77	24.59	287	89.00	250.73	48276	151379	2.14
S5	212.00	411.8	722.29	50.33(6.82)	81.00(8.89)	14.9	25.51	283.33	92.33	252.95	48678	159929	2.29
S6	233.33	522.33	834.33	61.33(7.81)	85.33(9.04)	19.93	24.34	279	92.00	253.34	48276	151882	2.15
S7	244.67	441.33	753.33	54.00(7.23)	99.00(9.82)	17.36	27.79	279.67	86.67	246.63	49080	136445	1.78
C.D. (0.05)	33.84	58.8	70.38	3.37	3.41	17.32	20.34	12.47	9.22	21.75			
C.V. (%)	8.51	7.61	5.25	25.89	20.6	53.19	46.79	2.47	5.71	4.87			
Soil type													
pH													
EC													
OC													
Variety & Duration													
Applied NPK kg/ha													
Available NPK kg/ha													

(Values in parentheses are transformed values)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VII ADUTHURAI															
	Grain yield (t/ha)	Plant population no/m ²	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population (no/m ²) at Active tillering stage				Weed population (no/m ²) at Panicle initiation stage				Cost of Cultivation	B:C RATIO
							Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total		
S1	3.66	61.33	196	183	4.77	21.97	45.00(6.72)	35.00(5.93)	23.00(4.82)	103.00(10.13)	25.00(5.04)	18.00(4.29)	12.00(3.52)	55.00(7.45)	44650	0.88
S2	4.65	51.67	203	196	4.88	22.57	34.00(5.87)	29.00(5.42)	19.00(4.40)	82.00(9.07)	21.00(4.61)	12.00(3.52)	9.00(3.06)	42.00(6.48)	49770	1.15
S3	4.87	48.67	235	222	5.11	22.93	29.00(5.42)	19.00(4.40)	12.00(3.52)	60.00(7.76)	16.00(4.06)	11.00(3.38)	7.00(2.73)	34.00(5.87)	46080	1.43
S4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S5	4.43	47.33	190	177	4.82	14.97	33.00(5.78)	23.00(4.83)	13.00(3.67)	69.00(8.34)	23.00(4.83)	17.00(4.17)	9.00(3.06)	49.00(7.03)	47960	1.06
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05) C.V. (%) Soil type pH EC OC Variety Applied NPK kg/ha Soil Available NPK initial : Soil Available NPK (kg/ha) final :	0.35	3.73	13	11	0.09	10.9	1.05	1.02	1.02	1.62	0.73	0.58	0.85	0.84		
	4.3	3.7	3	3	0.95	27.72	9.33	10.44	13.16	9.71	8.46	8.02	14.74	6.65		
	Clay soil															

(Values in parentheses are transformed values)

- S1: Broadcasting of seeds
- S2: Manual Line sowing
- S3: Drum Seeding
- S4:
- S5 – Semi Dry System
- S6 -
- S7:

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VII ADUTHURAI Contd.							
	Weed biomass (g/m ²) at Active tillering stage				Weed biomass (g/m ²) at Panicle initiation stage			
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
S1	6.87	5.99	4.64	17.5	5.94	4.67	4.35	14.96
S2	4.83	3.83	3.06	11.72	4.51	3.51	3.13	11.15
S3	3.93	2.97	1.68	8.58	4.72	4.03	3.19	11.94
S4	-	-	-	-	-	-	-	-
S5	4.93	3.23	1.37	9.53	5.47	4.93	3.6	14
S6	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-
C.D. (0.05)	1.02	1.47	1.22	2.67	1.19	0.62	0.77	1.6
C.V. (%)	10.46	18.58	22.61	11.59	12.07	7.66	11.5	6.5
Soil type								
pH								
EC								
OC								
Variety & Duration								
Applied NPK kg/ha								
Available NPK kg/ha								

Table 4.2.3.1: Contd.

ZONE-VII COIMBATORE																
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ² at 15DAS	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Dry mater accumulation (g/m2) 105 DAS	Weed population (no/m ²)			Cost of Cultivation	Gross returns (Rs/ ha)	B:C RATIO
											At Active tillering	At panicle initiation	At Active tillering			
S1	4.22	5.88	50.67	83.87	299	267	2.02	13.91	96.67	832.67	33.43(5.82)	16.70(4.13)	46265	84340	0.82	
S2	5.2	6.91	67.33	87.13	365	329	2.54	13.94	97.33	863.67	25.80(5.12)	14.77(3.90)	48238	104020	1.16	
S3	5.57	7.41	64.33	90.2	371	338	2.51	13.94	98.33	869.33	19.27(4.43)	11.50(3.45)	47288	111380	1.36	
S4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S5	5.62	7.68	55.33	92.43	381	351	3.01	13.98	98.33	945.67	12.60(3.60)	10.47(3.28)	47750	112420	1.11	
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S7	4.01	5.49	48.67	82.47	281	255	1.96	13.94	98.33	803.33	41.27(6.45)	23.57(4.89)	46642	80060	0.72	
C.D. (0.05) C.V. (%) Soil type	0.2	0.21	5.27	0.78	7	7	0.45	0.79	1.29	50.57	0.84	0.88		2.37		
	2.21	1.72	5.06	0.49	1	1	10.33	3.11	0.72	3.24	9.37	12.41		34.70	32.20	
	Clay loam															
pH		8.3														
EC																
OC																
Variety & Duration	ADT 59	130 days														
Applied NPK kg/ha	150:50:50															
Available NPK kg/ha	243:24:475															

(Values in parentheses are transformed values)

- S1: Broadcasting of seeds
- S2: Manual line sowing
- S3: Paddy drum seeder
- S4:
- S5: Paddy + Daincha drum seeder
- S6:
- S7: Farmers practice of the Wet DSR method of the region

Table 4.2.3.1: Contd.

ZONE-VII MANDYA												
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle lenth (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	
			At 15 DAS									
S1	5.12	7.42	71.00	100.19	424	395	171.13	25.88	3.87	24.6	87.67	
S2	5.41	7.77	57.33	104.56	366	341	193.53	26.52	4.29	25.24	89.33	
S3	5.76	8.08	58.33	106.4	403	384	194.07	26.55	4.35	25.27	87.33	
S4	5.99	8.16	47	70.81	413	371	195	26.01	4.53	25.21	88	
S5	5.52	7.9	45.33	103.93	381	358	191.73	25.75	4.29	25.03	88.33	
S6	5.09	7.49	52	106.29	435	411	186.23	25.59	4.09	25.54	88.67	
S7	4.82	6.91	44.67	101.77	413	383	178.83	25.45	3.96	25.21	88.67	
C.D. (0.05)	0.89	1.17	5.23	42.36	88	84	41.78	1.26	0.55	1.67	1.69	
C.V. (%)	9.25	8.56	5.48	24.02	12	13	12.54	2.72	7.4	3.74	1.08	
Soil type	Red sandy loam											
pH	7.74											
EC	0.31											
OC	0.1											
Variety & Duration	KMP 220, 125-130 days											
Applied NPK kg/ha	125:62:62:20											
Available NPK kg/ha	294:68.7:282											

S1: Broadcasting of seeds (Sproted seed)

S2: Manual line sowing (Dry seed)

S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder-pre-germinated seed: Spacing as per the equipment specifications)

S4: Raised bed sowing

S5- Any improved system in that particular location (Drum seedling with water soaked seed)

S6- Location specific high yielding Wet DSR method (Broad casting of water soaked seed)

S7- Farmers practice of the Wet DSR method of the region (Broad casting of dry seed)

Table 4.2.3.1: Contd.

ZONE-VII MARUTERU															
Methods of Sowing	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ²		Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population (no/m ²)		Weed biomass (g/m ²)	
			At 15 DAS									At Active tillering	At panicle initiation	AT stage	PI stage
S1	3.41	5.5	226.67		104.73	235	200	21.33	2.65	12.27	90.33	15.37(3.98)	16(4.03)	18.59	19.36
S2	4.44	7.16	48.33		111.4	290	266	24.37	3.11	13.17	93	9.13(3.09)	10.13(3.24)	11.05	12.26
S3	4.79	7.73	45.67		112.8	321	279	25.6	3.29	13.43	92.67	7.9(2.89)	7.93(2.9)	9.56	9.6
S4	4.57	7.38	91.67		108.67	310	253	25.23	3.43	13.47	89.33	6.6(2.66)	5.93(2.53)	7.99	7.18
S5	4.27	6.88	71.33		107.07	254	233	23.13	2.94	12.3	93.67	16.7(4.14)	14.93(3.92)	20.21	18.07
S6	4.39	7.08	56.33		111.27	301	273	24.37	3.15	12.93	92.67	8.73(3.03)	8.3(2.95)	10.57	10.04
S7	-	-	-		-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)	0.48	0.77	71.91		10.62	88	101	1.71	0.32	0.73	4.43	0.51	0.66	4.25	5.86
C.V. (%)	6.11	6.11	43.92		5.34	17	22	3.91	5.73	3.09	2.65	8.55	11.15	17.98	25.26
Soil type	Alluvium soils														
pH	7.5														
EC	0.97														
OC	0.39%														
Variety & Duration	MTU-1262, 140 days														
Applied NPK kg/ha	90-60-60														
Available NPK kg/ha	N: 151-P: 11.75- K:257														

(Values in parentheses are transformed values)

- S1: Broadcasting of seeds
- S2: Manual line sowing
- S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
- S4: Raised bed sowing
- S5- Broadcasting with drone
- S6- Location specific high yielding Wet DSR method (Farmers practice- dry seed)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VII PATTAMBI										
	Grain yield (t/ha)	Straw yield (t/ha)	Plant population no/m ² At 30 DAS	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle length (cm)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
S1	5.37	13.27	188.67	96.33	465	458	154	18.50	6.37	21.70	86.33
S2	4.67	12.07	42.00	94.33	265	260	148	17.67	5.70	21.90	87.00
S3	3.17	12.37	41.67	100.33	121	120	154	20.67	5.93	22.20	87.33
S4	4.03	11.59	41.00	88.67	270	269	151	19.17	6.37	21.00	85.67
S5	5.43	14.11	52.00	109.00	282	281	153	16.93	6.70	23.00	88.00
S6	-	-	-	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)	0.28	1.88	23.45	6.61	58	57	6.42	2.75	1.67	3.55	4.76
C.V. (%)	3.64	8.26	18.66	3.77	12	12	2.32	8.13	14.89	8.86	3.00
Soil type											
pH											
EC											
OC											
Variety & Duration	Aiswarya (125 days)										
Applied NPK kg/ha	90:45:45:0										
Available NPK kg/ha											

S1: Broadcasting of seeds
S2: Manual line sowing
S3: Mechanized line sowing of seeds (Dribbler, Happy seeder or any Drum Seeder: Spacing as per the equipment specifications)
S4: Raised bed sowing
S5:

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VII PATTAMBI									
	Dry matter accumulation (g/m2)			Weed population (no/m ²)		Weed biomass (g/m ²)		Cost of cultivation Rs/ha	Gross returns Rs/ha	B:C RATIO
	45 DAS	75 DAS	105 DAS	At Active tillering	At panicle initiation	AT stage	PI stage			
S1	263.13	415.3	872.63	97.00(9.87)	98.67(9.95)	43.77	126.3	66900	123447	0.85
S2	253	353.63	774.3	60.00(7.78)	59.00(7.71)	29.23	74.5	68200	194453	1.85
S3	200.9	338.27	645.93	71.33(8.47)	60.33(7.74)	36.23	68.43	67850	187460	1.76
S4	255.57	339.63	740.9	62.00(7.90)	46.33(6.77)	36.23	51.63	69150	152547	1.21
S5	268.17	308.7	837.47	61.33(7.86)	54.67(7.41)	34.47	60.2	67200	166867	1.48
S6	225.5	289.27	633.6	55.33(7.47)	39.00(6.17)	32.37	31	69250	116833	0.69
S7										
C.D. (0.05)	42.24	65.56	56.49	0.52	1.86	4.62	18.21			
C.V. (%)	9.5	10.57	4.14	3.48	13.39	7.18	14.57			
Soil type	Clay loam									
pH	6.95									
EC	0.06									
OC										
Variety & Duration	CSR - 76									
Applied NPK kg/ha	120:40:40									

(Values in parentheses are transformed values)

Table 4.2.3.1: Contd.

Methods of Sowing	ZONE-VII PUDUCHERRY															
	Grain yield (t/ha)	Straw yield (t/ha)	Plant height (cm)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population (no/m ²)		Weed biomass (g/m ²)		B:C Ratio	Cost of cultivation Rs/ha	Gross returns Rs/ha	Net returns Rs/ha	B:C RATIO
								At Active tillering	At panicle initiation	AT stage	PI stage					
S1	6.03	9.53	70	256	240	2.07	25.82	98.34(9.94)	78.26(8.87)	63.21	52.52	2.18	65425	142802	77377	2.18
S2	6.25	9.54	71.52	277	259	2.22	26.12	81.27(9.04)	59.60(7.75)	49.49	32.11	2.22	67575	149870	82295	2.22
S3	6.62	9.91	73.01	296	273	2.34	26.52	71.76(8.50)	45.00(6.75)	41.14	21.21	2.31	65900	152526	86626	2.31
S4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)	0.17	0.33	2.97	9	1	0.01	0.23	0.14	0.16	1.83	1.57	0.01				
C.V. (%)	1.91	2.33	2.86	2	0	0.37	0.61	1.06	1.45	2.45	3.07	0.39				
Soil type																
pH																
EC																
OC																
Variety & Duration																
Applied NPK kg/ha																
Available NPK kg/ha																

(Values in parentheses are transformed values)

4.2.3.2. Evaluation of varieties for their suitability and enhancement of the productivity in wet direct seeded rice (Puddled soil), kharif-2025

One of the major challenges confronting the development of wet DSR in India is poor choice of suitable varieties and variety breeding. Hence, the present trial is constituted to enhance the productivity of the wet DSR with the following objectives 1) To identify the suitable and promising rice cultivars in wet direct seeded rice and 2) To assess the various agronomic parameters for suitability of rice cultivars in wet direct seeded rice establishment methods. The trial was conducted at three locations (Kota, Raipur and Warangal). The trial was laid out in RBD with 12 varietal treatments and replicated thrice. Treatments are T₁: DRRDhan 44 (early) T₂: Sabhagidhan (very early) T₃: DRRDhan 60 T₄: DRRDhan 42 (Mid early) T₆: Anjali T₇: Varalu (Upland-western zone) T₈: IRRI 1 T₉: IRRI 2 T₁₀: IRRI 3 T₁₁: Local check 1 T₁₂: Local check 2 T₁₃: Local check 3. The results are summarized and presented in **Table 4.2.3.2**, and the salient findings are given below.

In **Zone II**, at **Kota**, higher grain yield was recorded by IRRI 1, DRRDhan 60 and DRRDhan 44 (early) varieties. DRR Dhan 42 (mid early) variety recorded higher straw yield followed by DRRDhan 60, IRRI 1, IRRI 3 and CR Dhan 201 varietal treatments. The number of panicles/m² were higher in DRRDhan 60 and panicle weight in DRRDhan 44 (early). DRR Dhan 42 (mid early) recorded higher test weight.

In **Zone V**, at **Raipur**, higher grain and straw yield was recorded in Bastar Dhan-1, DRRDhan 40 (early), DR Dhan 60, Danteshwari and CG Baraki Dhan-2 varietal treatments. Similar trend was also followed in the case of number of tillers/m² and panicles/m². DRR Dhan 60 recorded higher panicle weight and it was at par with Sabhagidhan (very early), Danteshwari and CG Barani Dhan-2 varietal treatments. The highest test weight was recorded with DRRDhan 44 (early) among all the varietal treatments.

In **ZoneVII**, at **Warangal**, KNM 118, DRRDhan 44 (early), DRRDhan 60 and WGL915 recorded higher grain yield. Higher straw yield was recorded with WGL 915 and KNM 118. RNR 15048 recorded the highest number of panicles/m², panicle weight and test weight were higher in WGL 915 and no significant difference in dry matter accumulation at 105 days.

In **Zones II, V and VII**, at three locations (Kota, Raipur and Warangal) the local varieties viz., Bastar Dhan 1, KNM118 and DRRDhan 60, DRRDhan44, DRRDhan40 and IRRI1 were found suitable for wet DSR system and recorded higher grain yields.

Table 4.2.3.2: Evaluation of varieties for suitability and enhancement of productivity in Wet direct seeded rice (Puddle soil) , Kharif-2025.

Cultivars	ZONE-II-KOTA						
	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle weight(g)	Test weight(g)	Cost of cultivation
1. DRR Dhan 44 (Early)	5.84	7.00	295	267	4.61	23.05	56728
2. Sabhagidhan (Very Early)	5.14	6.20	299	258	3.98	24.49	56728
3. DRR Dhan 60	5.92	7.80	326	307	3.77	15.16	56728
4. DRR Dhan 42 (Mid Early)	5.4	7.88	303	277	4.06	25.59	56728
5. Anjali	2.18	5.64	275	237	2.92	24.95	56728
6. Varalu (Upland-western zone)	4.97	7.04	288	259	4.35	22.28	56728
7. IRRI 1	6.13	7.37	327	302	3.43	25.19	56728
8. IRRI 2	5.09	6.52	279	249	4.13	25.13	56728
9. IRRI 3	4.86	7.27	287	262	4.02	25.05	56728
10. LC 1	4.53	7.59	303	275	3.79	23.98	56728
11. LC 2	4.65	6.86	287	258	3.9	23.01	56728
12. LC 3	-	-	-	-	-	-	-
Expt. Mean	4.97	7.01	297	268	3.91	23.44	
C.D. (0.05)	0.49	0.61	24	23	0.49	1.32	
C.V. (%)	5.82	5.11	5	5	7.32	3.31	
Soil type	Clay						
pH	7.42						
EC	0.56						
Soil Organic Carbon	0.64						
Applied NPK kg/ha	N-214.8 P-26.4 K 438.1						
Available NPK kg/ha	120-60-40 Znso4 20kg/ha						

V11. LC 1 - (CR Dhan 201) 120-125 days

V12. LC 2 - (CR Dhan 202) 120-125 days

V13. LC 3 -

Table 4.2.3.2: Contd.

Cultivars	ZONE-V-RAIPUR					
	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle weight (g)	Test weight (g)
1. DRR Dhan 44 (Early)	3.91	6.99	288	224	2.86	27.63
2. Sabhagidhan (Very Early)	2.63	4.88	208.78	157	3.15	23.7
3. DRR Dhan 60	3.78	6.73	290	232	3.7	15.4
4. DRR Dhan 42 (Mid Early)	3.46	5.79	276	212	2.78	24.6
5. Anjali	2.1	3.83	243.78	188	2.59	25.7
6. Varalu (Upland- western zone)	-	-	-	-	-	-
7. IRRI 1	-	-	-	-	-	-
8. IRRI 2	-	-	-	-	-	-
9. IRRI 3	-	-	-	-	-	-
10. LC 1	4.3	7.37	336	267	2.92	24.17
11. LC 2	3.98	7.15	306.78	232	3.64	21.73
12. LC 3	4.15	7.24	308.78	255	3.31	23.03
Expt. Mean	3.54	6.25	282.26	220.83	3.12	23.25
C.D. (0.05)	0.67	1.48	50.98	48.42	0.57	1.28
C.V. (%)	10.84	13.49	10.31	12.52	10.44	3.14
Soil type	Vertisol					
pH	6.9					
EC	Lock Check1 - Bastar Dhan-1					
Soil Organic Carbon	Lock Check2 - Danteshwari					
Applied NPK kg/ha	Lock Check3 - CG Barani Dhan-2					
Available NPK kg/ha	225.2:18.8:376.3					

V11. Lock Check1 - Bastar Dhan-1

V12. Lock Check2 - Danteshwari

V13. Lock Check3 - CG Barani Dhan-2

Table 4.2.3.2: Contd.

Cultivars	ZONE-VII-WARANGAL					
	Grain yield (t/ha)	Straw yield (t/ha)	Panicle/m ² (No.)	Panicle weight(g)	Test weight(g)	Dry matter accumulation 105 DAS
1. DRR Dhan 44 (Early)	5.39	4.99	370	3.61	22.94	1052.33
2. Sabhagidhan (Very Early)	4.9	4	383	3.97	25.08	1188.33
3. DRR Dhan 60	5.3	4.47	383	3.7	12.45	1369.67
4. DRR Dhan 42 (Mid Early)	4.83	4.81	392	4.05	22.28	1140.33
5. Anjali	-	-	-	-	-	-
6. Varalu (Upland-western zone)	3.78	4.1	368	2.8	21	1213.33
7. IRRI 1	-	-	-	-	-	-
8. IRRI 2	-	-	-	-	-	-
9. IRRI 3	-	-	-	-	-	-
10. LC 1	5.01	5.53	400	6.48	29.62	1296
11. LC 2	5.96	5.28	370	3.2	25	1008.33
12. LC 3	4.63	4.61	437	3.15	13.88	1095
Expt. Mean	4.98	4.72	388	3.87	21.53	1170.42
C.D. (0.05)	1.04	0.46	32	0.55	3.13	361.18
C.V. (%)	11.9	5.59	5	8.18	8.3	17.62
Soil type	clay					
pH	8.7					
EC						
Soil Organic Carbon						
Applied NPK kg/ha	120-60-40-50					
Available NPK kg/ha	138-48-452					

V11. Local check 1: WGL 915, 135 days duration

V12. Local check 2: KNM118, 135 days duration

V13. Local check 3: RNR15048, 135 days duration

RICE BASED CROP DIVERSIFICATION SYSTEM TRIALS



4.3. RICE BASED CROP DIVERSIFICATION SYSTEM TRIALS (RBCD's)

4.3.1. Conversation Agriculture/system based management practices in rice and rice-based cropping systems (crop diversification) for higher profitability

Among the various cropping systems being practiced in India, Rice-based cropping systems is considered to be the most important because of its large area coverage and contribution to overall food grain production. Transplanting is the most dominant and traditional method of establishment in irrigated lowland rice. However, due to the non-availability of irrigation water, shortage of labour during the peak period of transplanting and escalating labour costs make the transplanting technique more expensive which invariably leads to delay in transplanting and resulting in a reduction of yield. Crop residue especially Rice-Straw containing about 1-2% of 'K' a good source of nutrient especially for intensively cropped soils. Residue incorporation is known to help *Rabi* crops in rice-based cropping systems. To address this problem, alternate methods of crop establishment need to be evolved to substitute manual transplanting methods under various agro-ecologies. Hence, this trial was initiated to evaluate systems of rice crop establishment under different residue management during 2017 and continued in *Kharif* 2025. The trial was laid out in RBD design at two locations namely **Karjat** and **Ghaghrahat** to assess the effect of different crop establishment methods (M₁: Transplanting, M₂: Wet seeding (line sowing under puddled conditions) and M₃: Aerobic rice – Dry rice cultivation) on growth and yield performance of rice. Subplot treatments comprised of two different tillage practices (S₁: Conventional tillage, S₂: Minimum tillage). The results are summarized and presented in Table 4.3.1 and the salient findings are summarized below.

Karjat

Performance of Crop Establishment Methods (M)

Over the three-year study period (2022–2025), Transplanting (M₁) consistently achieved the highest mean REY (*Kharif* + *Rabi*). In the most recent cycle (2024–25), M₁ recorded a mean REY of 6.82 t/ha, outperforming Wet Seeding (M₂: 6.50 t/ha) and Aerobic Rice (M₃: 6.35 t/ha). All methods showed a slight declining trend in REY from 2022-23 to 2024-25, though the relative ranking of the methods remained stable.

The continued dominance of Transplanted Rice (M₁) suggests that the controlled environment of puddle-transplanting provides a more stable yield base for the subsequent *Rabi* crop. While Wet Seeding (M₂) showed competitive results (reaching 7.73 t/ha in specific S₁C₄ interactions), Aerobic Rice (M₃) struggled to maintain high REY. This is likely due to the inherent weed pressure and nutrient dynamics associated with dry rice cultivation, which can negatively impact the residual moisture and soil physical properties for the following crop.

Impact of Tillage and Soil Management (S)

Conventional Tillage (S₁) proved significantly superior to Minimum Tillage (S₂) across all years. For the 2024–25 season, S₁ recorded a system REY of 6.88 t/ha, while S₂ yielded 6.22 t/ha. The productivity gap between S₁ and S₂ was most pronounced in the Aerobic Rice (M₃)

system, where REY dropped to as low as 5.30 t/ha under minimum tillage with wheat (C3) diversification.

While Minimum Tillage (S2) is a pillar of Conservation Agriculture aimed at long-term soil health, the data reveals a "yield penalty" in the short-to-medium term compared to Conventional Tillage (S1). The REY was consistently higher in S1 across all establishment methods. This suggests that in the current rice-based system, the intensive soil preparation in S1 may be better at mineralizing nutrients and suppressing weed seed banks, thereby providing a cleaner start for both the rice and the diverse Rabi crops.

System Diversification with Rabi Crops (C)

The choice of Rabi crop significantly influenced the total system REY. Chickpea (C4) emerged as the most resilient and productive diversification option in the 2024–25 cycle, achieving a mean REY of 7.04 t/ha. Maize (C1) followed closely with 6.91 t/ha, though it showed a sharper decline from its 2022-23 peak of 7.73 t/ha. Wheat (C3) consistently recorded the lowest system REY, averaging 5.80 t/ha in the recent year.

The performance of Chickpea (C4) is a highlight of this study. Unlike Maize or Wheat, Chickpea maintained a relatively stable REY over the three years (7.42 to 7.04 t/ha). The inclusion of a legume not only supports system productivity but likely contributes to soil nitrogen status. Maize (C1) remains a high-yielding alternative, especially when paired with transplanting, but the 2024–25 data suggests that its productivity may be more sensitive to seasonal variations or soil fatigue compared to Chickpea.

Weed Population (No./m²)

The statistical analysis reveals significant differences in weed population across various establishment methods and tillage practices. At 30 DAS, the lowest mean weed population was recorded in Transplanting (M1), which was significantly lower than Wet Seeding (M2) and Aerobic Rice (M3). This trend persisted at 60 DAS, where M1 maintained the lowest population compared to M3, which reached the highest density. Among the tillage practices conventional tillage (S1) significantly reduced weed populations compared to minimum tillage (S2). At 60 DAS, the mean for S1 was 4.61, whereas S2 plots recorded a significantly higher mean of 4.79. Sub-sub Plot (C): Diversification with Chickpea (C4) resulted in the lowest weed population at 60 DAS, whereas Wheat (C3) plots exhibited the highest weed pressure.

Weed Dry Weight (g/m²)

Weed biomass accumulation, a critical indicator of weed-crop competition, followed a similar pattern to the population data. Transplanting (M1) demonstrated superior suppression of weed growth, resulting in the lowest mean dry weight at 30 DAS (7.09 g/m²) and 60 DAS (7.82 g/m²). In contrast, Aerobic rice (M3) faced the highest biomass accumulation, peaking at 11.93 g/m² at 60 DAS. Conventional tillage (S1) was highly effective in limiting weed dry matter. At 30 DAS, S1 recorded 8.52 g/m² compared to 10.22 g/m² in S2. By 60 DAS, S1 remained significantly superior (9.37 g/m²). A significant interaction was observed for weed dry weight at 60 DAS. The highest dry weight was recorded in the M3S2C4 interaction (16.83 g/m²), while the lowest was observed in the M1S1C2 treatment (5.55 g/m²).

The results indicate that Transplanting (M1) is the most effective establishment method for weed suppression at the Karjat station. This is likely due to the "head start" transplanted seedlings have over germinating weed seeds and the suppressive effect of the initial puddled water layer. Conversely, Aerobic Rice (M3) recorded the highest weed population and dry weight. The absence of standing water in aerobic systems provides a favorable environment for the simultaneous germination of weeds and rice, leading to intensified competition and higher biomass accumulation, particularly by 60 DAS.

The significant reduction in weed population and biomass under Conventional Tillage (S1) compared to Minimum Tillage (S2) suggests that intensive soil inversion at Karjat effectively buries weed seeds to depths that inhibit germination. In S2 (Minimum Tillage) plots, the concentration of the weed seed bank in the upper soil profile likely leads to the observed higher populations (18.56 no/m² at 60 DAS). This confirms that for the Karjat region, reduced tillage practices currently require more robust chemical weed control to compensate for the lack of mechanical suppression.

The lower weed dry weights observed in Chickpea (C4) and Mustard (C2) sub-plots, compared to Wheat (C3), can be attributed to differences in crop canopy architecture. Chickpea, with its spreading growth habit, provides better ground cover and competition against late-emerging weeds at 60 DAS. The high weed dry weight in Wheat (10.28 g/m²) indicates that the wheat canopy in the Karjat Rabi season may be less competitive, necessitating early and targeted herbicide interventions to protect yield potential.

Conclusion

The Karjat data underscores the challenge of implementing CA in traditional rice-growing tracts. While Minimum Tillage (S2) is intended to save costs and energy, the 0.66 t/ha yield gap between S1 and S2 (6.88 vs 6.22 t/ha) suggests that reduced tillage may lead to poor seed-to-soil contact or increased weed competition for the Rabi crop. The success of the Rice-Chickpea system in Karjat is likely due to the residual moisture utilization by the legume. Chickpea's ability to maintain high REY (7.04 t/ha) even under M2 (Wet Seeding) conditions suggests that farmers in the Karjat region could transition away from transplanting without losing system profitability, provided they choose a high-value legume for the Rabi season. Conversely, the decline in Aerobic Rice (M3) productivity highlights the need for specialized weed management protocols in Karjat, as the lack of a standing water layer in the aerobic system allows aggressive local weed flora to dominate, eventually depressing the system's total REY. For maximizing total system REY in this region, the combination of Transplanting (M1) or Wet Seeding (M2) with Conventional Tillage (S1), followed by Chickpea (C4) or Maize (C1), represents the most productive management strategy. Moving forward, refining the nutrient and weed management in the M3S2 (Aerobic-Minimum Tillage) system is essential if the environmental benefits of CA are to be realized without sacrificing yield.

Weed dry weight at 60 DAS was the most critical factor influencing final grain yield. The transition to CA (M3 and S2) led to a significant increase in weed populations, indicating that current reduced-tillage protocols at Karjat require more robust, integrated weed management strategies, potentially combining pre-emergence herbicides with targeted post-emergence interventions, to bridge the productivity gap with conventional systems.

Ghaghraghat

Crop Establishment and Yield Parameters (Kharif 2025)

Statistical analysis indicates significant differences in performance based on the establishment method: Grain Yield: Transplanting (M1) achieved the highest grain yield (3.53 t/ha), significantly outperforming Wet Seeding (M2: 3.20 t/ha) and Aerobic Rice (M3: 2.70 t/ha). M1 recorded superior growth parameters, including the highest panicle density (208 No./m²) and test weight (24.0 g). These values showed a progressive decline in M2 and M3 systems. Straw Yield: Similar to grain yield, straw production was highest in M1 (3.71 t/ha) and lowest in M3 (3.18 t/ha).

System Productivity (Kharif + Rabi)

Total system productivity was measured using Rice Equivalent Yield (REY): Transplanting (M1) emerged as the most productive system with a cumulative REY of 7.81 t/ha, followed by Wet Seeding (7.43 t/ha) and Aerobic Rice (7.21 t/ha). Tillage Effects: Conventional Tillage (S1) demonstrated a productivity advantage (7.56 t/ha) over Minimum Tillage (S2: 7.41 t/ha). Rabi Diversification: In terms of REY, Mustard (C2) diversification (6.75 t/ha) marginally outperformed Wheat (C1: 6.62 t/ha), primarily due to its higher equivalent value despite lower absolute grain yields.

Weed Dynamics

Establishment methods had a profound impact on weed pressure, which was inversely correlated with yield: Weed Population: At 60 DAS, the highest weed density was recorded in Aerobic Rice (7.34 No./m²), while the lowest was in Transplanting (4.64 No./m²). Weed Dry Weight: Biomass accumulation was significantly higher in M3 (45.27 g/m²) at 60 DAS, which is more than three times the biomass recorded in the M1 system (14.53 g/m²).

Yield and Resource Utilization

The superiority of Transplanting (M1) at Ghaghraghat can be attributed to better crop stand establishment and a significant reduction in weed-crop competition. The higher panicle count (208/m²) in M1 suggests that the puddled environment optimizes nutrient and water availability during the critical tillering phase. In contrast, the yield lag in Aerobic Rice (M3) is a direct result of moisture stress and poor nutrient uptake in the sandy loam soil, combined with aggressive weed growth.

Tillage and Tillage-System Synergy

The higher mean REY observed under Conventional Tillage (S1) compared to Minimum Tillage (S2) suggests that in Ghaghraghat's sandy loam conditions, intensive soil preparation is necessary to manage the weed seed bank and improve soil aeration for the subsequent Rabi crops. The #DIV/0! error in the Kharif S2 data likely reflects a data entry gap, but the Rabi results clearly show that S1 remains the more reliable tillage protocol for maximizing system-wide output.

Weed Competition and Biomass Accumulation

The massive spike in weed dry weight in Aerobic Rice (M3)—reaching 45.27 g/m² compared to 14.53 g/m² in M1—highlights the primary challenge for Conservation Agriculture in this region. Without the suppressive effect of standing water (as found in M1 and M2), weeds thrive in the aerobic soil. The significant CD values for weed parameters confirm that weed pressure is the most influential biological constraint at this station, directly depressing the test weight and grain yield of the NDR 2065 variety.

Conclusion

For the Ghaghraghat station, the Rice-Mustard cropping sequence under Transplanted (M1) establishment and Conventional Tillage (S1) is the most effective strategy for high productivity. While Mustard (C2) serves as a high-value diversifying crop, the success of the entire system depends heavily on controlling the aggressive weed growth associated with direct-seeded and aerobic establishment methods.

Table 4.3.1(R) - Conservation Agriculture/System based management practices in rice and rice-based cropping systems (crop diversification) for higher profitability. Rabi 2024-25

Crop Establishment Methods	Sub plots	Sub-Sub plot	KARJAT								
			Kharif 2022 Rice	Grain Yield (t/ha) Rb 22-23 Systems	Kh 2023 Rice	Grain Yield (t/ha) Rb 23-24 Systems	Kh 2024 Rice	Grain Yield (t/ha) Rb 24-25 Systems	Straw Yield (t/ha)	Days to 50% flowering	Test weight (g)
M1: Transplanting	S1- Conventional tillage	C1	4.68	4.08	4.85	3.81	4.03	4.1	4.99	56.00	195.1
		C2		1.07		1.05		1.1	1.62	40.67	2.6
		C3		2.57		2.49		2.2	2.71	48.00	31.6
		C4		1.35		1.10		1.4	1.74	57.00	144.2
	S2- Minimum tillage	C1		3.13		2.86		3.5	3.78	53.00	195.0
		C2		0.95		0.92		0.9	1.34	37.00	2.5
		C3		1.78		1.62		1.9	2.24	46.67	29.4
		C4		1.12		1.02		1.1	1.37	55.00	143.8
M2: Wet seeding (Line sowing under puddle condition)	S1- Conventional tillage	C1	4.34	3.99	4.76	3.72	3.91	2.8	3.38	58.00	193.1
		C2		1.04		1.01		1.3	1.76	40.00	2.4
		C3		2.55		2.46		2.1	2.50	48.00	28.5
		C4		1.25		1.08		1.6	1.99	63.00	144.8
	S2- Minimum tillage	C1		3.00		2.73		2.5	3.04	56.33	190.8
		C2		0.93		0.87		0.8	1.11	38.33	2.4
		C3		1.67		1.54		1.6	1.71	46.00	29.3
		C4		1.11		1.00		1.3	1.49	60.00	145.0
M3: Aerobic rice - Dry rice cultivation	S1- Conventional tillage	C1	3.98	3.97	4.48	3.70	3.77	3.1	3.43	57.00	193.9
		C2		0.97		0.99		1.4	1.59	39.33	2.3
		C3		2.50		2.45		2.2	2.64	48.33	29.3
		C4		1.20		1.07		1.5	1.94	59.00	145.7
	S2- Minimum tillage	C1		2.98		2.71		2.7	3.23	55.67	191.5
		C2		0.92		0.86		0.8	1.03	38.00	2.3
		C3		1.59		1.53		1.5	1.82	47.33	30.0
		C4		1.02		0.98		1.1	1.33	57.00	148.7
Mean of methods											
M1			4.68	2.00	4.85	1.86	4.03	2.03	2.47	49.2	93.0
M2			4.34	1.94	4.76	1.80	3.91	1.74	2.12	51.2	92.0
M3			3.98	1.89	4.48	1.79	3.77	1.78	2.13	50.2	93.0
C.D.				NS		N/A		NS	0.25	NS	NS
SE(m)				0.05		0.04		0.07	0.06	0.4	0.5
Mean of sub plot											
S1-Conventional tillage				2.21		2.08		2.05	2.52	51.2	92.8
S2-Minimum tillage				1.68		1.55		1.64	1.96	49.2	92.6
C.D.				0.16		0.20		0.07	0.06	0.3	NS
SE(m)				0.05		0.06		0.02	0.02	0.1	0.2
Mean of sub ub plot											
C1-Maize				3.53		3.26		3.11	3.64	56.0	193.2
C2-Mustard				0.98		0.95		1.04	1.41	38.9	2.4
C3-Wheat				2.11		2.02		1.91	2.27	47.4	29.7
C4-Chickpea				1.17		1.04		1.33	1.64	58.5	145.4
C.D.				0.17		0.16		0.12	0.02	0.7	0.9
SE(m)				0.06		0.06		0.04	0.05	0.2	0.3
Interaction											
Interaction A X B X C				NS		NS		NS	NS	NS	NS

Table 4.3.1(R)- Continued...

Crop Establishment Methods	Sub plots	Sub-Sub plot	KARJAT					
			Weed population at 30DAS (no/m2)	Transformed	Weed population at 60DAS (no/m2)	Transformed	Weed dry weight at 30DAS (g/m2)	Weed dry weight at 60 DAS (no/m2)
M1: Transplanting	S1- Conventional tillage	C1	17.11	4.63	15.00	4.36	7.44	5.55
		C2	17.76	4.71	15.67	4.45	4.93	8.29
		C3	18.54	4.81	17.33	4.65	7.72	8.47
		C4	17.21	4.65	12.67	4.05	5.94	7.62
	S2-Minimum tillage	C1	18.95	4.85	17.00	4.61	7.48	8.20
		C2	22.63	5.25	18.67	4.81	5.40	7.50
		C3	22.72	5.27	20.67	5.03	11.33	12.29
		C4	22.75	5.26	15.00	4.35	6.45	4.62
M2: Wet seeding (Line sowing under puddle condition)	S1- Conventional tillage	C1	22.63	5.25	15.67	4.44	9.54	7.72
		C2	18.82	4.84	18.67	4.81	8.75	13.19
		C3	26.28	5.62	20.67	5.04	9.78	7.71
		C4	27.33	5.71	15.33	4.40	8.79	8.77
	S2-Minimum tillage	C1	20.33	5.00	17.00	4.61	11.81	7.81
		C2	22.33	5.22	19.33	4.89	10.39	8.36
		C3	25.33	5.52	20.00	4.96	11.87	9.57
		C4	29.67	5.94	15.33	4.40	11.76	12.99
M3: Aerobic rice - Dry rice cultivation	S1- Conventional tillage	C1	27.33	5.72	17.00	4.60	10.28	8.37
		C2	25.67	5.56	17.67	4.70	7.45	15.19
		C3	21.67	5.14	23.33	5.33	12.29	12.31
		C4	22.00	5.19	15.67	4.45	9.33	9.29
	S2-Minimum tillage	C1	27.33	5.72	18.00	4.74	12.26	9.56
		C2	19.33	4.89	19.00	4.85	10.21	12.56
		C3	25.00	5.50	25.67	5.56	13.16	11.31
		C4	30.67	6.03	17.00	4.62	10.49	16.83
Mean of methods								
M1			19.71	4.93	16.50	4.54	7.09	7.82
M2			24.09	5.39	17.75	4.69	10.34	9.52
M3			24.88	5.47	19.17	4.85	10.68	11.93
C.D.				0.20		0.13	1.60	1.76
SE(m)				0.05		0.03	0.41	0.45
Mean of sub plot								
S1-Conventional tillage			21.86	5.15	17.06	4.61	8.52	9.37
S2-Minimum tillage			23.92	5.37	18.56	4.79	10.22	10.13
C.D.				0.12		0.12	0.99	NS
SE(m)				0.03		0.04	0.29	0.36
Mean of sub ub plot								
C1-Maize			22.28	5.20	16.61	4.56	9.80	7.87
C2-Mustard			21.09	5.08	18.17	4.75	7.86	10.85
C3-Wheat			23.26	5.31	21.28	5.09	11.02	10.28
C4-Chickpea			24.94	5.46	15.17	4.38	8.79	10.02
C.D.				0.23		0.28	1.61	1.51
SE(m)				0.08		0.10	0.56	0.53
Interaction								
Interaction A X B X C			NS		NS	NS	NS	3.70

Table 4.3.1(R) - Continued...

Crop Establishment Methods	Sub plots	Sub-Sub plot	KARJAT						
			System Productivity	REY (Rb 2022-23	REY (K + R)	REY (Rb 2023-24)	REY (K + R)	REY (Rb 2024-25)	REY (K + R)
M1: Transplanting	S1- Conventional tillage	C1	9.51	3.93	8.61	3.26	8.11	3.96	7.99
		C2	7.69	2.99	7.67	2.62	7.47	2.78	6.81
		C3	7.44	2.81	7.49	2.43	7.28	2.15	6.18
		C4	9.16	3.54	8.22	2.56	7.41	3.27	7.30
	S2-Minimum tillage	C1	8.29	3.01	7.69	2.45	7.30	3.34	7.37
		C2	7.14	2.67	7.35	2.31	7.16	2.27	6.30
		C3	5.94	1.95	6.63	1.58	6.43	1.91	5.94
		C4	7.59	2.95	7.63	2.37	7.22	2.62	6.65
M2: Wet seeding (Line sowing under puddle condition)	S1- Conventional tillage	C1	7.83	3.85	8.19	3.19	7.95	2.70	6.61
		C2	7.90	2.93	7.27	2.51	7.27	3.08	6.99
		C3	6.98	2.79	7.13	2.40	7.16	2.08	5.99
		C4	9.05	3.28	7.62	2.53	7.29	3.82	7.73
	S2-Minimum tillage	C1	7.35	2.90	7.24	2.34	7.10	2.44	6.35
		C2	6.26	2.61	6.95	2.18	6.94	1.96	5.87
		C3	6.48	1.83	6.17	1.50	6.26	1.53	5.44
		C4	8.00	2.92	7.26	2.33	7.09	3.04	6.95
M3: Aerobic rice - Dry rice cultivation	S1- Conventional tillage	C1	7.93	3.83	7.81	3.17	7.65	2.99	6.76
		C2	7.84	2.73	6.71	2.47	6.95	3.33	7.10
		C3	6.98	2.74	6.72	2.38	6.86	2.15	5.92
		C4	8.41	3.14	7.12	2.49	6.97	3.45	7.22
	S2-Minimum tillage	C1	7.32	2.87	6.85	2.32	6.80	2.59	6.36
		C2	6.48	2.59	6.57	2.14	6.62	1.97	5.74
		C3	6.21	1.74	5.72	1.49	5.97	1.53	5.30
		C4	7.43	2.68	6.66	2.29	6.77	2.60	6.37
Mean of methods									
M1			7.84	2.98	7.66	2.45	7.30	2.79	6.82
M2			7.48	2.89	7.23	2.37	7.13	2.58	6.50
M3			7.33	2.79	6.77	2.35	6.83	2.58	6.35
C.D.			0.25						
SE(m)			0.06						
Mean of sub plot									
S1-Conventional tillage			8.06	3.21	7.55	2.67	7.37	2.98	6.88
S2-Minimum tillage			7.04	2.56	6.89	2.11	6.81	2.32	6.22
C.D.			0.19						
SE(m)			0.05						
Mean of sub ub plot									
C1-Maize			8.04	3.40	7.73	2.79	7.49	3.00	6.91
C2-Mustard			7.22	2.75	7.09	2.37	7.07	2.57	6.47
C3-Wheat			6.67	2.31	6.64	1.96	6.66	1.89	5.80
C4-Chickpea			8.28	3.09	7.42	2.43	7.13	3.13	7.04
C.D.			0.25						
SE(m)			0.09						
Interaction									
Interaction A X B X C			0.60						

Table 4.3.1 (R) - Continued...

Crop Establishment Methods	Sub plots	Sub-Sub plot	GHAGHRAGHAT			
			Kharif 2024	Grain Yield (t/ha) Rabi 24-25 Systems	REY	REY (K + R)
M1: Transplanting	S1- Conventional tillage	C1	3.48	4.09	4.04	7.52
		C2		1.89	4.64	8.12
	S2-Minimum tillage	C1		3.85	3.81	7.29
		C2		1.59	3.90	7.38
M2: Wet seeding (Line sowing under puddle condition)	S1- Conventional tillage	C1	3.04	3.67	3.63	6.67
		C2		1.66	4.08	7.12
	S2-Minimum tillage	C1		3.34	3.30	6.34
		C2		1.54	3.79	6.83
M3: Aerobic rice - Dry rice cultivation	S1- Conventional tillage	C1	2.81	3.24	3.20	6.01
		C2		1.14	2.79	5.60
	S2-Minimum tillage	C1		3.09	3.06	5.87
		C2		1.06	2.61	5.42
Mean of methods						
M1			3.48	2.85	4.10	7.81
M2			3.04	2.55	3.70	7.43
M3			2.81	2.13	2.92	7.21
C.D.				0.008		
SE(m)				0.002		
Mean of sub plot						
S1-Conventional tillage				2.61	3.73	7.56
S2-Minimum tillage				2.41	3.41	7.41
C.D.				0.002		
SE(m)				0.001		
Mean of sub sub plot						
C1-Wheat				3.55	3.51	6.62
C2-Mustard				1.48	3.64	6.75
C.D.				0.05		
SE(m)				0.02		
Interaction						
Interaction A X B				NS		
Interaction A X C				NS		
Interaction B X C				NS		
Interaction A X B X C				NS		

Table 4.3.1 – Kharif 2025

Main Methods	GHAGHRGHAT								Rank
	Grain Yield (t/ha)	Straw Yield (t/ha)	Panicle/m2 (No.)	Test weight (g)	Weed population at 30 DAS (No/m2)	Weed population at 60 DAS (No/m2)	Weed Dry wt at 30 DAS (g/m2)	Weed Dry wt at 60 DAS (g/m2)	
M1- Transplanting	3.53	3.71	208	24.0	3.99	4.64	8.70	14.53	1
M2- Wet seeding (Line sowing under puddle condition)	3.20	3.40	195	23.2	5.35	6.13	16.73	29.27	2
M3- Aerobic rice - - Dry rice cultivation	2.70	3.18	166	22.2	6.48	7.34	25.50	45.27	3
Exp. mean	3.14	3.43	190	23.1	5.27	6.04	16.98	29.69	
CD(0.05)	0.33	0.14	16.54	0.15	0.06	0.06	2.40	4.57	
CV	7.24	2.77	6.02	0.45	0.79	0.71	9.75	10.61	
Variety	NDR 2065								
Soil type	Sandy Loam								
pH	7.4								
RDF N:P:K (kg/ha)	120:60:40								
Aval. NPK of soil (kg/ha)	200:24:234								

4.3.2. Analysis of long term meteorology data (temperatures and rainfall) for identifying the reasons for yield reduction

The Dataset consists of rice yield data and meteorological data of 10 locations like **Navasari, Rajendranagar, Mandya, Coimbatore, Gangavathi, Kaul, Khudwani, Ludhiana, Pattambi and Chinsurah and Karaikal** for the years 2005 to 2025. This data includes yield of rice crop (t/ha), rainfall of the crop season(mm) and mean weekly minimum temperature and maximum temperature of the crop season($^{\circ}\text{C}$).

The Random forest ($R^2=0.95$) algorithm performed well in predicting the yield of the rice crop (Fig. 1). Validation across four locations also showed strong agreement ($R^2 = 0.93$, $r = 0.96$) (Fig. 2). From the meteorological analysis, it is clear that weather conditions like min. temp $>20^{\circ}\text{C}$, max. temp $>29^{\circ}\text{C}$ and crop season rainfall between 300-1000 mm are favorable for rice crop in producing higher yield (>6 t/ha) as well as weather conditions like min. temp $>17^{\circ}\text{C}$, max. temp $>28^{\circ}\text{C}$ and crop season rainfall 50-1000 mm are favorable in producing yield ranging from 3-6 t/ha and low yields (< 3 t/ha) are influenced by rainfall >1000 mm or rainfall = 0 mm or min. temp $<15^{\circ}\text{C}$ or max. temp $26-28^{\circ}\text{C}$ (Fig. 3). Although the model performed well, its predictive capability can be further enhanced by incorporating larger multi-year datasets.

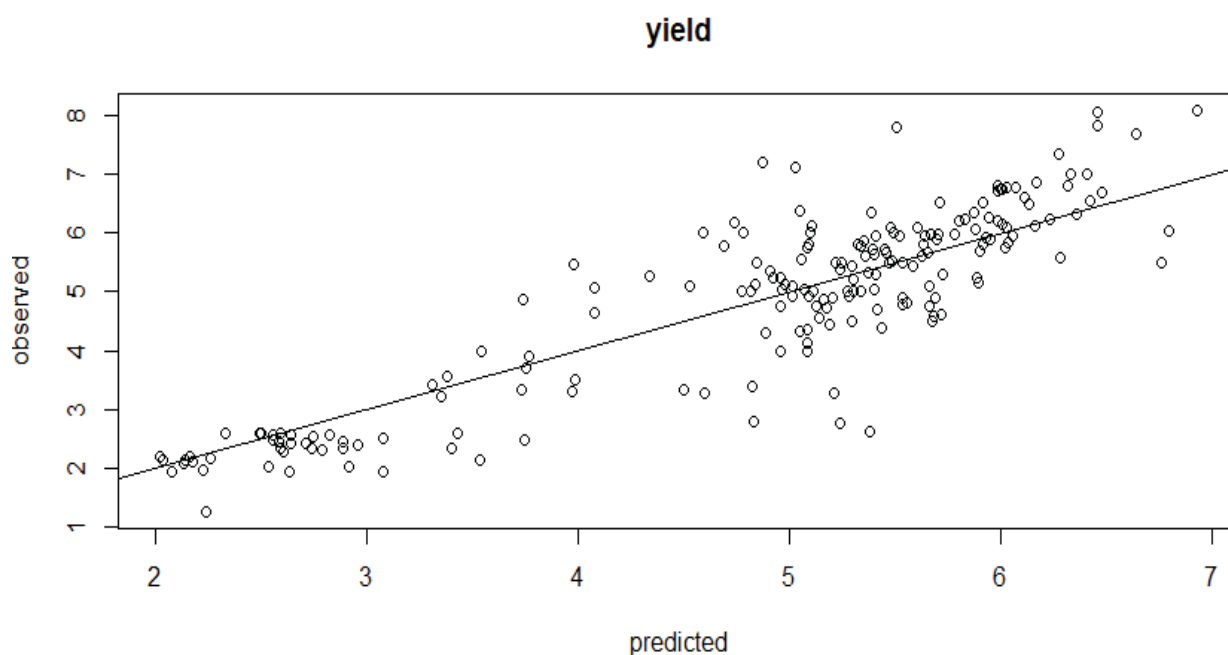


Fig 1 : Scatter plot showing the Predicted Vs Actual yield of Rice crop-Random Forest Algorithm

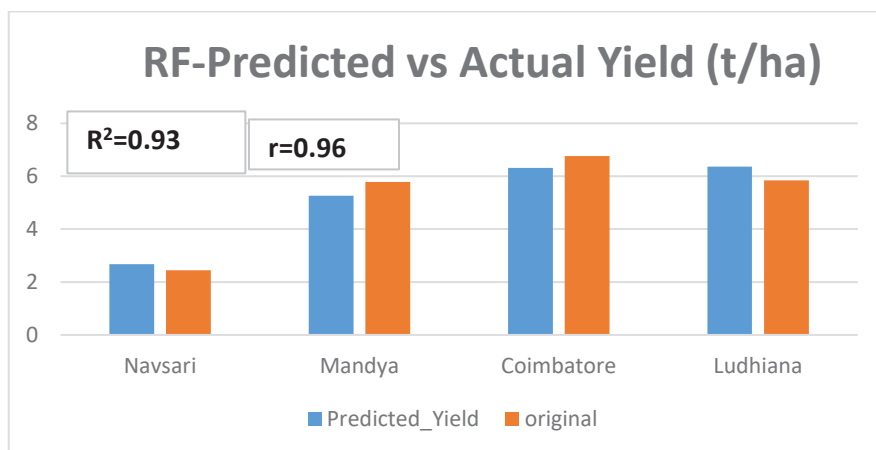


Fig 2 : RF Predicted Vs Actual yield of Rice crop in four locations during 2025

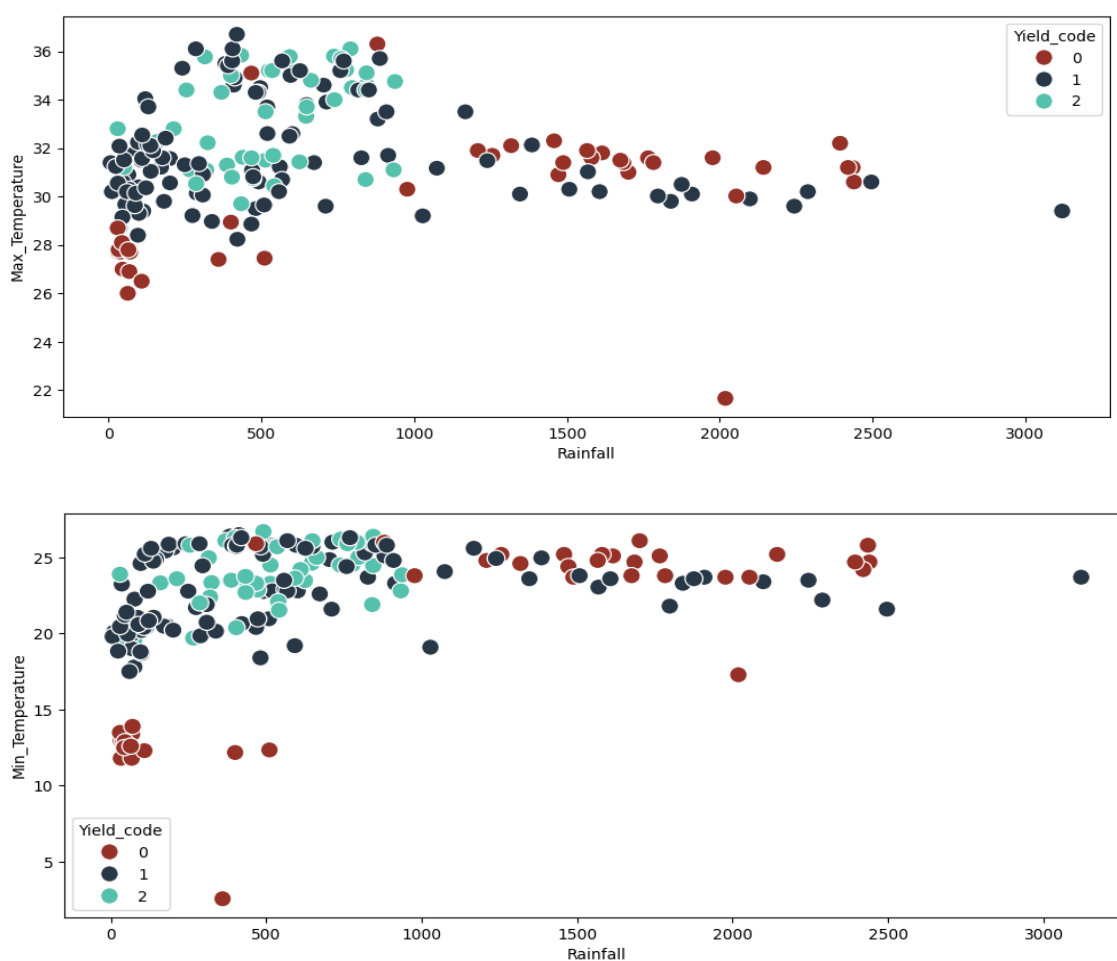


Fig 3 : Three yield scenarios with maximum and minimum temperatures and rainfall in the rice crop season (where x- axis represents rainfall in the season and y-axis represents Mean Weekly Maximum Temperature in the season. Yield code 0 represents the scenarios where the yield < 3, Yield code 1 represents the scenarios where yield ≥ 3 and yield < 6, Yield code 2 represents yield ≥ 6).

WEED MANAGEMENT TRIALS



4.4 WEED MANAGEMENT TRIALS (WMT's)

4.4.1. Long term trial on Weed Dynamics in Direct Seeded Rice (DSR)

The global shift toward Direct Seeded Rice (DSR) as a water-saving and labour-efficient alternative to conventional transplanting has significantly altered weed communities and increased the complexity of weed management. To systematically track these shifts, a long-term monitoring trial was initiated to evaluate weed flora dynamics, infestation levels, and the evolving efficacy of herbicide protocols across diverse rice establishment systems. During the 2024–25 cycle, this trial was implemented across 15 strategic locations representing major agro-climatic zones in India. The study followed a seasonal distribution, with 12 locations viz., **Aduthurai, ARI-Rajendranagar, Chiplima, Chinsurah, Gangavathi, Jagdalpur, Malan, Moncompu, Nawagam, Pantnagar, Pattambi and Titabar** in seven **Zones** conducting surveys during the *Kharif* season and two locations (Pattambi and Karaikal) extending the monitoring into the *Rabi* season. The trials consists of replicated split plot design with two main plots M1-Puddled Wet direct seeding, M2-Un-puddled Dry direct seeding and three sub plots **S1-** Herbicide Application, **S2 –** Rotational application, **S3-** Farmers practice (mention the practice followed - manual weeding), **S4-** Mechanical weeding / weeder (2-3 times), **S5-** Weedy check and **S6-** Weed free. The individual Genus and Species wise, group wise, total weed population, weed dry biomass at two critical crop growth stages of active tillering and panicle initiation; crop dry-matter production, yield attributes, grain and straw yield recorded by the test locations after statistical analysis are summarised and presented in **Tables 4.4.1**.

Weed flora reported in different test locations in Zones

Table: The location wise weeds at critical crop growth stages in rice systems

Centre	Active Tillering Stage	Panicle Initiation Stage
	Species	Species
Groups - Grasses		
Zone I – Hilly areas Malan	<i>Echinochloa colona</i> , <i>Echinochloa crusgalli</i> , <i>Panicum spp</i>	<i>Echinochloa colona</i> , <i>Echinochloa crusgalli</i> , <i>Panicum spp</i>
Zone II – Northern Pantnagar	<i>Echinochloa colona</i> , <i>Eleusine indica</i>	<i>Echinochloa colona</i> , <i>Eleusine indica</i>
Zone III – Eastern Chiplima	<i>Echinochloa crusgalli</i> , <i>Echinochloa colona</i> , <i>Paspalum distichum</i>	<i>Echinochloa colona</i>
Zone IV – North Eastern Titabar	<i>Echinochloa crusgalli</i> , <i>Leersia hexandra</i>	<i>Echinochloa crusgalli</i> , <i>Leersia hexandra</i>
Zone V – Central Jagdalpur	-	<i>Echinochloa spp</i> , <i>Cynodon dactylon</i>
Zone VI – Western Nawagam	<i>Echinochloa colona</i> , <i>Cynodon dactylon</i> , <i>Chloris barbata</i> , <i>Echinochloa crusgalli</i>	<i>Echinochloa colona</i> , <i>Cynodon dactylon</i> , <i>Chloris barbata</i> , <i>Echinochloa crusgalli</i>
Zone VII – Southern		
Aduthurai	<i>Echinochloa colona</i> , <i>Cynodon dactylon</i> , <i>Leptochloa chinensis</i> , <i>Echinochloa crusgalli</i> , <i>Panicum repens</i>	-
Gangavathi	<i>Echinochloa spp</i> , <i>Cynodon spp</i> , <i>Leptochloa spp</i>	<i>Echinochloa spp</i> , <i>Cynodon spp</i> , <i>Leptochloa spp</i>
Moncompu	<i>Isahcne miliacea</i> , <i>Echinochloa stagnina</i> , <i>Oryza. sativa f.sp. spontanea</i>	<i>Isahcne miliacea</i> , <i>Echinochloa stagnina</i> , <i>Oryza. sativa f.sp. spontanea</i>
Pattambi	<i>Isahcne miliacea</i>	<i>Isahcne miliacea</i>
Rajendranagar ARI	<i>Echinochloa colona</i> , <i>Cynodon dactylon</i> , <i>Echinochloa crusgalli</i> , <i>Panicum repens</i> , <i>Digitaria sanguinalis</i> , <i>Eleusine indica</i> , <i>Dactylactenium aegyptium</i>	<i>Echinochloa colona</i> , <i>Cynodon dactylon</i> , <i>Echinochloa crusgalli</i> , <i>Panicum repens</i> , <i>Digitaria sanguinalis</i> , <i>Eleusine indica</i> , <i>Dactylactenium aegyptium</i>

Groups - Sedges		
Zone I – Hilly areas Malan	<i>Cyperus rotundus</i> , <i>Cyperus difformis</i> , <i>Cyperus iria</i>	<i>Cyperus rotundus</i> , <i>Cyperus difformis</i> , <i>Cyperus iria</i>
Zone II – Northern Pantnagar	<i>Cyperus iria</i> , <i>Cyperus difformis</i> , <i>Fimbristylis miliacea</i>	<i>Cyperus iria</i> , <i>Cyperus difformis</i>
Zone III – Eastern Chiplima	<i>Cyperus difformis</i> , <i>Cyperus iria</i> , <i>Fimbristylis miliacea</i>	<i>Cyperus iria</i> , <i>Fimbristylis miliacea</i>
Zone IV – North Eastern Titabar	<i>Cyperus iria</i>	<i>Cyperus iria</i>
Zone V – Central Jagdalpur	-	<i>Cyperus spp</i>
Zone VI – Western Nawagam	<i>Cyperus iria</i> , <i>Cyperus esculentus</i> , <i>Cyperus rotundus</i>	<i>Cyperus iria</i> , <i>Cyperus esculentus</i> , <i>Cyperus rotundus</i>
Zone VII – Southern		
Aduthurai	<i>Cyperus rotundus</i> , <i>Cyperus difformis</i> , <i>Fimbristylis miliacea</i>	-
Gangavathi	<i>Cyperus rotundus</i>	<i>Cyperus rotundus</i>
Moncompu	<i>Cyperus difformis</i> , <i>Fimbristylis miliacea</i>	<i>Cyperus difformis</i> , <i>Fimbristylis miliacea</i> , <i>Cyperus haspan</i>
Pattambi	<i>Cyperus difformis</i> , <i>Fimbristylis miliacea</i> , <i>Cyperus laevigatus</i>	<i>Cyperus difformis</i> , <i>Fimbristylis miliacea</i> , <i>Cyperus laevigatus</i>
Rajendranagar ARI	<i>Cyperus iria</i> , <i>Cyperus difformis</i>	<i>Cyperus iria</i> , <i>Cyperus difformis</i>
Groups - BLW		
Zone I – Hilly areas Malan	<i>Monochoria vaginalis</i> , <i>Alternanthera spp</i> , <i>Eclipta alba</i>	<i>Monochoria vaginalis</i> , <i>Alternanthera spp</i> , <i>Eclipta alba</i>
Zone II – Northern Pantnagar	<i>Alternanthera sessilis</i> , <i>Commelina diffusa</i>	<i>Alternanthera sessilis</i> , <i>Commelina diffusa</i>
Zone III – Eastern Chiplima	<i>Ludwigia parviflora</i> , <i>Marsilea quadrifolia</i> , <i>Monochoria vaginalis</i> , <i>Sphenoclea zeylanica</i> , <i>Alternanthera philoxeroides</i>	<i>Ludwigia parviflora</i> , <i>Sphenoclea zeylanica</i>
Zone IV – North Eastern Titabar	<i>Alternanthera spp</i>	<i>Alternanthera spp</i>
Zone V – Central Jagdalpur	-	<i>Ludwigia spp</i> , <i>Alternanthera spp</i>
Zone VI – Western Nawagam	<i>Ipomoea aquatic</i> , <i>Trianthema monogyna</i> , <i>Eclipta alba</i>	<i>Ipomoea aquatic</i> , <i>Trianthema monogyna</i> , <i>Eclipta alba</i>
Zone VII – Southern		
Aduthurai	<i>Eclipta alba</i> , <i>Ammania baccifera</i> , <i>Euphorbia prostrata</i> , <i>Marsilea quadrifolia</i> , <i>Bergia capensis</i>	-
Gangavathi	<i>Cyanotis spp</i>	<i>Cyanotis spp</i>
Moncompu	<i>Monochoria vaginalis</i> , <i>Ludwigia hyssopifolia</i>	<i>Monochoria vaginalis</i> , <i>Ludwigia hyssopifolia</i>
Pattambi	<i>Monochoria vaginalis</i> , <i>Sagittaria guayanensis</i> , <i>Vallisneria spp</i>	-
Rajendranagar ARI	<i>Ammania baccifera</i> , <i>Bergia capensis</i> , <i>Eclipta alba</i> , <i>Marsilea quadrifolia</i> , <i>Ludwigia parviflora</i>	<i>Ammania baccifera</i> , <i>Bergia capensis</i> , <i>Eclipta alba</i> , <i>Marsilea quadrifolia</i> , <i>Ludwigia parviflora</i>

Relative Weed Dominance

The Genus and Species-wise weed population was reported by 11 locations viz., **Aduthurai**, **ARI-Rajendranagar**, **Chiplima**, **Gangavathi**, **Jagdalpur**, **Malan**, **Moncompu**, **Nawagam**, **Pantnagar**, **Pattambi** and **Titabar**. The establishment method dry DSR recorded higher weed populations (individual species-wise, group-wise, and total) compared to wet DSR across most high-pressure locations like **Titabar** and **Pattambi**. The weed population was significantly low with chemical weed control treatments.

At Active Tillering (AT) stage, the common and prevalent group-wise weed population was in the order of Grasses > Sedges > Broad Leaf Weeds (BLW) at four locations (**Aduthurai, ARI-Rajendranagar, Pantnagar, and Titabar**); whereas Grasses > BLW > Sedges was observed at three locations (**Chiplima, Jagdalpur, and Malan**). Sedges > Grasses > BLW was the dominant order at **Gangavathi, Moncompu and Pattambi**, while **Nawagam** followed the order Sedges > BLW > Grasses, indicating a strong presence of sedges and BLWs in southern and western coastal regions. At Panicle Initiation (PI) stage, the dominance of Grasses > Sedges > BLW continued at **Pantnagar, ARI-Rajendranagar, and Titabar**. However, a shift to Grasses > BLW > Sedges was reported at **Malan and Jagdalpur**. Sedges > Grasses > BLW remained the dominant order at **Gangavathi, Moncompu and Pattambi**, and Sedges > BLW > Grasses at **Nawagam**, indicating that sedge groups remained the most persistent competitors into the later growth stages at these locations.

The data on total weed population was reported by 10 locations at AT stage and 10 locations at PI stage (except **Aduthurai**). The total weed population was low (<10/m²) in management plots (herbicide and mechanical) across most locations but remained high (>20/m²) in the weedy check. **Titabar** and **Pattambi** recorded exceptionally high populations in the weedy check, exceeding 200/m² at AT. The individual grass weeds and species-wise population at active tillering were dominated by *Echinochloa colona*, reported as the major grass at **Aduthurai, ARI-Rajendranagar, Chiplitima, Malan, Pantnagar, and Titabar**. *Echinochloa crus-galli* was the dominant grass at **Nawagam**, while *Isachne miliacea* was the primary grass at **Pattambi**. Other grasses like *Leersia hexandra* (**Titabar**) and *Leptochloa chinensis* (**Nawagam**) were of localized importance. The results showed a continuing dominance of *Echinochloa colona* across most zones.

Regarding sedges, *Cyperus iria* was the major species at **ARI-Rajendranagar, Gangavathi, Pantnagar, Pattambi and Titabar**. *Cyperus difformis* was dominant at **Aduthurai and Nawagam**, while *Fimbristylis miliacea* was the exclusive major sedge at **Moncompu**. For Broad Leaf Weeds (BLW), diversity was high across locations. *Ludwigia parviflora* was a major weed at **ARI-Rajendranagar and Moncompu**. *Marsilea quadrifolia* was prominent at **Aduthurai**, *Sphaeranthus zeylanica* at **Chiplima**, and *Commelina diffusa* at **Malan and Pattambi**. *Caesulia axillaris* was reported as the dominant BLW at **Pantnagar**. These results highlight a significant regional diversity in BLW occurrence compared to the more uniform dominance of grass species.

Zone I (North Western Hils), at Malan, the most heterogeneous weed community was recorded. BLW density was significantly higher than in southern centers, reaching 36.54% in Wet DSR and Mechanical weeding. Unlike other sites, no single group achieved absolute dominance. Grasses, Sedges, and BLW each maintained a presence between 25% and 40%. The temporal decline in WCE observed from tillering to panicle initiation. **Zone VI (Western), at Nawagam**, high Sedge persistence was recorded. At panicle initiation, Sedges remained the dominant group (42.19% in Wet DSR and herbicide applications). The consistent dominance of Sedges across all management sub-plots suggests a high density of underground propagules (tubers). **Zone VII (Southern), at Aduthurai, RWD:** **Aduthurai** exhibited a high prevalence of graminaceous weeds. At the active tillering stage, Grasses reached a RWD of 79.53% under

Wet DSR and herbicide applications. The transition to Dry DSR further intensified this dominance, with Grass RWD increasing to 82.50% in the rotational application. At **Gangavathi**, a significant "weed shift" was noticed. While the weedy check showed a balanced distribution (approx. 42% Grasses and 41% Sedges), the herbicide treatment herbicide application under Wet DSR saw Grasses surge to 88.89% by the panicle initiation stage, while Sedges were reduced to 11.11%. At **Moncompu**, exhibited a profound Main-plot x Sub-plot interaction, with establishment methods acting as a primary driver of weed community composition. Puddled Wet DSR: This system was predominantly characterized by Grasses. In the Farmers' Practice plot, Grasses reached a peak RWD of 83.69%. Un-puddled Dry DSR: In dry seeding with the Weedy Check, Sedges dominated the flora at 81.19%, while Grasses were suppressed to just 10.50%. Temporal Dynamics: At the panicle initiation stage under M1, Grasses remained the primary threat, with RWDs as high as 89.27% in the mechanical weeding plots. At **Pattambi**, exhibited a "Sedge-climax" flora. In Puddled Wet DSR, Sedges reached a RWD of 100.00% across multiple management treatments. While Dry DSR allowed for a slight emergence of Grasses and BLW, Sedges remained the primary threat at 58.39%. At **ARI-RAJENDRANAGAR**, the weed community at ARI-Rajendranagar was characterized by high stability and an equitable distribution among the three major weed groups. Throughout the active tillering and panicle initiation stages, Grasses, Sedges, and BLW each maintained a relative density typically ranging between 25% and 40%. Unlike other centers, there was no drastic "weed shift" following herbicide application.

Weed Control Efficiency

Zone I (North Western Hills), at Malan, **WCE**: Under M1, S1 and S2 maintained approximately 69-71% WCE at the active tillering stage. There was a slight decline in efficiency by the panicle initiation stage, dropping to about 63-65%. **Zone V (Central)**, at **Jagdulpur**, evaluation at the panicle initiation stage showed exceptional results for herbicide applications (S1 and S2), both exceeding 92% WCE. **Zone VI (Western)**, at **Nawagam**, the WCE displayed very stable performance across both M1 and M2. Herbicide treatments (S1, S2) remained consistently strong, ranging between 79% and 83% regardless of the seeding method. **Zone VII (Southern)**, at **Gangavathi**, this center recorded high and consistent WCE across all treatments and both stages. Under M1, herbicide treatments (S1, S2) and manual weeding (S3) achieved statistically similar results, (~ 77-83%). At panicle initiation, S3 (manual weeding) under M1 reached a peak of 95.08%. At **Moncompu**, significant disparity was noted between M1 and M2. In M1, manual weeding (S3) was moderately effective (55.95%), but in M2 (Dry DSR), it collapsed to a statistically inferior 19.50%. At **Pattambi**, a significant Main-plot effect was observed here. In Wet DSR manual weeding was highly effective (90.90%), significantly outperforming the herbicide treatments (S1/S2 at ~76–88%). However, in un-puddled dry DSR, its efficiency dropped significantly to 48.22%. At **ARI-RAJENDRANAGAR**, wet DSR with herbicide application achieved only 30.15%. Interestingly, WCE was significantly higher in Dry DSR for the same treatment (51.92%). Mechanical weeding in un-puddled dry DSR (61.11%) was actually more efficient than chemical options.

Weed Biomass (dry) (g/m²)

The biomass of individual weed-wise and total weeds was reported at two critical stages by **ARI-Rajendranagar, Gangavathi, Jagdalpur, Malan, Moncompu, Nawagam, Pantnagar, Pattambi** and **Titabar**. At the active tillering stage, total weed biomass across the test locations was generally higher in the dry DSR compared to wet DSR at high-pressure sites like **Titabar** and **Pattambi**, whereas they were statistically at par in locations like **Gangavathi**. Among the weed management treatments, chemical weed control single and rotational method resulted in significantly low and superior over mechanical weeding. The results indicated relatively low intensity of weed pressure in **Jagdalpur, Malan, and Gangavathi** (in treated plots). The mean total weed biomass was medium to high at **Moncompu** (91.35 g/m²) and **Pattambi** (92.68 g/m²), and exceptionally high at **Titabar** (127.31 g/m²) and **Nawagam** (158.27 g/m²), indicating severe weed competition. At the panicle initiation stage, the total weed biomass showed a general decrease in several locations due to crop competition but remained high at **Nawagam** (111.49 g/m²) and **Moncompu** (76.14 g/m²).

The group-wise weed biomass at critical stages was reported by all nine locations. At both active tillering and panicle initiation stages, the order of dominance was Grasses > Sedges > BLW at **ARI-Rajendranagar, Pantnagar, and Titabar**; Grasses > BLW > Sedges at **Jagdalpur** and **Malan**; and Sedges > Grasses > BLW at **Gangavathi, Moncompu** and **Pattambi**. **Nawagam** reported a dominance of Sedges > BLW > Grasses, indicating a strong persistence of sedge biomass in the western and southern regions. The grass weed biomass showed a decrease from active tillering to panicle initiation at most locations, suggesting effective early-stage control and crop shading. At active tillering, grass biomass ranged from 6.07 g/m² at **Jagdalpur** to 108.62 g/m² at **Titabar**. At panicle initiation, it ranged from 4.13 g/m² at **Jagdalpur** to 50.65 g/m² at **Titabar**. Sedge weed biomass was highest at **Nawagam** (90.05 g/m²) and **Moncompu** (61.76 g/m²) at the AT stage. BLW biomass also peaked at **Nawagam** (32.71 g/m²) and **Moncompu** (18.33 g/m²) during active tillering.

The biomass of individual grass species-wise was dominated by *Echinochloa colona* at **ARI-Rajendranagar, Malan, Pantnagar, and Titabar**, with biomass reaching up to 89.33 g/m² in the weedy check at **Titabar**. *Echinochloa crus-galli* was the major grass at **Nawagam** (18.67 g/m²), while *Isachne miliacea* was dominant at **Moncompu** (32.00 g/m²) and **Pattambi** (28.89 g/m²). *Leersia hexandra* was a notable contributor at **Titabar** (12.07 g/m²). At the panicle initiation stage, *Echinochloa colona* remained dominant at most locations, while *Isachne miliacea* persisted as the primary grass at the southern coastal centers.

The biomass of individual species-wise sedge weeds was reported by all locations. At active tillering, *Cyperus iria* was the major sedge at **ARI-Rajendranagar, Gangavathi, Pantnagar, and Titabar**, while *Cyperus difformis* dominated at **Nawagam** (58.31 g/m²). *Fimbristylis miliacea* was the exclusive major sedge at **Moncompu** (58.00 g/m²). By the panicle initiation stage, sedge biomass generally followed a decreasing trend, though *Cyperus iria* and *Fimbristylis miliacea* remained the most persistent species.

The biomass of individual species-wise BLW showed significant diversity. *Ludwigia parviflora* was the dominant BLW at **ARI-Rajendranagar** and **Moncompu**. *Marsilea quadrifolia*

was prominent at ARI-Rajendranagar, while *Commelina diffusa* was the major BLW at Malan and Pattambi. *Caesulia axillaris* showed high biomass at Pantnagar. In contrast to some previous trends, BLW biomass at several locations showed a slight decrease or stabilization at the panicle initiation stage compared to active tillering, indicating that early chemical and mechanical interventions were effective in checking their growth.

Grain yield and Straw yield

In Zone I (Hilly Areas) at Malan, the trend reversed compared to **Titabar**. Un-puddled dry direct seeding (3.02 t/ha) performed significantly better than puddled wet DSR (2.53 t/ha). Sub Plot Effect: Significant differences were observed among weed treatments. Weed Free led the yields (3.22 t/ha), followed by Rotational application (3.06 t/ha). The Weedy Check drastically reduced yields to 2.27 t/ha. Interaction: A significant interaction was recorded. The highest individual treatment yield was observed in dry DSR under weed free condition (3.53 t/ha). Straw yield (4.03 t/ha) was significantly superior in dry DSR (3.37 t/ha), mirroring the grain yield results for this region. Weed free (4.30 t/ha) and rotational herbicide application (4.08 t/ha) produced the significantly highest biomass. Interaction: M2-S6 achieved the significantly highest individual straw yield (4.71 t/ha).

In Zone – II (Northern) at Pantnagar, there was no significant difference between Puddled Wet DSR (4.95 t/ha) and Un-puddled Dry DSR (4.51 t/ha), although M1 maintained a slight numerical edge. This indicates that both establishment methods are potentially viable for the region. Weed management practices significantly influenced grain yield. The Weed Free (S6) treatment recorded the highest yield (5.32 t/ha), followed closely by S3 (Farmers practice/Manual weeding) at 5.24 t/ha and S2 (Rotational application) at 5.18 t/ha. The Weedy Check (S5) resulted in a substantial yield reduction, producing only 2.74 t/ha. A significant interaction was observed. Under puddled conditions (M1), herbicide-based treatments like S1 and S2 performed exceptionally well (5.51 and 5.47 t/ha, respectively). However, under dry seeding (M2), these yields dipped slightly, while manual weeding (S3) remained robust. Straw yield no significant difference (M1: 6.33; M2: 5.80 t/ha). S6 (6.71 t/ha) and S3 (6.69 t/ha) recorded significantly highest straw production. Puddled Wet DSR generally incurred higher costs than Un-puddled Dry DSR. For instance, under S1, M1 cost Rs 42,294 /ha compared to Rs 39,895/ha in M2. Mechanical weeding was the most economical treatment across both establishment methods (Rs. 37,658/ha). In contrast, S2 and S3 were among the most expensive, reflecting the costs of rotational herbicide management and manual labour. No significant difference was observed between M1 (2.43) and M2 (2.34). Interestingly, Weed Free recorded the highest BCR (2.76), followed by S1 (2.57). Interaction: Significant. The highest profitability was observed in M2-S4 (2.81) and M2-S6 (2.72), indicating un-puddled DSR can be highly profitable when weeds are managed mechanically or kept completely free.

At **Chatha**, yield differences between establishment methods were significant. Puddled Wet DSR (M1, 2.68 t/ha) outperformed Un-puddled Dry DSR (M2, 2.51 t/ha). The statistical difference confirms M1 as the preferred method for maximizing yield potential. Sub-plot treatments showed high significance. The Mechanical Weeding treatment reached the highest yield (3.14 t/ha), surpassing even the Weed Free check (3.00 t/ha). This suggests that mechanical aeration or soil disturbance might be providing a secondary benefit (improves root

growth or nutrient availability) to the crop at this location. The success of Mechanical weeding at **Chatha** is a notable deviation from other centers where Weed Free or Chemical usually lead. The Weedy Check showed the most severe yield depression, dropping to 1.14 t/ha. Interaction: The interaction between establishment methods and weed management was not significant (NS) at Chatha. This implies that the superior performance of mechanical weeding or the yield loss in the weedy check occurred consistently regardless of whether the rice was sown in puddled or un-puddled soil. Straw yield M1 (3.31 t/ha) was significantly higher than M2 (3.12 t/ha). S4 (Mechanical) yielded the significant higher straw (3.89 t/ha), surpassing S6. Interaction not Significant.

In Zone III (Eastern) at Chiplima, there was a significant difference between the two establishment methods. Puddled Wet DSR (4.27 t/ha) performed significantly better than Un-puddled Dry DSR (3.81 t/ha). Weed management practices were highly significant. The Weed Free treatment produced the highest yield (4.80 t/ha), followed by S1 (Herbicide application) at 4.68 t/ha. The Weedy Check resulted in the lowest yield (2.35 t/ha), indicating that weeds can reduce potential yields by approximately 51% if left unmanaged. Interaction: A significant interaction was recorded. Notably, the M1-S6 combination achieved 5.20 t/ha, whereas M2-S6 only reached 4.40 t/ha. This confirms that the yield potential of the best weed management practices is maximized when paired with puddled wet seeding at this location. Straw yield of M1 (5.11 t/ha) was significantly superior to M2 (4.56 t/ha). Sub Plot: S6 (5.75 t/ha) and S1 (5.62 t/ha) were the top performers. Interaction: Significantly higher biomass was reached in M1-S6 (6.24 t/ha). The cost difference between M1 and M2 was marginal, though M2 showed slightly higher costs in specific treatments like S1 (Rs. 67,751/ha) compared to M1 (Rs. 65,669/ha). Farmers Practice/Manual Weeding was the most expensive treatment at this location, exceeding Rs 72,000/ha regardless of the main plot. Weedy Check naturally had the lowest cost (Rs 60,521/ha in M1). Puddled Wet DSR (2.08) recorded a significantly higher mean BCR compared to Un-puddled Dry DSR (1.80). Herbicide Application achieved the significantly highest BCR (2.32), followed closely by rotational application (2.20). Manual weeding and the weedy check showed poor economic efficiency (<1.70). The combination M1-S1 yielded the highest ratio (2.57), indicating that herbicide use in puddled conditions is the most profitable strategy.

In Zone IV (North Eastern) at Titabar, Puddled wet direct seeding (4.32 t/ha) significantly out-yielded un-puddled dry direct seeding (3.36 t/ha). The yield advantage of M1 over M2 was approximately 28.5%. Weed management practices showed significant differences. The Weed Free treatment recorded the highest yield (4.50 t/ha), closely followed by Herbicide application (4.22 t/ha). As expected, the Weedy Check resulted in the lowest yield (3.03 t/ha), indicating high weed pressure at this location. Interaction: The interaction was significant. Specifically, under puddled conditions, S6 reached a peak yield of 5.03 t/ha, whereas the same treatment under dry seeding only reached 3.97 t/ha. Straw yield of M1 (5.76 t/ha) significantly out-yielded M2 (4.48 t/ha). Sub Plot: S6 recorded significantly highest yield among all treatments (6.00 t/ha). Interaction: M1-S6 recorded the highest straw yield (6.71 t/ha).

In Zone V (Central) at Jagdalpur, there was no significant difference (NS) between M1 (4.66 t/ha) and M2 (4.45 t/ha). This suggests that either establishment method is viable in **Jagdalpur** without compromising potential yield. Weed management was highly significant. S6 (Weed Free) produced the highest yield (5.94 t/ha), while S2 (5.46 t/ha) and S1 (5.12 t/ha) also performed strongly. The Weedy Check (S5) suffered a massive yield loss, producing only 1.92 t/ha. Interaction: The interaction between establishment methods and weed management was not significant. Straw yield no significant difference (M1: 5.83; M2: 5.56 t/ha). S6 produced the significantly highest straw yield (7.43 t/ha). S5 showed extreme biomass reduction (2.40 t/ha). Interaction: Not Significant. M1 treatments were consistently more expensive than M2 by approximately Rs 3,000–4,000/ha. S6 (Weed Free) stood out as the most expensive treatment (Rs. 63,000/ha in M1), whereas herbicide-based treatments (S1 and S2) were significantly more affordable, ranging between Rs 45,000 and Rs 49,500/ha. Benefit-Cost Ratio was not difference between M1 (2.28) and M2 (2.35). S2 (Rotational Herbicide) provided the best BCR (2.97), closely followed by S1 (2.82). Interaction was not significant.

In Zone VI (Western) at Nawagam, the difference between M1 (3.95 t/ha) and M2 (4.02 t/ha) was not significant. Both puddled and un-puddled methods appear equally effective. Weed management practices significantly influenced yield. S1 (Herbicide application) yielded the highest (4.54 t/ha), performing on par with S4 (Mechanical weeding) (4.40 t/ha). Interestingly, S6 (Weed Free) yielded 4.28 t/ha. The Weedy Check (S5) was significantly lower at 3.11 t/ha. Interaction: No significant interaction was observed between the main plot and sub-plot factors. Straw yield has no significant difference S1 (5.68 t/ha) and S4 (5.50 t/ha) recorded significantly highest yield. Interaction: Not Significant. The cost of cultivation remained very stable between M1 and M2, with M1 being only slightly more expensive (a difference of Rs <1,000/ha for most treatments). Differences between sub-plots were minimal compared to other centers. S6 was the costliest (Rs 51,144/ha in M1), while herbicide application (S1) remained a cost-effective alternative (Rs 49,788/ha). Benefit-Cost Ratio was not Significant (M1: 2.17; M2: 2.26). S1 (2.54) and S2 (2.36) remained the most economically efficient sub-plots. Interaction was not Significant.

Zone VII (Southern) at Aduthurai, there was a significant difference between establishment methods. Puddled Wet DSR (M1, 4.93 t/ha) significantly outperformed Un-puddled Dry DSR (M2, 4.28 t/ha). Weed management treatments were highly significant. The Weed Free (S6) plot yielded the highest (5.57 t/ha), closely followed by S4 (Mechanical weeding) at 5.32 t/ha. The Weedy Check (S5) resulted in the lowest yield (2.19 t/ha), representing a 60% yield loss compared to the weed-free check. The interaction was not significant. Crop establishment methods significantly impacted biomass production, with Puddled Wet Direct Seeding (M1) yielding a superior straw biomass of 6.41 t/ha compared to 5.56 t/ha in Un-puddled Dry Direct Seeding (M2). Among the weed management modules, the Weed-free Check (S6) recorded the maximum straw yield (7.24 t/ha). The interaction effect between the establishment method and weed management was statistically non-significant. Cost of cultivation exhibited a marginal increase under the Puddled Wet DSR (M1) system compared to Un-puddled Dry DSR (M2), with a differential of approximately 1,000–2,000 ₹/ha. Among the weed management sub-plots, the Weed-free Check (S6) incurred the highest expenditure, reaching 47,956 ₹/ha within the M1 main plot.

At Gangavathi, no significant difference (NS) was found between M1 (3.94 t/ha) and M2 (3.72 t/ha). Sub Plot Effect: Significant differences were observed. Interestingly, S6 (Weed Free) was the top performer (4.58 t/ha), while S3 (Farmers practice) and S1 (Herbicide) were also effective. The interaction was not significant. No statistical disparity was observed between the two main-plot establishment methods (M1 and M2) regarding straw yield. The S6 (Weed-free) treatment attaining the highest yield at 5.72 t/ha. The M x S interaction remained non-significant, suggesting that the efficacy of the weed management sub-plots was consistent across both wet and dry DSR systems. A statistically significant main-plot effect in Cost of cultivation was observed, where M1 (56,280–60,030 ₹/ha) was substantially more expensive than M2 (50,280–56,980 ₹/ha). The maximum investment was recorded in the M1-S6 treatment combination, reflecting the high input requirement for maintaining absolute weed-free conditions in puddled systems. Analysis of the BCR revealed a non-significant differences. Among the sub-plot treatments, the herbicide sequences S1 (2.00) and S2 (1.97) emerged as the most economically efficient modules. The interaction was non-significant.

At Moncompu, there was no significant difference between M1 (3.69 t/ha) and M2 (3.49 t/ha). Sub Plot Effect: Weed treatments were significant. S6 (Weed Free) and S1 (Herbicide) were the leading treatments at 4.33 and 3.82 t/ha, respectively. The interaction was not significant. The main-plot effect of establishment methods on straw yield was found to be non-significant. The Weed-free Check (S6) maintained dominance among sub-plots, recording a yield of 5.42 t/ha. No significant interaction was recorded. The highest overall cultivation costs was recorded. The S6 (Weed-free) treatment reached an apex of 153,125 ₹/ha in M1 and 148,125 ₹/ha in M2. Notably, Farmers' Practice (S3 - Manual Weeding) also yielded exceptionally high costs (>128,000 ₹/ha). This extreme expenditure is indicative of high local labour wages and suggests that manual weed control is economically non-viable in this agro-ecological zone. Despite the exceptionally high cost of cultivation recorded, the herbicide-based treatments (S1 and S2) maintained robust BCRs, both exceeding 3.40. The interaction remained non-significant.

At Pattambi, a significant difference was observed. Puddled Wet DSR (M1, 4.60 t/ha) was superior to Un-puddled Dry DSR (M2, 3.78 t/ha). Significant differences showed that S2 (Rotational application) yielded the highest (4.84 t/ha), marginally outperforming S1 (4.75 t/ha) and even S6 (4.15 t/ha). The interaction was significant. Under M1, herbicide treatments (S1 and S2) were highly effective, reaching yields above 5.5 t/ha. Straw yield showed a significant main-plot effect, where M1 establishment significantly out-yielded M2. Notably, a significant Interaction effect (M x S) was observed. The combination of Puddled Wet DSR (M1) and Rotational Herbicide Application (S2) achieved the highest straw yield of 6.96 t/ha. Cultivation costs at **Pattambi** remained relatively high, with the S6 (Weed-free) and S4 (Mechanical weeding) sub-plots emerging as the most capital-intensive treatments. The M1 establishment method was consistently costlier than M2, maintaining a mean expenditure gap of approximately 6,000 ₹/ha. Benefit-Cost Ratio showed significant main-plot effect, with M1 (2.49) exhibiting a superior BCR compared to M2 (2.18). Sub-plot analysis identified S1 (2.80) and S2 (2.77) as the leading weed management strategies. Notably, a significant Interaction effect (M x S) was recorded. The combination of M1-S1 (Puddled Wet DSR with fixed herbicide application) was the peak economic performer with a BCR of 3.27.

At **ARI-Rajendranagar**, there was no significant difference between M1 (5.23 t/ha) and M2 (5.03 t/ha). ARI-Rajendranagar recorded the highest overall experimental mean (5.13 t/ha) among all centers. The Weed Free (S6) check reached a peak of 6.24 t/ha, while S1 (Herbicide) followed at 5.72 t/ha. Even the Weedy Check (S5) yielded 3.96 t/ha, which is higher than the best treatments at some other locations (like Chatha or Malan). The interaction was not significant. The straw yield did not differ significantly between the main-plot treatments, with M1 (6.54 t/ha) and M2 (6.29 t/ha) showing statistical parity. The interaction was also non-significant. This center emerged as the most economically efficient location in the study. The Mechanical Weeding (S4) treatment under M1 was executed at a cost of only 32,650 ₹/ha, representing the lowest cost-of-production module across the entire southern zone. This center recorded the highest BCR values in the multi-location study. The herbicide treatments S1 (3.85) and S2 (3.70) approached a ratio of 4.0, reflecting high economic productivity. There was no significant difference between the main-plot establishment methods, and the interaction effect was statistically non-significant.

Rabi 2024-2025

In Zone VII (Southern)

At **Karaikal and Pattambi**, the establishment methods significantly influenced grain yield and dry matter accumulation. In **Karaikal**, Mechanized transplanting (M1) proved superior, recording the highest grain yield (4.56 t/ha) and dry matter at the panicle initiation stage (733.83 g/m²). There was a progressive decline in performance with Puddled Direct Seeding (M2 - 3.73 t/ha) and Un-puddled Dry Direct Seeding (M3 - 3.24 t/ha). At **Pattambi**, interestingly, M2 (Puddled direct seeding) outperformed other methods in terms of yield (8.86 t/ha) and biomass production. M1 recorded the lowest B:C ratio (0.99) compared to M2 (1.25), suggesting that while M1 is effective, its cost of cultivation in **Pattambi** is significantly higher (Rs. 63,025–75,220). The significantly lower yield in M3 across both sites highlights the challenges of "un-puddled" systems. Weed management had a profound effect on all growth and yield parameters. In both **Karaikal** and **Pattambi**, S3 (Chemical weed control) and S2 (Mechanical weeding) were significantly superior to S1 (Weedy check) in terms of grain yield. In **Karaikal**, S3 achieved the highest grain yield (4.24 t/ha). While in **Pattambi**, S3 (9.07 t/ha) and S2 (8.89 t/ha) were statistically comparable, both dramatically outperformed the weedy check (4.91 t/ha). Yield Attributes: S2 and S3 recorded significantly higher numbers of panicles per m² and higher panicle weight.

The Benefit-Cost (B:C) ratio was consistently highest under S3 (2.14 in **Karaikal**; 1.32 in **Pattambi**), followed by S2. The interaction between establishment methods and weed management was Non-Significant (NS) for grain yield and most parameters in **Karaikal**. On contrary, in **Pattambi**, a significant interaction was observed for grain yield. The combination of M2S3 (Puddled direct seeding with chemical control) resulted in the highest overall grain yield of 11.50 t/ha, whereas M3S1 (Un-puddled dry seeding without weed control) resulted in the lowest yield of 4.50 t/ha. The Cost of Cultivation was highest for mechanized transplanting (M1) and mechanical weeding (S2) due to machinery and labour requirements. Consequently, M1S3 or M2S3 generally provided the best economic returns. In **Pattambi**, the B:C ratio for M1 was below 1.0 in some subplots.

Trial 4.4.1: Yield parameters and grain yield of long term trial on Weed Dynamics in rice based cropping systems under different establishment methods, Kharif 2025.

Main plot Treatments	Sub plot Treatments	Grain Yield t/ha					
		ZONE-VII Aduthurai	ZONE-II Chatha	ZONE-III Chiplima	ZONE-VII Gangavathi	ZONE-V Jagdalpur	ZONE-I Malan
M1	S1	5.30	3.03	5.10	4.44	5.22	2.66
	S2	5.36	2.94	4.77	4.34	5.50	2.69
	S3	4.86	2.59	3.73	4.49	4.81	2.32
	S4	5.72	3.22	4.23	3.32	4.51	2.48
	S5	2.51	1.24	2.57	2.32	2.09	2.11
	S6	5.83	3.07	5.20	4.72	5.83	2.90
M2	S1	4.59	2.82	4.27	4.12	5.02	3.41
	S2	4.45	2.78	4.23	4.04	5.42	3.42
	S3	4.58	2.42	3.83	4.21	4.33	2.61
	S4	4.91	3.05	4.00	3.54	4.11	2.69
	S5	1.87	1.05	2.13	1.98	1.76	2.43
	S6	5.31	2.94	4.40	4.43	6.04	3.53
Mean of Factor-1							
M1		4.93	2.68	4.27	3.94	4.66	2.53
M2		4.28	2.51	3.81	3.72	4.45	3.02
CD(0.05)		0.21	0.04	0.19	NS	NS	0.32
CV(%)		3.18	1.13	3.22	5.27	10.03	8.06
Mean of Factor-2							
S1		4.94	2.92	4.68	4.28	5.12	3.04
S2		4.90	2.86	4.50	4.19	5.46	3.06
S3		4.72	2.50	3.78	4.35	4.57	2.46
S4		5.32	3.14	4.12	3.43	4.31	2.58
S5		2.19	1.14	2.35	2.15	1.92	2.27
S6		5.57	3.00	4.80	4.58	5.94	3.22
CD(0.05)		0.36	0.04	0.29	0.27	0.51	0.17
CV(%)		6.47	1.27	6.01	5.94	9.24	5.12
Interaction							
M and T		NS	NS	0.40	NS	NS	0.33
T and M		NS	NS	0.41	NS	NS	0.24
Experimental Mean		4.61	2.60	4.04	3.83	4.55	2.77
Applied N:P:K:Zn Kg/ha		125:50:50	30:20:10		150:75:75	100:50:30	90:40:40
Avail N:P:K (kg/ha)			245:15:14.34:146.31	265:21:119			
Name of the variety		ADT	Basmati 370	Pratikshya	Tungabhadra sona	Samleshwari	HPR 1068
Soil type		Clay soil	Sandy clay loam		Black soil		Silty clay loam
pH		7.32	8.03	5.4			5.6
EC (dsm-1)			0.21				
Soil Organic carbon		0.45	0.57	0.6			0.92

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application (Wet DSR- Pre-emergence application of pyrazosulfonyl-ethyl fb post-emergence application of Triafamone+Ethoxy sulfuron; Dry DSR- Pre-emergence application of pendimethalin fb Post-emergence application of Penoxsulam + Cyhalofop-butyl)

S2 – Rotational application –once after 2 years changing herbicides (1 st year Kharif 2025- Wet DSR -Pre-emergence application of pyrazosulfonyl-ethyl fb post-emergence application of Triafamone+Ethoxy sulfuron; Dry DSR- Pre-emergence application of pendimethalin fb Post-emergence application of Penoxsulam + Cyhalofop-butyl)

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Grain Yield t/ha					
		ZONE-VII Moncompu	ZONE-VI Nawagam	ZONE-II Pantnagar	ZONE-VII Pattambi	ZONE-VII ARI-Rajendranagar	ZONE-IV Titabar
M1	S1	4.15	4.37	5.51	5.67	5.76	4.73
	S2	3.82	4.32	5.47	5.57	5.60	4.57
	S3	3.37	3.54	5.49	4.27	4.65	4.27
	S4	3.55	4.01	4.41	4.53	4.78	3.97
	S5	2.85	3.09	3.17	3.20	4.14	3.33
	S6	4.38	4.39	5.63	4.37	6.45	5.03
M2	S1	3.50	4.71	4.81	3.83	5.69	3.70
	S2	3.57	4.12	4.89	4.10	5.43	3.50
	S3	3.08	3.22	5.00	4.40	4.75	3.23
	S4	3.90	4.79	5.04	3.87	4.49	3.00
	S5	2.63	3.13	2.30	2.53	3.77	2.73
	S6	4.28	4.17	5.02	3.93	6.03	3.97
Mean of Factor-1							
	M1	3.69	3.95	4.95	4.60	5.23	4.32
	M2	3.49	4.02	4.51	3.78	5.03	3.36
	CD(0.05)	NS	NS	NS	0.05	NS	0.51
	CV(%)	8.37	3.18	7.89	0.80	6.57	9.35
Mean of Factor-2							
	S1	3.82	4.54	5.16	4.75	5.72	4.22
	S2	3.70	4.22	5.18	4.84	5.52	4.04
	S3	3.22	3.38	5.24	4.34	4.70	3.75
	S4	3.72	4.40	4.72	4.20	4.64	3.48
	S5	2.74	3.11	2.74	2.86	3.96	3.03
	S6	4.33	4.28	5.32	4.15	6.24	4.50
	CD(0.05)	0.50	0.50	0.27	0.14	0.46	0.11
	CV(%)	11.47	10.32	4.73	2.77	7.46	2.44
Interaction							
	M and T	NS	NS	0.54	0.18	NS	0.41
	T and M	NS	NS	0.38	0.20	NS	0.16
Experimental Mean		3.59	3.99	4.73	4.19	5.13	3.84
Applied N:P:K:Zn Kg/ha			100:25:00:25	150:60:40:ZnSo4 0.5% folior			60:20:40
Avail N:P:K (kg/ha)		250:18:252	266.6:25.6:315.2	230.22:25.1:212.0			
Name of the variety		MO 16 - Uma	GAR 201	Pant Dhan-24	Aiswarya		Numoli
Soil type		Clay loam	Clay loam				
pH		5.5	8.12	7.3			5.8
EC (dsm-1)			0.81				
Soil Organic carbon		2.5	0.71	0.74			0.58

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application (Wet DSR- Pre-emergence application of pyrazosulfonyl-ethyl fb post-emergence application of Triafamone+Ethoxy sulfuron; Dry DSR- Pre-emergence application of pendimethalin fb Post-emergence application of Penoxsulam + Cyhalofop-butyl)

S2 – Rotational application –once after 2 years changing herbicides (1 st year Kharif 2025- Wet DSR -Pre-emergence application of pyrazosulfonyl-ethyl fb post-emergence application of Triafamone+Ethoxy sulfuron; Dry DSR- Pre-emergence application of pendimethalin fb Post-emergence application of Penoxsulam + Cyhalofop-butyl)

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Straw yield t/ha					
		Aduthurai	Chatha	Chiplima	Gangavathi	Jagdulpur	Malan
M1	S1	6.32	6.06	6.13	6.90	6.31	3.26
	S2	5.68	5.87	5.73	6.81	6.73	3.23
	S3	5.82	5.18	4.87	7.01	6.00	2.60
	S4	6.82	6.45	5.13	6.63	5.43	2.93
	S5	2.48	2.47	3.50	4.15	2.52	2.53
	S6	6.36	6.13	6.10	7.47	7.29	3.52
M2	S1	5.51	5.64	4.90	6.00	6.29	4.28
	S2	5.34	5.57	5.20	5.95	6.51	4.32
	S3	5.50	4.84	4.53	6.19	5.56	3.18
	S4	5.90	6.10	5.10	5.58	5.10	3.41
	S5	2.24	2.10	3.30	3.59	2.24	3.09
	S6	6.00	5.88	5.43	6.31	7.67	4.34
Mean of Factor-1							
M1		5.58	5.36	5.24	6.50	5.71	3.01
M2		5.08	5.02	4.74	5.60	5.56	3.77
CD(0.05)		0.20	0.08	0.12	0.18	NS	0.45
CV(%)		2.58	1.13	1.73	2.12	11.03	9.24
Mean of Factor-2							
S1		5.92	5.85	5.52	6.45	6.30	3.77
S2		5.51	5.72	5.46	6.38	6.62	3.78
S3		5.66	5.01	4.70	6.60	5.78	2.89
S4		6.36	6.28	5.12	6.10	5.26	3.17
S5		2.36	2.28	3.40	3.87	2.38	2.81
S6		6.18	6.00	5.76	6.89	7.48	3.93
CD(0.05)		0.16	0.08	0.38	0.92	0.76	0.31
CV(%)		2.45	1.27	6.27	12.67	11.25	7.54
Interaction							
M and T		0.25	NS	0.50	NS	NS	NS
T and M		0.22	NS	0.53	NS	NS	NS
Experimental Mean		5.33	5.19	4.99	6.05	5.64	3.39

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)
S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Straw yield t/ha					
		Moncompu	Nawgam	Pantnagar	Pattambi	ARI-Rajendranagar	Titabar
M1	S1	5.53	4.92	5.73	20.27	7.25	11.10
	S2	4.87	5.09	5.70	18.30	7.08	10.07
	S3	4.12	4.40	5.57	15.73	6.10	8.67
	S4	4.88	4.70	4.47	14.17	6.18	8.00
	S5	3.68	3.93	3.36	12.00	5.11	6.70
	S6	5.48	5.40	6.90	8.67	7.64	12.57
M2	S1	4.95	5.61	5.30	11.33	6.94	8.17
	S2	4.28	4.93	5.30	9.60	6.60	7.53
	S3	3.95	3.92	5.57	12.67	5.84	6.57
	S4	4.83	5.67	5.11	12.50	5.86	6.13
	S5	3.25	3.67	2.49	10.03	5.04	5.73
	S6	5.50	5.00	5.75	15.23	7.14	9.17
Mean of Factor-1							
M1		4.76	4.74	5.29	14.86	6.56	9.52
M2		4.46	4.80	4.92	11.89	6.24	7.22
CD(0.05)		NS	NS	NS	0.12	NS	NS
CV(%)		8.12	2.40	9.75	0.62	8.07	22.11
Mean of Factor-2							
S1		5.24	5.26	5.52	15.80	7.10	9.64
S2		4.58	5.01	5.50	13.95	6.84	8.80
S3		4.04	4.16	5.57	14.20	5.97	7.62
S4		4.86	5.18	4.79	13.34	6.02	7.06
S5		3.46	3.80	2.92	11.02	5.08	6.22
S6		5.49	5.20	6.32	11.95	7.39	10.87
CD(0.05)		0.88	0.50	0.50	0.31	0.71	0.81
CV(%)		15.86	8.77	8.05	1.90	9.26	8.08
Interaction							
M and T		NS	0.66	0.85	0.41	NS	NS
T and M		NS	0.71	0.70	0.43	NS	NS
Experimental Mean		4.61	4.77	5.10	13.38	6.40	8.37

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	No of Panicles/m ²										
		Aduthurai	Chatha	Chiplima	Gangavathi	Malan	Moncompu	Nawagam	Pantnagar	Pattambi	ARI-Rajendranagar	Tita bar
M1	S1	257	222	243	161	266	460	201	297	587	288	254
	S2	242	218	237	164	267	443	207	293	523	280	249
	S3	229	215	221	178	253	421	149	319	416	228	231
	S4	278	239	230	130	258	467	171	291	405	235	216
	S5	153	142	179	91	230	244	138	257	459	172	195
	S6	288	229	247	193	271	466	186	315	533	335	273
M2	S1	230	215	233	157	288	469	217	266	491	293	227
	S2	209	210	229	160	292	443	194	265	512	275	213
	S3	219	208	226	188	263	443	137	275	512	241	193
	S4	256	234	232	139	267	472	193	278	288	223	176
	S5	141	138	172	84	258	244	133	244	299	157	153
	S6	257	222	230	191	290	457	162	268	405	350	241
Mean of Factor-1												
M1		241	211	226	153	257	417	175	295	487	256	236
M2		219	204	220	153	276	421	173	266	418	256	201
CD(0.05)		8	3	NS	NS	18	NS	NS	8	NS	NS	29
CV(%)		3	1	3	2	5	14	12	2	15	6	9
Mean of Factor-2												
S1		244	218	238	159	277	465	209	282	539	291	241
S2		226	214	233	162	279	443	201	279	517	277	231
S3		224	211	223	183	258	432	143	297	464	234	212
S4		267	237	231	134	263	469	182	284	347	229	196
S5		147	140	176	87	244	244	135	251	379	165	174
S6		273	225	238	192	281	461	174	291	469	343	257
CD(0.05)		7	4	6	5	16	36	22	14	117	24	11
CV(%)		3	2	2	3	5	7	10	4	22	8	4
Interaction												
M and T		11	NS	11	8	NS	NS	NS	NS	NS	NS	NS
T and M		12	NS	9	8	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		230	208	223	153	267	419	174	281	452	256	219

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Panicle weight (g)					
		Aduthurai	Chatha	Chiplima	Gangavathi	Malan	Moncompu
M1	S1	5.22	2.05	5.13	3.40	2.47	3.38
	S2	4.85	2.03	4.20	3.34	2.51	3.53
	S3	5.04	1.99	3.93	3.26	2.28	3.18
	S4	5.60	2.19	4.30	2.98	2.33	3.20
	S5	4.07	0.90	2.97	2.30	2.01	1.52
	S6	5.11	2.16	5.20	3.88	2.60	3.60
M2	S1	5.12	2.02	4.77	3.09	2.76	4.00
	S2	4.71	1.99	4.23	3.02	2.75	3.52
	S3	4.90	1.86	3.63	3.16	2.46	3.92
	S4	5.56	2.15	4.13	2.77	2.62	3.88
	S5	4.02	0.79	2.83	2.33	2.12	1.88
	S6	5.02	2.11	4.40	3.76	3.08	3.92
Mean of Factor-1							
M1		4.98	1.89	4.29	3.19	2.37	3.07
M2		4.89	1.82	4.00	3.02	2.63	3.52
CD(0.05)		NS	0.03	0.09	NS	0.18	0.20
CV(%)		1.40	0.97	1.45	4.18	4.93	4.18
Mean of Factor-2							
S1		5.17	2.04	4.95	3.24	2.62	3.69
S2		4.78	2.01	4.22	3.18	2.63	3.52
S3		4.97	1.92	3.78	3.21	2.37	3.55
S4		5.58	2.17	4.22	2.88	2.48	3.54
S5		4.04	0.84	2.90	2.32	2.06	1.70
S6		5.06	2.14	4.80	3.82	2.84	3.76
CD(0.05)		0.05	0.03	0.41	0.45	0.23	0.45
CV(%)		0.84	1.46	8.26	12.12	7.64	11.26
Interaction							
M and T		NS	0.05	NS	NS	NS	NS
T and M		NS	0.05	NS	NS	NS	NS
Experimental Mean		4.93	1.85	4.14	3.11	2.50	3.29

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Panicle weight (g)				
		Nawagam	Pantnagar	Pattambi	ARI-Rajendranagar	Titabar
M1	S1	5.05	2.06	4.00	3.01	3.60
	S2	4.53	2.02	3.83	3.10	3.40
	S3	4.56	1.87	4.50	2.40	3.03
	S4	4.57	1.86	5.50	2.57	2.73
	S5	4.47	1.73	3.50	2.68	2.53
	S6	5.10	1.96	3.17	3.11	3.93
M2	S1	5.34	2.36	3.33	2.95	2.97
	S2	4.21	2.26	4.50	2.99	2.73
	S3	4.25	2.18	4.33	2.49	2.43
	S4	4.53	2.01	5.00	2.56	2.20
	S5	4.21	1.91	3.83	2.72	2.07
	S6	4.89	2.37	3.67	3.04	3.37
Mean of Factor-1						
M1		4.71	1.92	4.08	2.81	3.20
M2		4.57	2.18	4.11	2.79	2.63
CD(0.05)		NS	0.05	NS	NS	NS
CV(%)		7.26	1.63	11.33	9.16	15.79
Mean of Factor-2						
S1		5.20	2.21	3.66	2.98	3.28
S2		4.37	2.14	4.16	3.04	3.06
S3		4.40	2.02	4.42	2.44	2.73
S4		4.55	1.94	5.25	2.56	2.46
S5		4.34	1.82	3.66	2.70	2.30
S6		5.00	2.16	3.42	3.08	3.65
CD(0.05)		0.34	0.11	0.51	ns	0.09
CV(%)		6.06	4.35	10.41	14.44	2.59
Interaction						
M and T		NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS
Experimental Mean		4.64	2.05	4.10	2.80	2.92

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)
S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Test weight (g)						
		Aduthurai	Chatha	Chiplima	Gangavathi	Jagdapur	Malan	Moncompu
M1	S1	23.60	20.73	23.20	16.35	24.19	25.99	24.60
	S2	22.47	20.57	23.27	16.85	25.07	25.69	25.03
	S3	22.70	19.17	20.97	16.10	23.57	23.32	22.73
	S4	23.10	21.27	22.73	15.55	24.40	23.77	24.67
	S5	20.53	19.17	19.03	13.50	21.47	20.46	21.17
	S6	22.93	21.00	23.63	18.40	24.70	26.46	25.73
M2	S1	23.20	20.50	22.83	15.60	24.30	28.74	25.57
	S2	22.37	20.30	22.13	15.90	24.06	28.76	25.27
	S3	22.60	19.07	21.77	15.90	23.09	25.33	25.43
	S4	22.87	20.90	22.40	15.50	23.03	25.27	25.10
	S5	20.57	18.80	18.60	13.20	20.27	21.51	24.53
	S6	22.67	20.77	23.40	16.85	24.65	31.29	25.47
Mean of Factor-1								
M1		22.56	20.32	22.14	16.12	23.90	24.28	23.99
M2		22.38	20.06	21.86	15.49	23.23	26.82	25.23
CD(0.05)		NS	0.16	NS	0.37	NS	2.17	NS
CV(%)		1.05	0.54	3.78	1.64	2.74	5.93	6.58
Mean of Factor-2								
S1		23.40	20.62	23.02	15.98	24.24	27.36	25.08
S2		22.42	20.44	22.70	16.38	24.56	27.22	25.15
S3		22.65	19.12	21.37	16.00	23.33	24.32	24.08
S4		22.98	21.08	22.56	15.52	23.72	24.52	24.88
S5		20.55	18.98	18.82	13.35	20.87	20.98	22.85
S6		22.80	20.88	23.52	17.62	24.68	28.88	25.60
CD(0.05)		0.14	0.13	1.31	0.97	1.08	1.58	1.39
CV(%)		0.53	0.51	4.96	5.08	3.80	5.15	4.70
Interaction								
M and T		NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS
Experimental Mean		22.47	20.19	22.00	15.81	23.57	25.55	24.61

M1-Puddled Wet direct seeding

M2-Unpuddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Test weight (g)				
		Nawagam	Pantnagar	Pattambi	ARI-Rajendranagar	Titabar
M1	S1	28.93	25.60	27.00	13.33	23.80
	S2	28.93	27.47	28.00	13.40	24.50
	S3	27.83	27.23	27.33	12.60	24.40
	S4	29.10	25.77	27.67	13.03	24.47
	S5	27.87	26.23	28.93	13.23	24.17
	S6	28.83	27.13	27.50	13.33	24.57
M2	S1	29.60	27.27	28.47	12.97	23.53
	S2	28.57	27.27	24.07	13.40	24.00
	S3	27.53	27.13	27.33	11.93	23.90
	S4	28.70	26.53	27.20	12.50	24.40
	S5	27.83	26.67	27.67	12.73	24.47
	S6	29.83	27.23	27.33	11.60	23.67
Mean of Factor-1						
M1		28.58	26.57	27.74	13.15	24.32
M2		28.68	27.02	27.01	12.52	24.00
CD(0.05)		NS	0.17	NS	0.48	0.31
CV(%)		3.74	0.45	4.45	2.59	0.90
Mean of Factor-2						
S1		29.26	26.44	27.74	13.15	23.66
S2		28.75	27.37	26.04	13.40	24.25
S3		27.68	27.18	27.33	12.26	24.15
S4		28.90	26.15	27.44	12.76	24.44
S5		27.85	26.45	28.30	12.98	24.32
S6		29.33	27.18	27.42	12.46	24.12
CD(0.05)		1.02	0.32	1.30	0.76	NS
CV(%)		2.95	1.00	3.94	4.90	4.03
Interaction						
M and T		NS	0.44	2.17	NS	NS
T and M		NS	0.46	1.84	NS	NS
Experimental Mean		28.63	26.79	27.38	12.84	24.16

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Total dry matter kg/m ² at Active Tillering Stage							
		Chatha	Chiplima	Malan	Moncompu	Pattambi	Nawagam	ARI-Rajendranagar	Titabar
M1	S1	0.23	0.15	0.25	0.84	0.18	0.31	0.19	0.93
	S2	0.23	0.15	0.27	0.74	0.10	0.30	0.18	0.86
	S3	0.22	0.12	0.21	0.45	0.15	0.28	0.18	0.78
	S4	0.25	0.15	0.21	0.95	0.28	0.27	0.18	0.72
	S5	0.21	0.10	0.19	0.53	0.30	0.21	0.12	0.64
	S6	0.25	0.16	0.27	0.80	0.15	0.31	0.25	1.03
M2	S1	0.22	0.15	0.31	0.78	0.21	0.30	0.18	0.48
	S2	0.22	0.14	0.31	0.62	0.16	0.30	0.18	0.50
	S3	0.21	0.14	0.27	0.52	0.18	0.27	0.19	0.48
	S4	0.23	0.15	0.25	0.84	0.23	0.29	0.18	0.43
	S5	0.20	0.10	0.21	0.60	0.30	0.19	0.11	0.44
	S6	0.23	0.13	0.33	0.81	0.27	0.34	0.23	0.67
Mean of Factor-1									
M1		0.23	0.14	0.23	0.72	0.19	0.28	0.19	0.83
M2		0.22	0.14	0.28	0.70	0.22	0.28	0.18	0.50
CD(0.05)		NS	NS	0.02	NS	NS	NS	NS	0.11
CV(%)		5.26	1.29	6.40	18.09	12.71	9.91	15.99	11.78
Mean of Factor-2									
S1									
S2		0.22	0.15	0.28	0.81	0.20	0.30	0.19	0.70
S3		0.22	0.14	0.29	0.68	0.13	0.30	0.18	0.68
S4		0.22	0.13	0.24	0.48	0.16	0.28	0.19	0.63
S5		0.24	0.15	0.23	0.90	0.26	0.28	0.18	0.58
S6		0.20	0.10	0.20	0.56	0.30	0.20	0.12	0.54
		0.24	0.14	0.30	0.80	0.21	0.32	0.24	0.85
CD(0.05)									
CV(%)		0.01	0.01	0.02	0.16	0.06	0.01	0.03	0.11
Interaction		3.98	6.76	7.18	18.30	21.99	3.25	13.2	13.17
M and T		NS	0.01	NS	NS	NS	0.03	NS	NS
T and M		NS	0.02	NS	NS	NS	0.02	NS	NS
Experimental Mean		0.23	0.14	0.26	0.71	0.21	0.28	0.18	0.66

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Total dry matter kg/m ² at at Panicle Initiation Stage							
		Chatha	Chiplima	Malan	Moncompu	Pattambi	Nawagam	ARI-Rajendranagar	Titabar
M1	S1	0.44	0.25	0.49	1.10	0.36	0.69	0.48	1.18
	S2	0.43	0.23	0.47	0.98	0.26	0.70	0.43	1.12
	S3	0.42	0.21	0.41	1.11	0.28	0.61	0.42	1.04
	S4	0.44	0.24	0.42	1.17	0.46	0.61	0.40	0.94
	S5	0.31	0.16	0.37	0.80	0.48	0.46	0.22	0.86
	S6	0.44	0.26	0.50	1.10	0.33	0.68	0.63	1.26
M2	S1	0.43	0.24	0.55	1.13	0.39	0.66	0.45	0.92
	S2	0.42	0.22	0.56	1.03	0.31	0.70	0.42	0.87
	S3	0.41	0.20	0.46	1.06	0.36	0.61	0.43	0.78
	S4	0.43	0.23	0.47	1.22	0.41	0.62	0.40	0.71
	S5	0.30	0.15	0.43	0.85	0.48	0.42	0.20	0.60
	S6	0.43	0.22	0.58	1.21	0.45	0.69	0.57	0.97
Mean of Factor-1									
M1		0.41	0.22	0.44	1.04	0.36	0.62	0.43	1.07
M2		0.40	0.21	0.51	1.08	0.40	0.62	0.41	0.81
CD(0.05)		NS	0.01	0.05	NS	NS	NS	NS	0.11
CV(%)		3.45	1.80	7.56	6.98	6.80	9.18	15.62	7.98
Mean of Factor-2									
S1								0.46	
S2		0.44	0.24	0.52	1.12	0.38	0.68	0.43	1.05
S3		0.42	0.22	0.52	1.00	0.28	0.70	0.43	1.00
S4		0.42	0.20	0.44	1.08	0.32	0.61	0.40	0.91
S5		0.44	0.24	0.44	1.20	0.44	0.62	0.21	0.82
S6		0.30	0.16	0.40	0.82	0.48	0.44	0.60	0.73
		0.44	0.24	0.54	1.16	0.39	0.68		1.12
CD(0.05)								0.07	
CV(%)		0.01	0.01	0.03	0.22	0.06	0.03	13.91	0.06
Interaction		2.37	5.03	5.63	17.08	12.25	3.86		5.43
M and T		NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		0.41	0.22	0.48	1.06	0.38	0.62	0.42	0.94

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Cost of cultivation Rs/ha								
		Aduthurai	Chipli ma	Gangavathi	Jagdaldur	Moncompu	Nawagam	Pantnagar	Pattambi	ARI-Rajendranagar
M1	S1	46049	65669	56280	49000	83075	49788	42294	66725	33850
	S2	46049	65358	56280	49500	83075	49941	44509	66725	33850
	S3	47044	72193	57530	53000	128750	49966	44509	74850	39850
	S4	47345	67589	56530	52000	98375	50795	37658	75220	32650
	S5	45957	60521	52530	48000	80000	49225	33086	63025	28650
	S6	47956	71542	60030	63000	153125	51144	42230	79025	40650
M2	S1	44722	67751	50680	45000	78275	48573	39895	60725	34800
	S2	44722	67726	50280	45500	78275	48773	39895	60725	34800
	S3	45716	72576	54480	49000	140000	48734	39895	68850	40800
	S4	46017	69958	50980	48000	93375	49576	37658	69220	33050
	S5	44630	64036	46980	44000	75000	47957	33086	57025	29050
	S6	46629	74328	56980	59000	148125	49989	38420	73025	40650

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot Treatments	Sub plot Treatments	Benefit -Cost Ratio							
		Chiplima	Gangavathi	Jagdapur	Moncompu	Nawagam	Pantnagar	Pattambi	ARI-Rajendranagar
M1	S1	2.57	1.97	2.75	3.73	2.41	2.71	3.27	3.93
	S2	2.37	1.93	2.87	3.43	2.38	2.50	3.17	3.80
	S3	1.67	1.95	2.34	1.93	1.96	2.51	2.23	2.67
	S4	2.07	1.47	2.24	2.70	2.17	2.34	2.27	3.37
	S5	1.40	1.10	1.12	2.70	1.75	1.73	2.53	3.33
	S6	2.40	1.97	2.39	2.13	2.37	2.80	1.47	3.67
M2	S1	2.07	2.03	2.88	3.33	2.67	2.43	2.33	3.77
	S2	2.03	2.01	3.07	3.40	2.33	2.50	2.37	3.60
	S3	1.73	1.93	2.28	1.63	1.83	2.57	2.37	2.70
	S4	1.90	1.74	2.21	3.13	2.66	2.81	2.10	3.13
	S5	1.10	1.05	1.04	2.63	1.79	0.98	1.77	2.97
	S6	1.97	1.94	2.64	2.17	2.30	2.72	2.13	3.40
Mean of Factor-1									
M1		2.08	1.73	2.28	2.77	2.17	2.43	2.49	3.46
M2		1.80	1.78	2.35	2.72	2.26	2.34	2.18	3.26
CD(0.05)		0.09	NS	NS	NS	NS	NS	0.02	NS
CV(%)		3.10	5.34	9.33	8.51	2.91	12.00	0.71	5.95
Mean of Factor-2									
S1		2.32	2.00	2.82	3.53	2.54	2.57	2.80	3.85
S2		2.20	1.97	2.97	3.42	2.36	2.50	2.77	3.70
S3		1.70	1.94	2.31	1.78	1.90	2.54	2.30	2.68
S4		1.98	1.60	2.22	2.92	2.42	2.58	2.18	3.25
S5		1.25	1.08	1.08	2.66	1.77	1.36	2.15	3.15
S6		2.18	1.96	2.52	2.15	2.34	2.76	1.80	3.54
CD(0.05)									
CV(%)		0.16	0.13	0.27	0.39	0.26	0.21	0.07	0.33
Interaction		6.81	6.00	9.50	11.93	9.87	7.29	2.55	8.05
M and T		0.22	NS	NS	NS	NS	0.42	0.09	NS
T and M		0.22	NS	NS	NS	NS	0.30	0.10	NS
Experimental Mean		1.94	1.76	2.32	2.74	2.22	2.38	2.33	3.36

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)
S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Summary on Species wise Weed population no. /m² of Long term trial on weed dynamics in rice under different establishment methods, Kharif 2025.

Main plot	Sub plot Treatments	ZONE-VII Aduthurai							
		Active Tillering Stage							
		Grasses					Sedges		
		<i>Echinochloa colona</i>	<i>Echinochloa crusgalli</i>	<i>Leptochloa chinensis</i>	<i>Panicum repens</i>	<i>Cynodon dactylon</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Fimbristylis miliacea</i>
M1	S1	63.00(7.96)	24.00(4.88)	39.00(6.28)	30.00(5.51)	12.00(3.49)	8.00(2.90)	5.00(2.32)	0.00(0.71)
	S2	33.00(5.78)	33.00(5.78)	30.00(5.51)	24.00(4.93)	12.00(3.49)	4.00(2.10)	3.00(1.87)	3.00(1.87)
	S3	66.00(8.10)	33.00(5.74)	48.00(6.96)	39.00(6.28)	21.00(4.62)	11.00(3.38)	8.00(2.90)	3.00(1.87)
	S4	24.00(4.93)	27.00(5.24)	21.00(4.62)	15.00(3.89)	9.00(3.08)	3.00(1.87)	3.00(1.87)	3.00(1.87)
	S5	399.00(19.98)	201.00(14.19)	216.00(14.71)	141.00(11.88)	69.00(8.31)	44.00(6.66)	19.00(4.41)	14.00(3.80)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	105.00(10.23)	72.00(8.50)	54.00(7.27)	45.00(6.72)	33.00(5.78)	14.00(3.80)	7.00(2.73)	7.00(2.73)
	S2	60.00(7.74)	186.00(13.65)	69.00(8.31)	51.00(7.13)	39.00(6.28)	22.00(4.73)	10.00(3.23)	0.00(0.71)
	S3	81.00(8.99)	45.00(6.72)	63.00(7.96)	57.00(7.58)	36.00(6.01)	16.00(4.06)	13.00(3.67)	7.00(2.73)
	S4	42.00(6.51)	39.00(6.28)	30.00(5.51)	24.00(4.93)	18.00(4.30)	7.00(2.73)	7.00(2.73)	6.00(2.55)
	S5	432.00(20.79)	246.00(15.69)	312.00(17.68)	168.00(12.96)	144.00(11.99)	47.00(6.89)	26.00(5.15)	16.00(4.06)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1									
	M1	97.50(7.91)	53.00(6.09)	59.00(6.46)	41.50(5.53)	20.50(3.95)	11.67(2.94)	6.33(2.35)	3.83(1.80)
	M2	120.00(9.16)	98.00(8.59)	88.00(7.90)	57.50(6.67)	45.00(5.84)	17.67(3.82)	10.50(3.03)	6.00(2.25)
	CD(0.05)	0.38	0.17	0.68	0.32	0.40	0.53	0.36	0.23
	CV%	3.08	1.62	6.57	3.63	5.65	11.04	9.38	7.83
Mean of Factor-2									
	S1	84.00(9.09)	48.00(6.69)	46.50(6.77)	37.50(6.12)	22.50(4.63)	11.00(3.35)	6.00(2.53)	3.50(1.72)
	S2	46.50(6.76)	109.50(9.71)	49.50(6.91)	37.50(6.03)	25.50(4.88)	13.00(3.42)	6.50(2.55)	1.50(1.29)
	S3	73.50(8.54)	39.00(6.23)	55.50(7.46)	48.00(6.93)	28.50(5.31)	13.50(3.72)	10.50(3.29)	5.00(2.30)
	S4	33.00(5.72)	33.00(5.76)	25.50(5.06)	19.50(4.41)	13.50(3.69)	5.00(2.30)	5.00(2.30)	4.50(2.21)
	S5	415.50(20.39)	223.50(14.94)	264.00(16.19)	154.50(12.42)	106.50(10.15)	45.50(6.77)	22.50(4.78)	15.00(3.93)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.80	0.67	0.71	0.75	0.57	0.33	0.26	0.18
	CV%	7.81	7.55	8.26	10.14	9.67	8.19	8.02	7.48
Interaction									
	M and T	NS	0.94	1.01	NS	0.81	0.47	0.37	0.26
	T and M	NS	0.87	1.06	NS	0.8	0.6	0.44	0.3
Experimental Mean		8.53	7.34	7.18	6.1	4.9	3.38	2.69	2.03

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Aduthurai					
		Active Tillering Stage					
		BLW					TOTAL
		<i>Ammania baccifera</i>	<i>Bergia capensis</i>	<i>Eclipta alba</i>	<i>Euphorbia prostrata</i>	<i>Marselia quadrifolia</i>	
M1	S1	7.00(2.73)	3.00(1.87)	9.00(3.06)	6.00(2.55)	5.00(2.27)	211.00(14.53)
	S2	3.00(1.87)	0.00(0.71)	17.00(4.18)	10.00(3.21)	3.00(1.87)	175.00(13.24)
	S3	10.00(3.23)	6.00(2.55)	12.00(3.52)	9.00(3.08)	8.00(2.88)	274.00(16.55)
	S4	3.00(1.87)	3.00(1.87)	14.00(3.80)	7.00(2.68)	3.00(1.87)	135.00(11.63)
	S5	43.00(6.59)	13.00(3.67)	129.00(11.36)	84.00(9.19)	23.00(4.83)	1395.00(37.35)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	11.00(3.38)	7.00(2.73)	17.00(4.18)	10.00(3.23)	8.00(2.88)	390.00(19.74)
	S2	11.00(3.38)	7.00(2.73)	17.00(4.18)	9.00(3.08)	10.00(3.21)	491.00(22.15)
	S3	13.00(3.67)	8.00(2.90)	17.00(4.18)	13.00(3.67)	11.00(3.37)	380.00(19.49)
	S4	7.00(2.73)	8.00(2.90)	19.00(4.41)	12.00(3.52)	7.00(2.73)	226.00(15.05)
	S5	43.00(6.59)	19.00(4.40)	140.00(11.85)	82.00(9.08)	24.00(4.94)	1699.00(41.22)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1							
	M1	11.00(2.83)	4.17(1.90)	30.17(4.44)	19.33(3.57)	7.00(2.41)	365.00(15.67)
	M2	14.17(3.41)	8.17(2.73)	35.00(4.92)	21.00(3.88)	10.00(2.97)	531.00(19.73)
	CD(0.05)	0.21	0.31	NS	0.25	NS	0.27
	CV%	4.71	9.45	7.59	4.67	16.81	1.08
Mean of Factor-2							
	S1	9.00(3.06)	5.00(2.30)	13.00(3.62)	8.00(2.89)	6.50(2.58)	300.50(17.13)
	S2	7.00(2.63)	3.50(1.72)	17.00(4.18)	9.50(3.14)	6.50(2.54)	333.00(17.70)
	S3	11.50(3.45)	7.00(2.73)	14.50(3.85)	11.00(3.38)	9.50(3.12)	327.00(18.02)
	S4	5.00(2.30)	5.50(2.39)	16.50(4.11)	9.50(3.10)	5.00(2.30)	180.50(13.34)
	S5	43.00(6.59)	16.00(4.03)	134.50(11.61)	83.00(9.13)	23.50(4.89)	1547.00(39.28)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.28	0.29	0.35	0.38	0.49	0.71
	CV%	7.38	10.26	6.14	8.51	15.17	3.32
Interaction							
	M and T	0.39	0.4	NS	NS	NS	1
	T and M	0.39	0.44	NS	NS	NS	0.94
Experimental Mean		3.12	2.31	4.68	3.73	2.69	17.7

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-III Chiplima												
		Weed population g/m ² at active Tillering Stage												
		Grasses			Sedges			BLW						
		<i>Echinochloa colona</i>	<i>Echinochloa crusgalli</i>	<i>Paspalum distichum</i>	<i>Cyperus diformis</i>	<i>Cyperus iria</i>	<i>Fimbristylis millicaea</i>	<i>Alternanthera philoxeroides</i>	<i>Ludwigia parviflora</i>	<i>Marsilea quadrifolia</i>	<i>Monochoria vaginalis</i>	<i>Sphenoclea zeylanica</i>	TOTAL	
M1	S1	2.33(1.64)	1.33(1.29)	1.33(1.29)	1.67(1.39)	1.33(1.27)	4.00(2.08)	0.00(0.71)	4.33(2.18)	4.67(2.26)	1.33(1.29)	2.67(1.77)	25.00(5.05)	
	S2	3.33(1.93)	3.00(1.86)	2.67(1.76)	2.00(1.56)	2.33(1.68)	8.67(3.01)	1.33(1.34)	5.67(2.46)	6.33(2.60)	2.00(1.56)	2.67(1.74)	40.00(6.36)	
	S3	5.33(2.40)	7.67(2.83)	5.67(2.48)	6.00(2.54)	6.00(2.52)	14.00(3.80)	5.33(2.40)	9.33(3.13)	12.67(3.62)	5.00(2.34)	4.67(2.26)	81.67(9.05)	
	S4	3.33(1.95)	5.00(2.34)	4.00(2.11)	5.67(2.46)	2.67(1.74)	9.33(3.11)	2.33(1.68)	5.33(2.41)	7.00(2.73)	3.00(1.86)	3.00(1.72)	50.67(7.15)	
	S5	4.00(2.10)	9.33(3.12)	6.33(2.59)	8.33(2.94)	7.00(2.71)	27.67(5.30)	6.67(2.67)	16.00(4.05)	18.33(4.32)	9.33(3.13)	15.33(3.97)	128.33(11.33)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
M2	S1	4.00(2.11)	5.00(2.35)	3.33(1.93)	3.67(2.03)	3.33(1.94)	7.00(2.73)	1.00(1.17)	7.00(2.73)	9.67(3.18)	2.67(1.76)	4.00(2.11)	50.67(7.15)	
	S2	4.67(2.22)	6.67(2.66)	3.67(2.04)	3.67(2.00)	2.67(1.72)	12.00(3.52)	1.67(1.44)	8.00(2.89)	9.33(3.13)	2.67(1.77)	4.33(2.16)	59.33(7.73)	
	S3	6.00(2.53)	12.33(3.56)	6.33(2.60)	6.67(2.67)	7.33(2.75)	17.00(4.16)	6.33(2.60)	13.33(3.71)	14.33(3.85)	6.67(2.67)	7.33(2.78)	103.67(10.18)	
	S4	2.67(1.72)	7.33(2.80)	4.00(2.08)	5.00(2.34)	5.00(2.34)	11.67(3.48)	3.00(1.86)	7.33(2.80)	7.33(2.77)	3.00(1.86)	4.33(2.18)	60.67(7.81)	
	S5	7.00(2.73)	14.67(3.89)	11.00(3.39)	18.00(4.30)	11.33(3.42)	50.67(7.14)	9.33(3.11)	25.00(5.03)	25.67(5.10)	14.67(3.89)	22.33(4.77)	209.67(14.49)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
Mean of Factor-1	M1	3.06(1.79)	4.39(2.02)	3.33(1.82)	3.94(1.93)	3.22(1.77)	10.61(3.00)	2.61(1.58)	6.78(2.49)	8.17(2.71)	3.44(1.81)	4.72(2.03)	54.28(6.61)	
	M2	4.06(2.00)	7.67(2.66)	4.72(2.13)	6.17(2.34)	4.94(2.15)	16.39(3.62)	3.56(1.81)	10.11(2.98)	11.06(3.12)	4.94(2.11)	7.06(2.45)	80.67(8.01)	
	CD(0.05)	0.21	0.22	NS	0.28	NS	0.21	0.03	0.2	0.08	NS	0.41	0.2	
	CV%	7.58	6.43	12.36	9.28	21.72	4.45	1.06	5.09	1.96	23.54	12.79	1.87	
	Mean of Factor-2	S1	3.17(1.88)	3.17(1.82)	2.33(1.61)	2.67(1.71)	2.33(1.60)	5.50(2.41)	0.50(0.94)	5.67(2.46)	7.17(2.72)	2.00(1.53)	3.33(1.94)	37.83(6.10)
		S2	4.00(2.08)	4.83(2.26)	3.17(1.90)	2.83(1.78)	2.50(1.70)	10.33(3.26)	1.50(1.39)	6.83(2.67)	7.83(2.87)	2.33(1.67)	3.50(1.95)	49.67(7.05)
		S3	5.67(2.47)	10.00(3.20)	6.00(2.54)	6.33(2.61)	6.67(2.63)	15.50(3.98)	5.83(2.50)	11.33(3.42)	13.50(3.73)	5.83(2.50)	6.00(2.52)	92.67(9.61)
		S4	3.00(1.84)	6.17(2.57)	4.00(2.10)	5.33(2.40)	3.83(2.04)	10.50(3.30)	2.67(1.77)	6.33(2.61)	7.17(2.75)	3.00(1.86)	3.67(1.95)	55.67(7.48)
		S5	5.50(2.42)	12.00(3.50)	8.67(2.99)	13.17(3.62)	9.17(3.06)	39.17(6.22)	8.00(2.89)	20.50(4.54)	22.00(4.71)	12.00(3.51)	18.83(4.37)	169.00(12.91)
		S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	Interaction M and T and M	CD(0.05)	0.41	0.38	0.38	0.45	0.52	0.44	0.36	0.32	0.4	0.31	0.44	0.49
		CV%	18.17	13.61	15.96	17.67	21.94	10.96	17.55	9.59	11.36	12.93	16.42	5.57
Interaction		NS	NS	NS	NS	NS	0.62	NS	NS	NS	NS	NS	0.69	
M and T		NS	NS	NS	NS	NS	0.59	NS	NS	NS	NS	NS	0.65	
Experimental Mean	T and M	NS	NS	NS	NS	NS	3.31	1.7	2.73	2.91	1.96	2.24	7.31	
	Experimental Mean	1.9	2.34	1.97	2.14	1.96	3.31	1.7	2.73	2.91	1.96	2.24	7.31	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-III Chiplima					
		Weed population g/m ² at Panicle Initiation stage					
		Grasses		Sedges		BLW	
		<i>Echinochloa colona</i>	<i>Cyperus iria</i>	<i>Fimbristylis miliacea</i>	<i>Ludwigia parviflora</i>	<i>Sphenoclea zeylanica</i>	TOTAL
M1	S1	0.00(0.71)	0.00(0.71)	2.33(1.68)	3.33(1.93)	1.00(1.10)	6.67(2.64)
	S2	0.33(0.88)	0.00(0.71)	2.67(1.77)	5.33(2.41)	2.33(1.57)	10.67(3.33)
	S3	4.00(2.11)	3.33(1.93)	9.33(3.12)	11.00(3.39)	6.67(2.66)	34.33(5.90)
	S4	1.00(1.17)	2.00(1.56)	6.00(2.54)	6.33(2.60)	2.33(1.68)	17.67(4.26)
	S5	6.67(2.67)	3.00(1.86)	12.67(3.62)	14.33(3.84)	8.67(3.02)	45.33(6.76)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	1.67(1.44)	0.00(0.71)	4.67(2.27)	5.00(2.34)	2.67(1.72)	9.33(3.09)
	S2	1.67(1.46)	2.00(1.56)	4.33(2.20)	6.67(2.67)	3.67(2.02)	18.33(4.34)
	S3	6.33(2.60)	3.33(1.93)	14.67(3.89)	13.33(3.72)	9.00(3.07)	46.67(6.87)
	S4	3.00(1.86)	2.00(1.56)	8.67(3.02)	7.67(2.85)	5.67(2.48)	27.00(5.24)
	S5	10.00(3.23)	6.33(2.60)	22.00(4.74)	18.00(4.29)	12.33(3.57)	68.67(8.31)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean	M1	2.00(1.37)	1.39(1.25)	5.50(2.24)	6.72(2.48)	3.50(1.79)	19.11(3.93)
	M2	3.78(1.88)	2.28(1.51)	9.06(2.80)	8.44(2.76)	5.56(2.26)	28.33(4.76)
	CD(0.05)	0.33	NS	0.31	0.16	0.1	0.14
	CV%	13.93	28.33	8.45	4.19	3.41	2.17
	S1	0.83(1.07)	0.00(0.71)	3.50(1.97)	4.17(2.14)	1.83(1.41)	8.00(2.86)
	S2	1.00(1.17)	1.00(1.13)	3.50(1.99)	6.00(2.54)	3.00(1.79)	14.50(3.83)
	S3	5.17(2.36)	3.33(1.93)	12.00(3.51)	12.17(3.55)	7.83(2.86)	40.50(6.38)
	S4	2.00(1.51)	2.00(1.56)	7.33(2.78)	7.00(2.73)	4.00(2.08)	22.33(4.75)
	S5	8.33(2.95)	4.67(2.23)	17.33(4.18)	16.17(4.07)	10.50(3.29)	57.00(7.54)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.31	0.27	0.27	0.32	0.47	0.39
	CV%	16.05	16.55	8.97	10.12	19.31	7.38
	Interaction						
	M and T	NS	0.39	NS	NS	NS	0.55
	T and M	NS	0.56	NS	NS	NS	0.51
	Experimental Mean	1.63	1.38	2.52	2.62	2.02	4.34

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Gangavathi					
		Weed population g/m ² at Panicle Initiation stage					
		Grasses		Sedges		BLW	Total
		<i>Echinochloa spp</i>	<i>Leptochloa spp</i>	<i>Cynodon spp</i>	<i>Cyperus rotundus</i>	<i>Cynotis spp</i>	
M1	S1	4.80(2.30)	0.00(0.71)	0.00(0.71)	6.00(2.55)	0.00(0.71)	10.80(3.36)
	S2	5.24(2.39)	0.00(0.71)	0.00(0.71)	6.80(2.70)	0.00(0.71)	12.04(3.54)
	S3	2.60(1.62)	0.00(0.71)	0.00(0.71)	5.20(2.38)	0.67(1.05)	8.47(2.98)
	S4	10.70(3.34)	0.00(0.71)	0.00(0.71)	31.07(5.60)	0.67(1.05)	42.43(6.54)
	S5	26.24(5.16)	0.00(0.71)	0.00(0.71)	55.33(7.46)	1.22(1.31)	82.79(9.13)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	7.33(2.80)	2.00(1.47)	11.14(3.40)	12.70(3.63)	10.72(3.35)	43.89(6.66)
	S2	7.52(2.83)	1.33(1.28)	11.94(3.53)	12.02(3.54)	10.50(3.32)	43.31(6.62)
	S3	3.63(1.97)	0.00(0.71)	4.67(2.04)	7.00(2.73)	0.00(0.71)	15.30(3.93)
	S4	23.64(4.90)	2.00(1.47)	13.18(3.69)	25.20(5.06)	5.74(2.50)	69.76(8.38)
	S5	102.00(10.11)	30.00(5.42)	20.00(4.51)	64.60(8.07)	20.00(4.53)	236.60(15.40)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1	M1	8.26(2.59)	0.00(0.71)	0.00(0.71)	17.40(3.57)	0.43(0.92)	26.09(4.37)
	M2	24.02(3.89)	5.89(1.84)	10.15(2.98)	20.25(3.95)	7.83(2.52)	68.14(6.95)
CD(0.05)		0.03	0.91	0.71	0.19	0.41	0.58
	CV%	0.64	50.05	26.99	3.51	16.67	7.13
Mean of Factor-2	S1	6.07(2.55)	1.00(1.09)	5.57(2.06)	9.35(3.09)	5.36(2.03)	27.34(5.01)
	S2	6.38(2.61)	0.67(0.99)	5.97(2.12)	9.41(3.12)	5.25(2.01)	27.68(5.08)
	S3	3.12(1.80)	0.00(0.71)	2.33(1.37)	6.10(2.55)	0.33(0.88)	11.88(3.46)
	S4	17.17(4.12)	1.00(1.09)	6.59(2.20)	28.13(5.33)	3.20(1.77)	56.10(7.46)
	S5	64.12(7.64)	15.00(3.06)	10.00(2.61)	59.97(7.77)	10.61(2.92)	159.70(12.26)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		0.53	0.57	0.44	0.35	0.16	0.37
	CV%	13.72	36.85	19.93	7.65	7.53	5.45
Interaction	M and T	0.76	0.8	0.63	0.49	0.22	0.53
	T and M	0.69	1.02	0.8	0.47	0.37	0.66
Experimental Mean		3.24	1.27	1.84	3.76	1.72	5.66

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Gangavathi						
		Weed population g/m ² at Panicle Initiation stage						
		Grasses			Sedges		BLW	
		<i>Echinochloa spp</i>	<i>Leptochloa spp</i>	<i>Cynodon spp</i>	<i>Cyperus rotundus</i>	<i>Cynotis spp</i>		Total
M1	S1	1.42(1.38)	0.66(1.04)	0.00(0.71)	5.02(2.35)	1.62(1.37)		8.72(3.01)
	S2	1.12(1.27)	0.60(1.02)	0.00(0.71)	4.66(2.27)	1.34(1.28)		7.72(2.87)
	S3	2.00(1.47)	0.00(0.71)	0.00(0.71)	1.84(1.51)	0.00(0.71)		3.84(2.07)
	S4	2.00(1.47)	0.66(1.04)	0.00(0.71)	16.00(4.06)	0.00(0.71)		18.66(4.38)
	S5	30.00(5.52)	12.00(3.06)	4.67(2.27)	28.66(5.39)	5.72(2.49)		81.05(9.03)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)
M2	S1	2.00(1.47)	2.00(1.47)	2.99(1.87)	12.38(3.59)	2.64(1.77)		22.01(4.74)
	S2	2.30(1.55)	0.66(1.04)	2.80(1.78)	12.80(3.65)	2.20(1.52)		20.76(4.59)
	S3	2.00(1.47)	2.00(1.47)	2.67(1.78)	4.38(2.21)	0.00(0.71)		11.05(3.37)
	S4	10.00(3.23)	4.66(2.27)	4.80(2.30)	16.72(4.15)	6.66(2.52)		42.84(6.58)
	S5	42.60(6.56)	14.60(3.35)	6.00(2.55)	32.38(5.73)	13.24(3.70)		108.82(10.44)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)
Mean of Factor-1		M1	6.09(1.97)	2.32(1.26)	0.78(0.97)	9.36(2.71)	1.45(1.21)	20.00(3.68)
		M2	9.82(2.50)	3.99(1.72)	3.21(1.83)	13.11(3.34)	4.12(1.82)	34.25(5.07)
		CD(0.05)	NS	0.14	0.21	0.5	NS	0.21
		CV%	19.48	6.49	10.43	11.57	28.71	3.32
Mean of Factor-2		S1	1.71(1.43)	1.33(1.26)	1.50(1.29)	8.70(2.97)	2.13(1.57)	15.37(3.88)
		S2	1.71(1.41)	0.63(1.03)	1.40(1.25)	8.73(2.96)	1.77(1.40)	14.24(3.73)
		S3	2.00(1.47)	1.00(1.09)	1.33(1.24)	3.11(1.86)	0.00(0.71)	7.44(2.72)
		S4	6.00(2.35)	2.66(1.66)	2.40(1.50)	16.36(4.10)	3.33(1.61)	30.75(5.48)
		S5	36.30(6.04)	13.30(3.21)	5.33(2.41)	30.52(5.56)	9.48(3.10)	94.93(9.73)
		S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
		CD(0.05)	0.6	1.21	0.17	0.19	0.58	0.42
		CV%	22.35	67.1	10.05	5.16	31.54	7.91
Interaction		M and T	NS	NS	0.24	0.27	NS	0.59
		T and M	NS	NS	0.27	0.46	NS	0.56
Experimental Mean			2.23	1.49	1.4	3.03	1.52	4.37

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-V Jagdalpur					
		Grasses			Panicle initiation stage		
		Cynodon dactylon		Sedges	BLW		Total
		Echinochloa spp	Cynodon dactylon	Cyperus spp	Alternanthera spp	Ludwigia spp	
M1	S1	6.67(2.67)	0.11(0.78)	3.33(1.93)	1.28(1.27)	1.15(1.17)	12.54(3.57)
	S2	3.56(2.01)	0.17(0.81)	3.53(1.93)	1.15(1.25)	1.58(1.43)	9.99(3.19)
	S3	9.78(3.20)	0.18(0.82)	4.21(2.14)	7.48(2.78)	6.00(2.51)	27.65(5.26)
	S4	7.23(2.72)	0.15(0.80)	6.10(2.50)	6.45(2.58)	8.33(2.96)	28.27(5.35)
	S5	59.56(7.63)	0.07(0.75)	14.91(3.90)	26.90(5.19)	33.67(5.82)	135.10(11.60)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	8.44(2.96)	0.19(0.81)	5.88(2.49)	2.17(1.54)	3.00(1.82)	19.69(4.42)
	S2	16.44(4.06)	0.08(0.76)	6.45(2.53)	4.00(2.02)	4.33(2.09)	31.31(5.63)
	S3	21.33(4.64)	0.00(0.71)	10.50(3.26)	8.30(2.93)	12.33(3.52)	52.47(7.28)
	S4	29.33(5.38)	0.08(0.76)	14.00(3.76)	8.04(2.87)	16.53(4.10)	67.99(8.20)
	S5	81.78(9.04)	0.44(0.95)	19.50(4.43)	32.21(5.69)	41.08(6.27)	175.01(13.19)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1		14.46(3.16)	0.11(0.78)	5.35(2.18)	7.21(2.30)	8.46(2.43)	35.59(4.95)
Mean of Factor-2	M1	26.22(4.47)	0.13(0.78)	9.39(2.86)	9.12(2.63)	12.88(3.08)	57.74(6.57)
	M2	0.52	NS	0.17	NS	NS	1.32
	CV%	9.58	15.65	4.57	26.31	20.02	15.95
	S1	7.56(2.81)	0.15(0.79)	4.61(2.21)	1.73(1.40)	2.08(1.49)	16.11(3.99)
	S2	10.00(3.03)	0.13(0.79)	4.99(2.23)	2.57(1.63)	2.96(1.76)	20.65(4.41)
	S3	15.56(3.92)	0.09(0.76)	7.35(2.70)	7.89(2.85)	9.17(3.02)	40.06(6.27)
	S4	18.28(4.05)	0.12(0.78)	10.05(3.13)	7.25(2.72)	12.43(3.53)	48.13(6.77)
	S5	70.67(8.34)	0.26(0.85)	17.20(4.16)	29.55(5.44)	37.38(6.05)	155.05(12.39)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.89	NS	0.8	0.7	0.93	1.01
Interaction M and T T and M Experimental Mean	CV%	19.49	14.12	26.28	23.71	27.98	14.55
	Interaction	NS	NS	NS	NS	NS	NS
	M and T	NS	NS	NS	NS	NS	NS
	T and M	3.81	0.78	2.52	2.46	2.76	5.76

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-I Malan									
		Active Tillering Stage								Total	
		Grasses		Sedges		BLW					
		<i>Echinochloa colonum</i>	<i>Echinochlo crusgalli</i>	<i>Panicum spp.</i>	<i>Cyperus iria</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Alternanthera spp.</i>	<i>Eclipta alba</i>	<i>Monochoria vaginalis</i>	
M1	S1	4.67(2.26)	2.00(1.58)	2.00(1.58)	2.00(1.58)	2.00(1.58)	2.00(1.58)	2.67(1.76)	1.33(1.29)	1.33(1.29)	20.00(4.53)
	S2	4.67(2.26)	2.67(1.76)	1.33(1.29)	2.00(1.58)	2.00(1.58)	2.67(1.76)	2.00(1.58)	2.67(1.76)	1.33(1.29)	21.33(4.66)
	S3	4.00(2.08)	3.33(1.94)	2.67(1.76)	2.67(1.76)	2.67(1.76)	3.33(1.94)	3.33(1.94)	3.33(1.94)	2.00(1.58)	27.33(5.25)
	S4	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.67(1.76)	3.33(1.94)	2.00(1.58)	3.33(1.90)	3.33(1.94)	2.67(1.65)	25.33(5.08)
	S5	10.67(3.34)	9.33(3.09)	4.67(2.26)	7.33(2.76)	8.00(2.92)	9.33(3.12)	6.00(2.55)	10.00(3.23)	7.33(2.79)	72.67(8.54)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	3.33(1.73)	2.00(1.58)	2.00(1.58)	2.67(1.76)	2.00(1.58)	2.00(1.58)	2.67(1.76)	1.33(1.18)	1.33(1.29)	19.33(4.40)
	S2	3.33(1.90)	2.00(1.58)	2.67(1.76)	2.00(1.58)	2.00(1.47)	2.00(1.58)	2.00(1.47)	1.33(1.29)	2.00(1.58)	19.33(4.44)
	S3	4.00(2.12)	2.67(1.76)	2.67(1.76)	2.00(1.58)	2.67(1.76)	3.33(1.94)	2.67(1.76)	2.67(1.76)	2.00(1.58)	24.67(5.01)
	S4	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.00(1.58)	1.33(1.18)	3.33(1.94)	2.00(1.58)	22.00(4.74)
	S5	11.33(3.44)	9.33(3.09)	6.67(2.64)	8.00(2.90)	12.00(3.47)	9.33(3.09)	6.00(2.53)	6.67(2.64)	9.33(3.13)	78.67(8.90)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1	M1	4.44(2.07)	3.33(1.81)	2.22(1.56)	2.78(1.69)	3.00(1.75)	3.22(1.78)	2.89(1.74)	3.44(1.81)	2.44(1.55)	27.78(4.80)
	M2	4.11(1.94)	3.11(1.75)	2.78(1.70)	2.89(1.72)	3.56(1.79)	3.11(1.75)	2.44(1.57)	2.56(1.59)	2.78(1.65)	27.33(4.70)
CD(0.05)		NS	NS	NS	NS	NS	NS	NS	NS	0.08	NS
	CV%	22.39	16.2	20.53	12.95	13.84	16.93	10.74	21.72	3.57	9.94
Mean of Factor-2	S1	4.00(2.00)	2.00(1.58)	2.00(1.58)	2.33(1.67)	2.00(1.58)	2.00(1.58)	2.67(1.76)	1.33(1.23)	1.33(1.29)	19.67(4.47)
	S2	4.00(2.08)	2.33(1.67)	2.00(1.53)	2.00(1.58)	2.00(1.53)	2.33(1.67)	2.00(1.53)	2.00(1.53)	1.67(1.44)	20.33(4.55)
	S3	4.00(2.10)	3.00(1.85)	2.67(1.76)	2.33(1.67)	2.67(1.76)	3.33(1.94)	3.00(1.85)	3.00(1.85)	2.00(1.58)	26.00(5.13)
	S4	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.67(1.76)	3.00(1.85)	2.00(1.58)	2.33(1.54)	3.33(1.94)	2.33(1.62)	23.67(4.91)
	S5	11.00(3.39)	9.33(3.09)	5.67(2.45)	7.67(2.83)	10.00(3.19)	9.33(3.11)	6.00(2.54)	8.33(2.93)	8.33(2.96)	75.67(8.72)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		0.52	0.42	0.36	0.33	0.42	0.32	0.51	0.53	0.46	0.49
	CV%	21.4	19.63	18.52	16.19	19.52	14.9	25.43	25.89	23.67	8.65
Interaction	M and T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	T and M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		2.01	1.78	1.63	1.7	1.77	1.76	1.65	1.7	1.6	4.75

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1-Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-I Malan									
		Panicle Initiation stage									
		Grasses			Sedges			BLW			Total
		<i>Echinochloa colonum</i>	<i>Echinochloa crusgalli</i>	<i>Panicum spp.</i>	<i>Cyperus iria</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Alternanthera spp.</i>	<i>Eclipta alba</i>	Monochoria vaginalis	
M1	S1	6.00(2.53)	3.33(1.94)	2.67(1.76)	2.67(1.76)	2.00(1.58)	3.33(1.94)	2.67(1.76)	3.33(1.94)	2.00(1.58)	28.00(5.34)
	S2	6.67(2.67)	3.33(1.94)	1.33(1.29)	2.00(1.58)	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.67(1.76)	26.67(5.21)
	S3	4.67(2.26)	3.33(1.94)	2.67(1.76)	4.00(2.12)	2.67(1.76)	3.33(1.94)	3.33(1.94)	3.33(1.94)	3.33(1.94)	30.67(5.58)
	S4	4.00(2.08)	2.67(1.76)	3.33(1.94)	4.00(2.08)	2.67(1.76)	2.67(1.76)	4.67(2.26)	2.00(1.58)	4.67(2.26)	30.67(5.58)
	S5	12.00(3.53)	10.00(3.18)	5.33(2.41)	7.33(2.79)	9.33(3.12)	8.67(3.02)	6.67(2.67)	10.67(3.33)	9.33(3.13)	79.33(8.93)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	5.33(2.31)	2.67(1.76)	2.67(1.76)	3.33(1.94)	3.33(1.94)	2.67(1.76)	2.67(1.76)	2.67(1.76)	2.67(1.65)	28.00(5.31)
	S2	4.67(2.26)	2.67(1.76)	4.00(2.08)	3.33(1.90)	3.33(1.94)	2.00(1.58)	3.33(1.94)	1.33(1.29)	2.67(1.76)	27.33(5.27)
	S3	3.33(1.94)	4.67(2.26)	3.33(1.94)	3.33(1.94)	3.33(1.94)	2.67(1.76)	3.33(1.94)	2.67(1.76)	3.33(1.94)	30.00(5.52)
	S4	4.67(2.26)	2.67(1.76)	2.00(1.58)	4.00(2.08)	2.67(1.76)	5.33(2.41)	5.33(2.41)	2.67(1.76)	1.33(1.29)	30.67(5.58)
	S5	10.00(3.21)	9.33(3.09)	7.33(2.79)	11.33(3.42)	12.00(3.50)	13.33(3.66)	7.33(2.78)	10.00(3.15)	4.67(2.26)	85.33(9.24)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1		5.56(2.30)	3.78(1.91)	2.56(1.64)	3.33(1.84)	3.22(1.78)	3.44(1.86)	3.33(1.85)	3.67(1.88)	3.67(1.90)	32.56(5.22)
Mean of Factor-2	M1	4.67(2.12)	3.67(1.89)	3.22(1.81)	4.22(2.00)	4.11(1.97)	4.33(1.98)	3.67(1.92)	3.22(1.74)	2.44(1.60)	33.56(5.27)
	M2	NS	NS	0.09	NS	0.04	NS	NS	NS	NS	NS
	CD(0.05)	10.4	18.42	3.75	8.32	1.36	26.2	12.17	19.05	12.87	2.39
	CV%										
	S1	5.67(2.42)	3.00(1.85)	2.67(1.76)	3.00(1.85)	2.67(1.76)	3.00(1.85)	2.67(1.76)	3.00(1.85)	2.33(1.62)	28.00(5.33)
	S2	5.67(2.47)	3.00(1.85)	2.67(1.69)	2.67(1.74)	3.00(1.85)	2.33(1.67)	3.00(1.85)	2.00(1.53)	2.67(1.76)	27.00(5.24)
Interaction M and T and M	S3	4.00(2.10)	4.00(2.10)	3.00(1.85)	3.67(2.03)	3.00(1.85)	3.00(1.85)	3.33(1.94)	3.00(1.85)	3.33(1.94)	30.33(5.55)
	S4	4.33(2.17)	2.67(1.76)	2.67(1.76)	4.00(2.08)	2.67(1.76)	4.00(2.08)	5.00(2.34)	2.33(1.67)	3.00(1.78)	30.67(5.58)
	S5	11.00(3.37)	9.67(3.13)	6.33(2.60)	9.33(3.11)	10.67(3.31)	11.00(3.34)	7.00(2.73)	10.33(3.24)	7.00(2.70)	82.33(9.09)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.48	0.48	0.38	0.42	0.4	0.39	0.35	0.44	0.45	0.48
	CV%	18.21	21.12	18.44	18.32	17.74	17.04	15.35	20.01	21.23	7.6
Experimental Mean		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		2.21	1.9	1.73	1.92	1.87	1.92	1.89	1.81	1.75	5.25

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-VII Moncompu									
Main plot	Sub plot Treatments	Active Tillering Stage							
		Grasses		Sedges		BLW		Total	
		<i>Isachnae miliaceae</i>	<i>Echinochloa stagnina</i>	<i>O.sativa f.sp. spontanea</i>	<i>Cyperus difformis</i>	<i>Fimbristylis miliaceae</i>	<i>Ludwigia hyssopifolia</i>	<i>Monochoria vaginalis</i>	
M1	S1	0.00(0.71)	0.00(0.71)	6.00(2.29)	0.00(0.71)	2.67(1.44)	0.00(0.71)	0.00(0.71)	8.67(2.64)
	S2	0.00(0.71)	0.00(0.71)	8.00(2.56)	2.67(1.44)	6.67(1.98)	0.00(0.71)	0.00(0.71)	17.33(4.13)
	S3	16.00(2.79)	0.00(0.71)	9.33(2.77)	2.67(1.44)	12.67(2.54)	0.00(0.71)	0.00(0.71)	40.67(5.77)
	S4	0.00(0.71)	6.00(2.12)	0.00(0.71)	2.67(1.44)	10.67(2.37)	0.00(0.71)	0.00(0.71)	19.33(3.76)
	S5	33.33(4.95)	10.33(2.90)	2.67(1.44)	16.00(4.01)	32.67(5.26)	8.00(2.12)	4.00(1.65)	107.00(10.24)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	13.33(3.25)	0.00(0.71)	2.67(1.44)	0.00(0.71)	6.00(2.29)	0.00(0.71)	0.00(0.71)	22.00(4.64)
	S2	20.00(3.87)	0.00(0.71)	0.00(0.71)	2.67(1.44)	6.00(2.29)	0.00(0.71)	0.00(0.71)	28.67(5.23)
	S3	53.33(7.31)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	53.33(7.31)
	S4	10.67(2.37)	0.00(0.71)	0.00(0.71)	0.00(0.71)	21.33(4.57)	2.67(1.44)	0.00(0.71)	34.67(5.78)
	S5	13.33(2.59)	0.00(0.71)	0.00(0.71)	15.33(3.91)	70.33(8.35)	1.33(1.18)	8.00(2.12)	108.33(10.37)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1									
M1	M1	8.22(1.76)	2.72(1.31)	4.33(1.75)	4.00(1.63)	10.89(2.38)	1.33(0.94)	0.67(0.86)	32.17(4.54)
	M2	18.44(3.35)	0.00(0.71)	0.44(0.83)	3.00(1.36)	17.28(3.15)	0.67(0.91)	1.33(0.94)	41.17(5.67)
CD(0.05)	CD(0.05)	NS	0.18	0.53	NS	NS	NS	NS	NS
	CV%	119.51	12.39	28.86	49.23	42.03	78.74	113.71	41.03
Mean of Factor-2									
S1	S1	6.67(1.98)	0.00(0.71)	4.33(1.87)	0.00(0.71)	4.33(1.87)	0.00(0.71)	0.00(0.71)	15.33(3.64)
	S2	10.00(2.29)	0.00(0.71)	4.00(1.63)	2.67(1.44)	6.33(2.13)	0.00(0.71)	0.00(0.71)	23.00(4.68)
S3	S3	34.67(5.05)	0.00(0.71)	4.67(1.74)	1.33(1.08)	6.33(1.62)	0.00(0.71)	0.00(0.71)	47.00(6.54)
	S4	5.33(1.54)	3.00(1.41)	0.00(0.71)	1.33(1.08)	16.00(3.47)	1.33(1.08)	0.00(0.71)	27.00(4.77)
S5	S5	23.33(3.77)	5.17(1.80)	1.33(1.08)	15.67(3.96)	51.50(6.81)	4.67(1.65)	6.00(1.89)	107.67(10.30)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)	CD(0.05)	2.43	NS	NS	1.04	2.01	NS	NS	1.96
	CV%	78.88	80.73	80.93	57.71	60.39	90.93	94.06	31.83
Interaction	Interaction								
	M and T	NS	NS	NS	NS	NS	NS	NS	NS
T and M	T and M	NS	NS	NS	NS	NS	NS	NS	NS
	Experimental Mean	2.56	1.01	1.29	1.49	2.77	0.93	0.9	5.11

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Moncompu									
		Panicle Initiation stage									
		Grasses					Sedges			BLW	
		<i>Isachnae miliaceae</i>	<i>Echinochloa stagnina</i>	<i>O.sativa f.sp. spontanea</i>	<i>Cyperus difformis</i>	<i>Cyperus haspan</i>	<i>Fimbristylis miliaceae</i>	<i>Ludwigia hyssopifolia</i>	<i>Monochoria vaginalis</i>	Total	
M1	S1	0.00(0.71)	2.67(1.44)	12.00(3.50)	0.00(0.71)	0.00(0.71)	3.33(1.55)	0.00(0.71)	0.00(0.71)	18.00(4.17)	
	S2	42.67(5.59)	0.00(0.71)	8.00(2.56)	0.00(0.71)	0.00(0.71)	4.00(1.65)	0.00(0.71)	0.00(0.71)	54.67(7.01)	
	S3	42.67(5.59)	0.00(0.71)	9.33(2.77)	0.00(0.71)	0.00(0.71)	10.67(2.37)	0.00(0.71)	0.00(0.71)	62.67(7.45)	
	S4	48.00(6.86)	8.00(2.56)	0.00(0.71)	2.67(1.44)	0.00(0.71)	10.00(2.31)	0.00(0.71)	0.00(0.71)	68.67(8.03)	
	S5	36.00(5.15)	13.00(3.64)	0.00(0.71)	5.33(2.18)	1.67(1.25)	26.67(5.04)	9.33(2.25)	4.00(1.65)	96.00(9.79)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
M2	S1	0.00(0.71)	0.00(0.71)	5.33(2.18)	0.00(0.71)	0.00(0.71)	12.00(3.47)	0.00(0.71)	0.00(0.71)	17.33(4.19)	
	S2	21.33(4.01)	0.00(0.71)	1.33(1.18)	5.33(1.83)	0.00(0.71)	11.67(3.43)	0.00(0.71)	0.00(0.71)	39.67(6.28)	
	S3	38.00(5.26)	1.67(1.25)	2.67(1.44)	0.00(0.71)	0.00(0.71)	6.00(1.91)	0.00(0.71)	0.00(0.71)	48.33(6.66)	
	S4	42.00(5.51)	1.33(1.18)	1.33(1.18)	0.00(0.71)	0.00(0.71)	25.00(4.99)	5.33(1.83)	0.00(0.71)	75.00(8.48)	
	S5	72.00(8.51)	10.67(2.37)	7.33(2.05)	31.33(5.61)	0.00(0.71)	73.33(8.53)	2.67(1.44)	8.00(2.12)	205.33(14.35)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2	M1	28.22(4.10)	3.94(1.63)	4.89(1.83)	1.33(1.08)	0.28(0.80)	9.11(2.27)	1.56(0.96)	0.67(0.86)	50.00(6.19)	
	M2	28.89(4.12)	2.28(1.15)	3.00(1.46)	6.11(1.71)	0.00(0.71)	21.33(3.84)	1.33(1.02)	1.33(0.94)	64.28(6.78)	
	CD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	CV%	48.56	82.79	88.15	41.22	36.28	53.44	84.58	113.71	30.54	
	S1	0.00(0.71)	1.33(1.08)	8.67(2.84)	0.00(0.71)	0.00(0.71)	7.67(2.51)	0.00(0.71)	0.00(0.71)	17.67(4.18)	
	S2	32.00(4.80)	0.00(0.71)	4.67(1.87)	2.67(1.27)	0.00(0.71)	7.83(2.54)	0.00(0.71)	0.00(0.71)	47.17(6.65)	
	S3	40.33(5.42)	0.83(0.98)	6.00(2.11)	0.00(0.71)	0.00(0.71)	8.33(2.14)	0.00(0.71)	0.00(0.71)	55.50(7.05)	
	S4	45.00(6.19)	4.67(1.87)	0.67(0.94)	1.33(1.08)	0.00(0.71)	17.50(3.65)	2.67(1.27)	0.00(0.71)	71.83(8.26)	
	S5	54.00(6.83)	11.83(3.00)	3.67(1.38)	18.33(3.90)	0.83(0.98)	50.00(6.79)	6.00(1.85)	6.00(1.89)	150.67(12.07)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
	CD(0.05)	3.34	1.39	1.36	1	NS	1.7	NS	NS	2.15	
	CV%	67.44	83.13	69.02	59.41	36.28	46.1	105.19	94.06	27.55	
	Interaction										
	M and T	NS	NS	NS	1.41	NS	NS	NS	NS	NS	
	T and M	NS	NS	NS	1.44	NS	NS	NS	NS	NS	
	Experimental Mean	4.11	1.39	1.64	1.39	0.75	3.06	0.99	0.9	6.48	

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VI Nawagam										
		Active Tillering Stage										
		Grasses					Sedges			BLW		
		<i>Echinochloa crusgalli</i>	<i>Echinochloa colonum</i>	<i>Cynodon dactylon</i>	<i>Chloris barbata</i>	<i>Cyperus rotundus</i>	<i>Cyperus iria</i>	<i>Cyperus esculentus</i>	<i>Eclipta alba</i>	<i>Ipomoea aquatic</i>	<i>Trianthema monogyna</i>	Total
M1	S1	14.00(3.33)	11.33(3.39)	3.00(1.86)	6.00(2.51)	6.00(2.52)	8.67(2.70)	12.67(3.20)	3.67(1.91)	4.00(2.04)	8.67(2.81)	78.00(8.82)
	S2	7.00(2.63)	12.00(3.16)	11.33(3.43)	11.67(3.25)	9.33(2.97)	9.67(3.12)	10.67(3.10)	1.67(1.46)	6.00(2.30)	7.33(2.73)	86.67(9.34)
	S3	8.00(2.79)	21.00(4.40)	5.67(2.45)	12.00(3.24)	14.33(3.77)	4.67(2.18)	24.67(4.67)	8.67(2.70)	9.00(2.97)	5.33(2.38)	113.33(10.59)
	S4	13.33(3.53)	16.67(3.99)	13.33(3.63)	21.67(4.47)	2.33(1.64)	22.33(4.57)	5.00(2.32)	3.33(1.88)	6.00(2.51)	22.67(4.54)	126.67(11.15)
	S5	59.00(7.36)	62.67(7.74)	51.33(7.10)	74.67(8.55)	39.67(6.15)	40.00(6.28)	35.00(5.93)	12.00(3.35)	27.67(4.80)	18.33(4.20)	420.33(20.49)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	16.00(3.76)	6.00(2.47)	8.67(3.00)	8.67(2.78)	4.00(2.06)	13.00(3.44)	14.33(3.50)	4.67(2.14)	16.33(4.04)	3.67(1.94)	95.33(9.72)
	S2	4.33(2.06)	9.33(2.85)	19.33(4.20)	6.00(2.47)	11.67(3.12)	9.33(2.95)	10.00(3.23)	4.00(2.10)	9.67(3.03)	9.33(2.68)	93.00(9.52)
	S3	25.33(4.97)	12.00(3.30)	14.00(3.68)	14.67(3.59)	7.67(2.68)	18.00(3.87)	12.00(3.25)	8.67(2.55)	12.00(3.19)	5.33(2.28)	129.67(11.35)
	S4	11.67(3.29)	28.00(5.12)	12.33(3.44)	35.33(5.92)	10.33(3.12)	4.33(2.10)	19.67(4.21)	16.00(3.96)	14.33(3.23)	4.67(2.14)	156.67(12.52)
	S5	61.33(7.83)	66.67(8.16)	48.33(6.77)	65.67(8.12)	45.00(6.33)	37.33(6.10)	57.33(7.30)	21.67(4.47)	16.33(3.99)	26.67(5.18)	446.33(21.08)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1		16.89(3.39)	20.61(3.90)	14.11(3.20)	21.00(3.79)	11.94(2.96)	14.22(3.26)	14.67(3.32)	4.89(2.00)	8.78(2.55)	10.39(2.89)	137.50(10.18)
CD(0.05)	M1	19.78(3.77)	20.33(3.77)	17.11(3.63)	21.72(3.93)	13.11(3.01)	13.67(3.19)	18.89(3.70)	9.17(2.65)	11.44(3.03)	8.28(2.49)	153.50(10.81)
	M2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%		48.63	27.35	20.19	6.83	69.76	26.77	11.02	44.42	64.32	36.53	9.21
Mean of Factor-2		15.00(3.55)	8.67(2.93)	5.83(2.43)	7.33(2.64)	5.00(2.29)	10.83(3.07)	13.50(3.35)	4.17(2.02)	10.17(3.04)	6.17(2.38)	86.67(9.27)
Interaction M and T	S1	5.67(2.34)	10.67(3.01)	15.33(3.82)	8.83(2.86)	10.50(3.05)	9.50(3.03)	10.33(3.17)	2.83(1.78)	7.83(2.67)	8.33(2.71)	89.83(9.43)
	S2	16.67(3.88)	16.50(3.85)	9.83(3.06)	13.33(3.41)	11.00(3.23)	11.33(3.02)	18.33(3.96)	8.67(2.62)	10.50(3.08)	5.33(2.33)	121.50(10.97)
	S3	12.50(3.41)	22.33(4.56)	12.83(3.54)	28.50(5.19)	6.33(2.38)	13.33(3.34)	12.33(3.26)	9.67(2.92)	10.17(2.87)	13.67(3.34)	141.67(11.84)
	S4	60.17(7.59)	64.67(7.95)	49.83(6.93)	70.17(8.34)	42.33(6.24)	38.67(6.19)	46.17(6.61)	16.83(3.91)	22.00(4.39)	22.50(4.69)	433.33(20.78)
	S5	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S6	1.79	1.72	1.39	1.68	1.57	1.62	1.93	1.33	1.76	1.33	1.63
CD(0.05)		41.62	37.28	33.84	36.21	43.75	41.81	45.53	47.29	52.4	41.14	12.91
CV%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		3.58	3.83	3.41	3.86	2.98	3.23	3.51	2.33	2.79	2.69	10.5

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VI Nawagam									
		Grasses					Sedges			BLW	
		<i>Echinochloa crusgalli</i>	<i>Echinochloa colonum</i>	<i>Cynodon dactylon</i>	<i>Chloris barbata</i>	<i>Cyperus rotundus</i>	<i>Cyperus iria</i>	<i>Cyperus esculentus</i>	<i>Eclipta alba</i>	<i>Ipomoea aquatic</i>	<i>Trianthema monogyna</i>
M1	S1	7.67(2.81)	4.33(2.02)	15.67(3.57)	10.33(2.78)	11.67(3.30)	17.67(3.79)	13.00(3.49)	4.67(2.14)	6.67(2.46)	3.00(1.86)
	S2	7.67(2.58)	21.00(4.55)	4.67(2.18)	12.67(3.01)	7.00(2.60)	19.00(4.11)	20.67(4.31)	5.67(2.33)	3.67(1.87)	2.33(1.66)
	S3	16.33(4.04)	18.00(4.14)	8.67(2.80)	9.67(3.09)	17.00(3.90)	20.67(4.29)	14.67(3.74)	3.67(1.91)	16.67(3.98)	6.33(2.42)
	S4	25.00(4.75)	11.67(3.45)	28.00(4.77)	8.00(2.87)	6.00(2.49)	19.67(4.28)	8.33(2.82)	8.33(2.71)	2.33(1.66)	5.67(2.34)
	S5	69.00(7.83)	74.33(8.50)	62.33(7.71)	77.67(8.64)	45.00(6.67)	46.33(6.66)	44.33(5.91)	28.67(5.14)	24.67(4.49)	23.67(4.49)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	9.33(2.68)	17.67(4.09)	3.00(1.86)	11.00(2.78)	21.00(4.46)	14.33(3.72)	9.67(3.00)	13.67(3.75)	8.00(2.54)	3.67(1.91)
	S2	10.00(3.08)	10.67(3.03)	19.33(4.20)	6.00(2.47)	17.67(3.95)	15.67(3.67)	18.00(3.89)	8.67(2.81)	9.00(2.59)	6.33(2.54)
	S3	29.67(5.32)	9.67(3.03)	13.67(3.61)	18.33(4.15)	24.67(4.98)	6.67(2.65)	26.00(4.73)	13.67(3.07)	28.00(4.89)	3.67(2.00)
	S4	23.00(4.39)	11.33(3.29)	40.33(6.02)	26.00(5.02)	7.33(2.70)	21.00(4.22)	15.00(3.18)	5.67(2.46)	11.67(2.92)	11.00(3.28)
	S5	52.33(7.21)	74.33(8.55)	89.67(9.33)	91.33(9.55)	56.33(7.24)	37.33(6.00)	71.00(8.22)	22.00(4.37)	34.67(5.75)	18.00(4.24)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1		20.94(3.79)	21.56(3.89)	19.89(3.62)	19.72(3.52)	14.44(3.28)	20.56(3.97)	16.83(3.50)	8.50(2.49)	9.00(2.53)	6.83(2.24)
M1		20.72(3.90)	20.61(3.78)	27.67(4.29)	25.44(4.11)	21.17(4.01)	15.83(3.49)	23.28(3.96)	10.61(2.86)	15.22(3.23)	7.11(2.44)
M2		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CD(0.05)		6.01	14.61	37.6	14.26	39.94	40.45	27.15	17.64	33.9	29.98
CV%											
Mean of Factor-2											
S1		8.50(2.75)	11.00(3.05)	9.33(2.71)	10.67(2.78)	16.33(3.88)	16.00(3.75)	11.33(3.24)	9.17(2.95)	7.33(2.50)	3.33(1.88)
S2		8.83(2.83)	15.83(3.79)	12.00(3.19)	9.33(2.74)	12.33(3.28)	17.33(3.89)	19.33(4.10)	7.17(2.57)	6.33(2.23)	4.33(2.10)
S3		23.00(4.68)	13.83(3.58)	11.17(3.21)	14.00(3.62)	20.83(4.44)	13.67(3.47)	20.33(4.24)	8.67(2.49)	22.33(4.43)	5.00(2.21)
S4		24.00(4.57)	11.50(3.37)	34.17(5.39)	17.00(3.94)	6.67(2.59)	20.33(4.25)	11.67(3.00)	7.00(2.58)	7.00(2.29)	8.33(2.81)
S5		60.67(7.52)	74.33(8.53)	76.00(8.52)	84.50(9.09)	50.67(6.95)	41.83(6.33)	57.67(7.06)	25.33(4.75)	29.67(5.12)	20.83(4.36)
S6		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		2.16	1.43	2.28	1.99	1.73	2.07	2.67	1.8	2.21	1.21
CV%		46.61	30.88	47.79	43.33	39.35	46.05	59.5	55.78	63.66	42.7
Interaction											
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		3.84	3.84	3.96	3.81	3.64	3.73	3.73	2.68	2.88	2.34
Total											

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

ZONE-II Pantnagar										
Main plot	Sub plot Treatments	Active Tillering Stage								
		Grasses		Sedges			BLW		Total	
		<i>Echinochloa Colona</i>	<i>Eleusine indica</i>	Cyperus iria	Cyperus difformis	Fimbristylis miliacea	Alternanthera sessilis	Commelina Diffusa		
M1	S1	4.67(2.26)	1.33(1.29)	13.33(3.71)	7.33(2.79)	2.00(1.47)	9.33(3.12)	13.33(3.69)	51.33(7.20)	
	S2	4.00(2.08)	3.33(1.94)	6.00(2.53)	3.33(1.94)	3.33(1.79)	2.67(1.65)	1.33(1.29)	24.00(4.95)	
	S3	5.33(2.41)	4.67(2.26)	0.67(1.00)	1.33(1.29)	4.67(2.26)	5.33(2.39)	0.67(1.00)	22.67(4.80)	
	S4	1.67(1.46)	4.67(2.26)	0.00(0.71)	0.00(0.71)	4.67(2.26)	0.00(0.71)	0.00(0.71)	11.00(3.39)	
	S5	4.67(2.21)	9.33(3.12)	6.67(2.65)	2.67(1.65)	6.67(2.67)	2.67(1.65)	2.00(1.47)	34.67(5.93)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
M2	S1	3.33(1.94)	4.00(2.08)	6.67(2.67)	2.00(1.58)	2.67(1.76)	2.00(1.47)	0.67(1.00)	21.33(4.65)	
	S2	2.00(1.47)	2.00(1.47)	0.00(0.71)	0.00(0.71)	1.33(1.18)	0.00(0.71)	0.00(0.71)	5.33(2.35)	
	S3	4.67(2.26)	0.00(0.71)	2.33(1.68)	3.33(1.94)	0.00(0.71)	4.67(2.27)	3.33(1.94)	18.33(4.34)	
	S4	6.00(2.53)	4.67(2.26)	3.33(1.94)	2.00(1.47)	3.33(1.94)	4.33(2.20)	4.00(2.12)	27.67(5.30)	
	S5	19.33(4.45)	16.00(4.06)	16.67(4.14)	7.33(2.79)	14.33(3.84)	12.00(3.50)	12.00(3.53)	97.67(9.91)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
Mean of Factor-1										
M1	3.39(1.86)	3.89(1.93)	4.44(1.88)	2.44(1.51)	3.56(1.86)	3.33(1.70)	2.89(1.48)	23.94(4.50)		
M2	5.89(2.23)	4.44(1.88)	4.83(1.97)	2.44(1.53)	3.61(1.69)	3.83(1.81)	3.33(1.67)	28.39(4.54)		
CD(0.05)	0.32	ns	ns	ns	ns	ns	ns	ns		
CV%	11.04	32.46	6.93	13.52	21.91	22.94	19.78	3.82		
Mean of Factor-2										
S1	4.00(2.10)	2.67(1.69)	10.00(3.19)	4.67(2.19)	2.33(1.62)	5.67(2.30)	7.00(2.35)	36.33(5.92)		
S2	3.00(1.78)	2.67(1.71)	3.00(1.62)	1.67(1.32)	2.33(1.49)	1.33(1.18)	0.67(1.00)	14.67(3.65)		
S3	5.00(2.34)	2.33(1.49)	1.50(1.34)	2.33(1.62)	2.33(1.49)	5.00(2.33)	2.00(1.47)	20.50(4.57)		
S4	3.83(2.00)	4.67(2.26)	1.67(1.32)	1.00(1.09)	4.00(2.10)	2.17(1.45)	2.00(1.41)	19.33(4.35)		
S5	12.00(3.33)	12.67(3.59)	11.67(3.40)	5.00(2.22)	10.50(3.26)	7.33(2.58)	7.00(2.50)	66.17(7.92)		
S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		
CD(0.05)	0.49	0.39	0.35	0.49	0.58	0.57	0.48	0.41		
CV%	20.06	16.99	15.14	26.5	27.09	27	25.28	7.55		
Interaction										
M and T	0.7	0.55	0.5	0.69	0.82	0.81	0.68	0.58		
T and M	0.69	0.85	0.48	0.67	0.87	0.87	0.71	0.56		
Experimental Mean	2.04	1.91	1.93	1.52	1.78	1.76	1.57	4.52		

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-II Pantnagar						
		Grasses			Sedges		Panicle Initiation stage	
		<i>Echinochloa colonum</i>		<i>Eleusine indica</i>	Cyperus iria	Cyperus difformis	BLW	
		<i>Echinochloa colonum</i>					Alternanthera sessilis	Commelina diffusa
M1	S1	4.67(2.26)	7.33(2.79)	3.33(1.94)	4.33(2.20)	5.67(2.47)	4.00(2.12)	29.33(5.46)
	S2	4.33(2.20)	4.67(2.26)	4.33(2.20)	5.00(2.34)	4.67(2.27)	2.33(1.64)	25.33(5.08)
	S3	4.33(2.20)	4.67(2.26)	4.33(2.20)	4.67(2.26)	4.00(2.12)	4.33(2.20)	26.33(5.18)
	S4	2.67(1.76)	5.33(2.39)	6.00(2.53)	2.00(1.47)	2.67(1.76)	4.33(2.20)	23.00(4.83)
	S5	18.00(4.27)	14.67(3.80)	12.67(3.61)	12.67(3.61)	10.67(3.33)	13.00(3.66)	81.67(9.06)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	7.33(2.79)	7.00(2.73)	7.67(2.85)	6.67(2.67)	6.00(2.54)	6.00(2.53)	40.67(6.40)
	S2	7.33(2.79)	8.00(2.90)	8.67(3.02)	6.67(2.67)	8.00(2.90)	6.33(2.60)	45.00(6.74)
	S3	5.00(2.34)	4.67(2.26)	5.33(2.41)	4.67(2.21)	4.67(2.26)	5.33(2.39)	29.67(5.45)
	S4	6.33(2.59)	6.00(2.53)	6.67(2.67)	6.67(2.67)	7.33(2.79)	4.67(2.26)	37.67(6.18)
	S5	20.67(4.57)	18.00(4.23)	16.67(4.14)	15.33(3.97)	14.00(3.80)	17.00(4.18)	101.67(10.11)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean	M1	5.67(2.23)	6.11(2.37)	5.11(2.20)	4.78(2.10)	4.61(2.11)	4.67(2.09)	30.94(5.05)
	M2	7.78(2.63)	7.28(2.56)	7.50(2.63)	6.67(2.48)	6.67(2.50)	6.56(2.45)	42.44(5.93)
	CD(0.05)	0.29	ns	0.11	0.16	0.32	0.32	0.27
	CV%	8.19	8.17	3.09	4.92	9.69	9.79	3.4
	S1	6.00(2.53)	7.17(2.76)	5.50(2.40)	5.50(2.43)	5.83(2.51)	5.00(2.33)	35.00(5.93)
	S2	5.83(2.49)	6.33(2.58)	6.50(2.61)	5.83(2.51)	6.33(2.59)	4.33(2.12)	35.17(5.91)
	S3	4.67(2.27)	4.67(2.26)	4.83(2.30)	4.67(2.24)	4.33(2.19)	4.83(2.29)	28.00(5.32)
	S4	4.50(2.18)	5.67(2.46)	6.33(2.60)	4.33(2.07)	5.00(2.28)	4.50(2.23)	30.33(5.50)
	S5	19.33(4.42)	16.33(4.01)	14.67(3.88)	14.00(3.79)	12.33(3.57)	15.00(3.92)	91.67(9.58)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.4	0.55	0.26	0.37	0.3	0.35	0.39
	CV%	13.55	18.58	8.96	13.24	10.78	12.77	5.9
	Interaction							
	M and T	ns	ns	0.37	ns	ns	ns	0.55
	T and M	ns	ns	0.35	ns	ns	ns	0.55
	Experimental Mean	2.43	2.46	2.42	2.29	2.31	2.27	5.49

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1-Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4-Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Pattambi							
		Active Tillering Stage							
		Grasses	Sedges		<i>Fimbristylis miliaceae</i>	Monochoria vaginalis	BLW		Total
			Cyperus difformis	<i>Cyperus laevigatus</i>			Sagittaria guayensis	<i>Vallisneria spp</i>	
M1	S1	30.00(5.50)	0.00(0.71)	0.00(0.71)	51.00(7.17)	0.00(0.71)	0.00(0.71)	0.00(0.71)	81.00(9.02)
	S2	40.33(6.39)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	40.33(6.39)
	S3	81.00(9.00)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	81.00(9.00)
	S4	69.33(8.32)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	69.33(8.32)
	S5	177.67(13.35)	84.00(9.19)	103.33(10.18)	62.00(7.90)	0.00(0.71)	35.33(5.98)	25.00(5.05)	487.33(22.09)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	25.33(5.06)	36.33(6.07)	35.00(5.95)	0.00(0.71)	0.00(0.71)	0.00(0.71)	25.67(5.11)	122.33(11.08)
	S2	8.00(2.90)	39.33(6.31)	62.33(7.92)	48.67(7.01)	0.00(0.71)	21.67(4.71)	23.67(4.92)	203.67(14.29)
	S3	78.67(8.90)	32.33(5.73)	30.67(5.58)	0.00(0.71)	24.33(4.98)	0.00(0.71)	0.00(0.71)	166.00(12.90)
	S4	69.33(8.35)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	69.33(8.35)
	S5	352.00(18.77)	32.33(5.73)	28.00(5.34)	61.00(7.84)	0.00(0.71)	0.00(0.71)	0.00(0.71)	473.33(21.77)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1	M1	66.39(7.21)	14.00(2.12)	17.22(2.29)	18.83(2.98)	0.00(0.71)	5.89(1.59)	4.17(1.43)	126.50(9.25)
	M2	88.89(7.45)	23.39(4.21)	26.00(4.37)	18.28(2.95)	4.06(1.42)	3.61(1.37)	8.22(2.14)	172.44(11.52)
	CD(0.05)	NS	0.03	0.12	NS	0.06	0.08	0.09	0.6
Mean of Factor-2	CV%	8.08	0.58	2.42	6.05	4.14	3.9	3.68	4.04
	S1	27.67(5.28)	18.17(3.39)	17.50(3.33)	25.50(3.94)	0.00(0.71)	0.00(0.71)	12.83(2.91)	101.67(10.05)
	S2	24.17(4.65)	19.67(3.51)	31.17(4.31)	24.33(3.86)	0.00(0.71)	10.83(2.71)	11.83(2.81)	122.00(10.34)
Interaction	S3	79.83(8.95)	16.17(3.22)	15.33(3.14)	0.00(0.71)	12.17(2.84)	0.00(0.71)	0.00(0.71)	123.50(10.95)
	S4	69.33(8.33)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	69.33(8.33)
	S5	264.83(16.06)	58.17(7.46)	65.67(7.76)	61.50(7.87)	0.00(0.71)	17.67(3.34)	12.50(2.88)	480.33(21.93)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.56	0.13	0.22	0.19	0.05	0.09	0.05	0.5
	CV%	6.36	3.45	5.4	5.35	4.14	5.16	2.53	4.03
Experimental Mean	M and T	0.79	0.19	0.31	0.27	0.08	0.13	0.08	0.71
	T and M	0.98	0.17	0.29	0.32	0.08	0.14	0.1	0.8
		7.33	3.16	3.33	2.97	1.06	1.48	1.79	10.38

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

		ZONE-VII Pattambi			
Main plot	Sub plot Treatments	Panicle Initiation Stage			
		Sedges			Total
		Grasses	Cyperus difformis	Cyperus laevigatus	
M1		Isachne miliaceae			
	S1	55.67(7.48)	0.00(0.71)	0.00(0.71)	51.00(7.17)
	S2	66.00(8.15)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S3	106.67(10.34)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S4	95.00(9.76)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S5	203.33(14.27)	84.00(9.19)	103.33(10.18)	62.00(7.90)
M2	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S1	51.00(7.17)	36.33(6.07)	35.00(5.95)	0.00(0.71)
	S2	33.67(5.83)	39.33(6.31)	62.33(7.92)	48.67(7.01)
	S3	104.33(10.24)	32.33(5.73)	30.67(5.58)	0.00(0.71)
	S4	95.00(9.77)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S5	377.67(19.44)	32.33(5.73)	28.00(5.34)	61.00(7.84)
Mean of Factor-1	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	M1	87.78(8.45)	14.00(2.12)	17.22(2.29)	18.83(2.98)
	M2	110.28(8.86)	23.39(4.21)	26.00(4.37)	18.28(2.95)
	CD(0.05)	ns	0.03	0.12	NS
	CV%	5.75	0.58	2.42	6.05
	Mean of Factor-2				
	S1	53.33(7.33)	18.17(3.39)	17.50(3.33)	25.50(3.94)
	S2	49.83(6.99)	19.67(3.51)	31.17(4.31)	24.33(3.86)
	S3	105.50(10.29)	16.17(3.22)	15.33(3.14)	0.00(0.71)
	S4	95.00(9.76)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S5	290.50(16.86)	58.17(7.46)	65.67(7.76)	61.50(7.87)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.46	0.13	0.22	0.19
	CV%	4.4	3.45	5.4	5.35
	Interaction				
M and T T and M Experimental Mean		0.65	0.19	0.31	0.27
		0.81	0.17	0.29	0.32
		8.66	3.16	3.33	2.97
					10.92

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot		ZONE-VII ARI-Rajendranagar						
Sub plot Treatments		Active Tillering Stage						
		Grasses						
		<i>Cynodon dactylon</i>	<i>Digitaria sanguinalis</i>	<i>Echinochloa colona</i>	<i>Echinochloa crusgalli</i>	<i>Panicum repense</i>	<i>Eleusine indica</i>	<i>Dactyloctenium aegyptium</i>
M1	S1	2.33(1.68)	4.33(2.18)	5.00(2.34)	4.67(2.26)	4.00(2.11)	0.67(1.05)	2.00(1.56)
	S2	1.33(1.34)	4.00(2.11)	4.67(2.24)	4.67(2.26)	3.67(2.04)	1.00(1.17)	1.67(1.44)
	S3	2.00(1.56)	4.33(2.18)	4.00(2.09)	4.33(2.16)	3.67(1.97)	2.00(1.56)	2.00(1.52)
	S4	1.33(1.34)	2.00(1.56)	4.67(2.22)	4.33(2.18)	4.33(2.20)	1.00(1.17)	1.00(1.17)
	S5	1.33(1.29)	5.00(2.33)	7.67(2.85)	9.33(3.13)	7.33(2.76)	3.00(1.86)	2.00(1.56)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	4.00(2.08)	2.33(1.64)	3.00(1.86)	4.33(2.18)	3.00(1.86)	5.67(2.47)	5.67(2.48)
	S2	7.00(2.71)	3.00(1.81)	2.67(1.74)	3.33(1.95)	3.67(2.00)	6.33(2.61)	3.67(2.04)
	S3	5.67(2.47)	2.67(1.77)	3.00(1.82)	3.00(1.86)	3.00(1.86)	6.67(2.62)	5.00(2.32)
	S4	6.67(2.67)	1.33(1.27)	2.33(1.68)	1.00(1.17)	3.00(1.86)	5.67(2.47)	4.33(2.15)
	S5	9.67(3.18)	4.33(2.18)	4.00(2.11)	4.67(2.24)	6.00(2.51)	9.33(3.12)	8.33(2.96)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1		1.39(1.32)	3.28(1.84)	4.33(2.08)	4.56(2.12)	3.83(1.96)	1.28(1.25)	1.44(1.33)
M1	M2	5.50(2.30)	2.28(1.56)	2.50(1.65)	2.72(1.69)	3.11(1.80)	5.61(2.33)	4.50(2.11)
	CD(0.05)	0.24	NS	0.19	0.4	NS	0.35	0.32
CV%	CV%	9.27	36.25	7.29	14.52	27.29	13.56	13.14
	Mean of Factor-2							
S1	S1	3.17(1.88)	3.33(1.91)	4.00(2.10)	4.50(2.22)	3.50(1.99)	3.17(1.76)	3.83(2.02)
	S2	4.17(2.03)	3.50(1.96)	3.67(1.99)	4.00(2.11)	3.67(2.02)	3.67(1.89)	2.67(1.74)
	S3	3.83(2.01)	3.50(1.98)	3.50(1.96)	3.67(2.01)	3.33(1.91)	4.33(2.09)	3.50(1.92)
	S4	4.00(2.00)	1.67(1.41)	3.50(1.95)	2.67(1.68)	3.67(2.03)	3.33(1.82)	2.67(1.66)
	S5	5.50(2.24)	4.67(2.25)	5.83(2.48)	7.00(2.69)	6.67(2.64)	6.17(2.49)	5.17(2.26)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)	CD(0.05)	0.4	0.38	0.46	0.4	0.44	0.43	0.43
	CV%	18.46	18.3	20.34	17.4	19.51	19.85	20.7
Interaction	M and T	0.57	NS	NS	NS	NS	NS	NS
	T and M	0.55	NS	NS	NS	NS	NS	NS
Experimental Mean		1.81	1.7	1.86	1.9	1.88	1.79	1.72

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-VII ARI-Rajendranagar									
Main plot	Sub plot Treatments	Active Tillering Stage							
		sedges		BLW					
		<i>Cyperus difformis</i>	<i>Cyperus iria</i>	<i>Ammania baccifera</i>	<i>Bergia capensis</i>	<i>Eclipta alaba</i>	<i>Ludwigia parviflora</i>	<i>Marsilea quadrifolia</i>	Total
M1	S1	9.67(3.18)	8.00(2.89)	4.67(2.26)	5.00(2.34)	2.00(1.56)	2.00(1.56)	2.00(1.56)	56.33(7.54)
	S2	7.00(2.73)	6.67(2.67)	5.33(2.41)	3.00(1.86)	2.00(1.56)	2.33(1.64)	3.00(1.86)	50.33(7.13)
	S3	5.67(2.47)	7.67(2.86)	5.33(2.39)	4.00(2.08)	1.67(1.44)	0.67(1.05)	1.67(1.39)	49.00(7.03)
	S4	8.67(3.02)	7.67(2.86)	5.67(2.47)	3.67(2.02)	1.67(1.46)	0.67(1.00)	2.33(1.68)	49.00(7.03)
	S5	13.00(3.66)	9.67(3.18)	8.00(2.91)	6.33(2.58)	2.33(1.64)	2.33(1.64)	4.00(2.06)	81.33(9.04)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	12.67(3.62)	8.00(2.89)	5.67(2.47)	4.67(2.27)	2.67(1.77)	1.33(1.34)	2.67(1.77)	65.67(8.13)
	S2	15.67(4.01)	11.00(3.38)	6.00(2.53)	4.00(2.08)	2.00(1.56)	3.00(1.86)	1.33(1.34)	72.67(8.55)
	S3	19.33(4.44)	13.00(3.66)	6.67(2.62)	5.33(2.41)	2.67(1.76)	1.67(1.46)	4.00(2.11)	81.67(9.06)
	S4	9.00(3.07)	6.67(2.67)	3.67(2.04)	3.00(1.86)	3.67(2.02)	1.00(1.17)	1.67(1.44)	53.00(7.31)
	S5	25.33(5.07)	13.67(3.75)	19.67(4.46)	15.00(3.92)	7.00(2.73)	6.33(2.56)	5.33(2.35)	138.67(11.76)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean	M1	7.33(2.63)	6.61(2.53)	4.83(2.19)	3.67(1.93)	1.61(1.39)	1.33(1.27)	2.17(1.54)	47.67(6.41)
	M2	13.67(3.49)	8.72(2.84)	6.94(2.47)	5.33(2.21)	3.00(1.76)	2.22(1.52)	2.50(1.62)	68.61(7.59)
	CD(0.05)	0.57	0.14	NS	NS	NS	NS	NS	0.47
	CV%	13.06	3.58	12.19	20.15	17.59	15.88	30.47	4.71
	S1	11.17(3.40)	8.00(2.89)	5.17(2.36)	4.83(2.30)	2.33(1.67)	1.67(1.45)	2.33(1.67)	61.00(7.83)
	S2	11.33(3.37)	8.83(3.02)	5.67(2.47)	3.50(1.97)	2.00(1.56)	2.67(1.75)	2.17(1.60)	61.50(7.84)
	S3	12.50(3.46)	10.33(3.26)	6.00(2.50)	4.67(2.25)	2.17(1.60)	1.17(1.26)	2.83(1.75)	65.33(8.05)
	S4	8.83(3.05)	7.17(2.76)	4.67(2.25)	3.33(1.94)	2.67(1.74)	0.83(1.08)	2.00(1.56)	51.00(7.17)
	S5	19.17(4.36)	11.67(3.47)	13.83(3.69)	10.67(3.25)	4.67(2.19)	4.33(2.10)	4.67(2.21)	110.00(10.40)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.33	0.36	0.45	0.37	0.37	0.46	0.43	0.46
	CV%	8.87	11.25	15.9	14.77	19.29	27.54	22.5	5.41
	Interaction								
	M and T	0.46	NS	0.63	0.52	NS	NS	NS	0.65
	T and M	0.61	NS	0.66	0.67	NS	NS	NS	0.7
	Experimental Mean	3.06	2.69	2.33	2.07	1.58	1.39	1.58	7

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar						
		Panicle Initiation Stage						
		Grasses						
		Cynodon dactylon	Digitaria sanguinalis	Echinochloa colona	Echinochloa crusgalli	Panicum repence	Eleusine indica	Dactyloctenium aegyptium
M1	S1	1.33(1.27)	7.00(2.72)	9.00(3.07)	10.67(3.33)	7.00(2.72)	2.00(1.56)	2.00(1.56)
	S2	3.67(2.00)	9.67(3.17)	9.00(3.06)	13.67(3.75)	6.67(2.67)	2.33(1.64)	1.67(1.35)
	S3	1.33(1.34)	7.00(2.72)	9.00(3.07)	10.67(3.33)	7.00(2.73)	2.00(1.56)	2.00(1.56)
	S4	3.67(2.03)	8.33(2.94)	9.67(3.16)	13.33(3.71)	5.67(2.47)	1.67(1.39)	2.00(1.56)
	S5	4.00(2.03)	9.33(3.13)	12.33(3.55)	14.33(3.84)	5.00(2.32)	2.67(1.74)	3.00(1.81)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	7.33(2.71)	6.00(2.54)	5.00(2.34)	6.00(2.54)	6.67(2.65)	8.00(2.88)	3.00(1.86)
	S2	10.00(3.19)	6.67(2.62)	4.67(2.26)	7.67(2.85)	6.33(2.59)	10.67(3.32)	5.00(2.30)
	S3	12.00(3.52)	6.33(2.56)	8.33(2.96)	10.33(3.28)	11.33(3.43)	11.00(3.38)	7.00(2.73)
	S4	7.00(2.67)	6.67(2.68)	4.33(2.20)	5.33(2.41)	6.67(2.65)	8.67(3.02)	2.67(1.77)
	S5	11.00(3.38)	6.67(2.62)	8.00(2.90)	10.00(3.24)	10.67(3.34)	12.33(3.57)	5.00(2.34)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1								
M1	M1	2.33(1.56)	6.89(2.56)	8.17(2.77)	10.44(3.11)	5.22(2.27)	1.78(1.43)	1.78(1.42)
	M2	7.89(2.70)	5.39(2.29)	5.06(2.23)	6.56(2.51)	6.94(2.56)	8.44(2.81)	3.78(1.95)
CD(0.05)	CD(0.05)	0.98	NS	0.1	0.21	0.28	0.74	0.14
	CV%	32	14.45	2.69	5.13	8.14	24.21	5.94
Mean of Factor-2								
S1	S1	4.33(1.99)	6.50(2.63)	7.00(2.70)	8.33(2.94)	6.83(2.68)	5.00(2.22)	2.50(1.71)
	S2	6.83(2.60)	8.17(2.89)	6.83(2.66)	10.67(3.30)	6.50(2.63)	6.50(2.48)	3.33(1.83)
	S3	6.67(2.43)	6.67(2.64)	8.67(3.01)	10.50(3.30)	9.17(3.08)	6.50(2.47)	4.50(2.15)
	S4	5.33(2.35)	7.50(2.81)	7.00(2.68)	9.33(3.06)	6.17(2.56)	5.17(2.20)	2.33(1.67)
	S5	7.50(2.70)	8.00(2.87)	10.17(3.23)	12.17(3.54)	7.83(2.83)	7.50(2.66)	4.00(2.08)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)	CD(0.05)	0.63	0.54	0.45	0.35	0.33	0.45	0.47
	CV%	24.62	18.39	15.08	10.37	11.42	17.74	23.32
Interaction								
M and T	M and T	NS	NS	NS	0.5	0.47	0.64	NS
	T and M	NS	NS	NS	0.48	0.48	0.82	NS
Experimental Mean		2.13	2.43	2.5	2.81	2.41	2.12	1.69

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-VII ARI-Rajendranagar									
Main plot	Sub plot Treatments	Panicle Initiation Stage							
		Sedges			BLW				
		<i>Cyperus difformis</i>	<i>Cyperus iria</i>	<i>Ammania baccifera</i>	<i>Bergia capensis</i>	<i>Eclipta alaba</i>	<i>Ludwigia parviflora</i>	<i>Marsilea quadrifolia</i>	Total
M1	S1	18.67(4.37)	14.67(3.89)	12.00(3.53)	14.33(3.82)	8.67(3.02)	6.00(2.51)	7.67(2.81)	121.00(11.02)
	S2	21.33(4.67)	19.67(4.48)	10.67(3.32)	11.00(3.36)	10.00(3.22)	4.00(2.11)	6.00(2.54)	129.33(11.38)
	S3	31.00(5.60)	23.00(4.83)	18.00(4.29)	13.67(3.75)	8.67(3.02)	4.67(2.24)	5.00(2.34)	143.00(11.96)
	S4	18.33(4.33)	18.33(4.32)	13.67(3.75)	13.33(3.70)	8.67(3.02)	3.00(1.79)	5.00(2.30)	124.67(11.19)
	S5	37.33(6.14)	25.67(5.11)	28.00(5.33)	24.67(5.01)	10.67(3.34)	2.67(1.74)	4.67(2.26)	184.33(13.59)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	28.67(5.39)	20.67(4.59)	10.67(3.32)	10.67(3.34)	9.33(3.12)	6.00(2.53)	5.67(2.47)	133.67(11.57)
	S2	18.67(4.37)	16.33(4.08)	15.67(3.96)	13.67(3.75)	10.33(3.25)	8.33(2.94)	7.67(2.80)	141.67(11.92)
	S3	32.00(5.70)	18.00(4.22)	10.33(3.28)	11.00(3.38)	7.33(2.79)	5.33(2.35)	5.67(2.46)	156.00(12.51)
	S4	36.67(6.09)	22.00(4.73)	14.00(3.79)	13.00(3.65)	10.33(3.28)	6.00(2.51)	5.33(2.36)	148.67(12.21)
	S5	43.00(6.58)	28.67(5.39)	21.00(4.61)	16.00(3.98)	14.67(3.87)	6.33(2.54)	6.33(2.56)	199.67(14.15)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1	M1	21.11(4.30)	16.89(3.89)	13.72(3.49)	12.83(3.39)	7.78(2.72)	3.39(1.85)	4.72(2.16)	117.06(9.97)
	M2	26.50(4.80)	17.61(3.95)	11.94(3.28)	10.72(3.13)	8.67(2.84)	5.33(2.26)	5.11(2.23)	129.94(10.51)
	CD(0.05)	0.33	NS	NS	NS	0.07	0.09	NS	NS
	CV%	5.05	12.36	8.97	12.38	1.66	2.91	18.43	4.26
	Mean of Factor-2								
	S1	23.67(4.88)	17.67(4.24)	11.33(3.43)	12.50(3.58)	9.00(3.07)	6.00(2.52)	6.67(2.64)	127.33(11.29)
	S2	20.00(4.52)	18.00(4.28)	13.17(3.64)	12.33(3.55)	10.17(3.24)	6.17(2.53)	6.83(2.67)	135.50(11.65)
	S3	31.50(5.65)	20.50(4.53)	14.17(3.78)	12.33(3.57)	8.00(2.90)	5.00(2.30)	5.33(2.40)	149.50(12.23)
	S4	27.50(5.21)	20.17(4.53)	13.83(3.77)	13.17(3.67)	9.50(3.15)	4.50(2.15)	5.17(2.33)	136.67(11.70)
	S5	40.17(6.36)	27.17(5.25)	24.50(4.97)	20.33(4.49)	12.67(3.60)	4.50(2.14)	5.50(2.41)	192.00(13.87)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.46	0.56	0.53	0.56	0.47	0.66	0.54	0.56
	CV%	8.44	11.95	13.12	14.16	13.94	26.72	20.48	4.5
	Interaction								
	M and T	0.65	NS	NS	NS	NS	NS	NS	NS
	T and M	0.65	NS	NS	NS	NS	NS	NS	NS
	Experimental Mean	4.55	3.92	3.38	3.26	2.78	2.06	2.19	10.24

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-IV Titabar									
		Active Tillering Stage					Panicle Initiation Stage				
		Grasses			BLW		Grasses			BLW	
		<i>Echinochloa crusgalli</i>	<i>Leersia hexandra</i>	<i>Cyperus iria</i>	<i>Alternanthera ssp.</i>	Total	<i>Echinochloa crusgalli</i>	<i>Leersia hexandra</i>	<i>Cyperus iria</i>	<i>Alternanthera ssp.</i>	Total
M1	S1	10.00(3.24)	8.33(2.97)	5.67(2.47)	5.00(2.30)	29.00(5.41)	9.33(3.13)	7.67(2.85)	7.00(2.73)	7.67(2.84)	31.67(5.67)
	S2	11.33(3.44)	11.67(3.49)	7.33(2.77)	7.00(2.71)	37.33(6.15)	12.33(3.57)	10.33(3.29)	9.33(3.13)	9.67(3.18)	41.67(6.49)
	S3	12.00(3.53)	14.33(3.84)	9.00(3.06)	8.67(3.02)	44.00(6.65)	14.67(3.87)	12.33(3.58)	11.00(3.39)	12.00(3.52)	50.00(7.10)
	S4	15.67(4.01)	17.00(4.17)	11.00(3.37)	10.67(3.33)	54.33(7.40)	17.67(4.24)	14.67(3.89)	13.00(3.67)	14.67(3.89)	60.00(7.77)
	S5	19.33(4.45)	19.67(4.48)	12.67(3.62)	12.67(3.62)	64.33(8.04)	21.67(4.70)	17.67(4.26)	16.33(4.10)	17.33(4.21)	73.00(8.57)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	12.00(3.52)	13.33(3.71)	7.33(2.79)	7.00(2.72)	39.67(6.33)	13.00(3.65)	10.00(3.24)	9.67(3.19)	9.67(3.18)	42.33(6.54)
	S2	15.33(3.97)	15.67(4.02)	7.67(2.84)	9.00(3.06)	47.67(6.93)	15.67(4.01)	12.33(3.58)	13.00(3.67)	11.00(3.38)	52.00(7.24)
	S3	19.67(4.47)	18.67(4.37)	10.00(3.23)	11.00(3.37)	59.33(7.73)	18.33(4.32)	14.67(3.89)	14.67(3.89)	14.00(3.80)	61.67(7.88)
	S4	23.00(4.83)	22.00(4.74)	12.67(3.62)	12.67(3.61)	70.33(8.41)	23.33(4.87)	16.33(4.10)	16.33(4.10)	16.67(4.13)	72.67(8.55)
	S5	26.33(5.17)	24.67(5.01)	15.67(4.01)	15.33(3.97)	82.00(9.08)	27.67(5.30)	20.33(4.56)	18.67(4.37)	20.67(4.59)	87.33(9.37)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1		11.39(3.23)	11.83(3.28)	7.61(2.67)	7.33(2.61)	38.17(5.73)	12.61(3.37)	10.44(3.10)	9.44(2.96)	10.22(3.06)	42.72(6.05)
Mean of Factor-2	M1	16.06(3.78)	15.72(3.76)	8.89(2.87)	9.17(2.91)	49.83(6.53)	16.33(3.81)	12.28(3.35)	12.06(3.32)	12.00(3.30)	52.67(6.72)
	M2	0.49	0.3	NS	0.14	0.27	0.04	0.23	0.29	0.05	0.21
	CV%	9.7	5.93	8.07	3.56	3.05	0.87	4.99	6.47	1.17	2.27
	S1	11.00(3.38)	10.83(3.34)	6.50(2.63)	6.00(2.51)	34.33(5.87)	11.17(3.39)	8.83(3.04)	8.33(2.96)	8.67(3.01)	37.00(6.10)
	S2	13.33(3.70)	13.67(3.75)	7.50(2.81)	8.00(2.89)	42.50(6.54)	14.00(3.79)	11.33(3.43)	11.17(3.40)	10.33(3.28)	46.83(6.87)
	S3	15.83(4.00)	16.50(4.11)	9.50(3.14)	9.83(3.19)	51.67(7.19)	16.50(4.10)	13.50(3.73)	12.83(3.64)	13.00(3.66)	55.83(7.49)
Interaction M and T T and M	S4	19.33(4.42)	19.50(4.46)	11.83(3.50)	11.67(3.47)	62.33(7.90)	20.50(4.56)	15.50(4.00)	14.67(3.88)	15.67(4.01)	66.33(8.16)
	S5	22.83(4.81)	22.17(4.75)	14.17(3.81)	14.00(3.79)	73.17(8.56)	24.67(5.00)	19.00(4.41)	17.50(4.24)	19.00(4.40)	80.17(8.97)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.26	0.23	0.21	0.23	0.3	0.23	0.15	0.13	0.19	0.16
	CV%	6.1	5.51	6.21	6.85	4.05	5.25	3.93	3.41	4.92	2.03
	Experimental Mean	0.36	NS	NS	NS	NS	NS	NS	0.18	NS	0.22
*(Values in parentheses are transformed values)		0.5	NS	NS	NS	NS	NS	NS	0.28	NS	0.26
		3.5	3.52	2.77	2.76	6.13	3.59	3.22	3.14	3.18	6.38

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Summary on Group wise Weed population no. /m² of Long term trial on weed dynamics in rice under different establishment methods, Kharif 2025.

Main plot	Sub plot Treatments	Zone-VII Aduthurai					ZONE-II Chatha				
		Activa Tillering Stage					Panicle Initiation Stage				
		Grasses	Sedges	BLW	Total		Grasses	Sedges	BLW	Total	
M1	S1	168.00(12.96)	13.00(3.67)	30.00(5.52)	211.00(14.53)		7.00(2.74)	9.67(3.19)	1.67(1.46)	18.33(4.34)	
	S2	132.00(11.51)	10.00(3.23)	33.00(5.78)	175.00(13.24)		6.00(2.55)	8.33(2.97)	1.33(1.34)	15.67(4.02)	
	S3	207.00(14.37)	22.00(4.74)	45.00(6.74)	274.00(16.55)		8.33(2.97)	13.00(3.67)	1.67(1.46)	23.00(4.85)	
	S4	96.00(9.82)	9.00(3.08)	30.00(5.51)	135.00(11.63)		5.33(2.41)	7.33(2.80)	1.00(1.22)	13.67(3.76)	
	S5	1026.00(32.03)	77.00(8.80)	292.00(17.10)	1395.00(37.35)		25.33(5.08)	42.00(6.52)	2.67(1.77)	70.00(8.40)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
M2	S1	309.00(17.56)	28.00(5.34)	53.00(7.31)	390.00(19.74)		8.33(2.97)	12.67(3.63)	2.33(1.68)	23.33(4.88)	
	S2	405.00(20.12)	32.00(5.69)	54.00(7.37)	491.00(22.15)		7.67(2.86)	10.67(3.34)	2.00(1.58)	20.33(4.56)	
	S3	282.00(16.79)	36.00(6.04)	62.00(7.91)	380.00(19.49)		9.67(3.19)	16.67(4.14)	2.00(1.58)	28.33(5.37)	
	S4	153.00(12.39)	20.00(4.52)	53.00(7.31)	226.00(15.05)		6.33(2.61)	8.67(3.03)	1.33(1.34)	16.33(4.10)	
	S5	1302.00(36.08)	89.00(9.46)	308.00(17.56)	1699.00(41.22)		29.33(5.46)	46.00(6.82)	3.00(1.87)	78.33(8.88)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
Mean of Factor-1											
Mean of Factor-2	M1	271.50(13.57)	21.83(4.04)	71.67(6.89)	365.00(15.67)		8.67(2.74)	13.39(3.31)	1.39(1.33)	23.44(4.35)	
	M2	408.50(17.27)	34.17(5.29)	88.33(8.03)	531.00(19.73)		10.22(2.97)	15.78(3.61)	1.78(1.46)	27.78(4.75)	
	CD(0.05)	0.53	0.39	0.62	0.27		0.06	0.3	0.08	0.23	
	CV%	2.4	5.9	5.81	1.08		1.43	6.04	3.92	3.6	
	S1	238.50(15.26)	20.50(4.50)	41.50(6.41)	300.50(17.13)		7.67(2.85)	11.17(3.41)	2.00(1.57)	20.83(4.61)	
	S2	268.50(15.82)	21.00(4.46)	43.50(6.57)	333.00(17.70)		6.83(2.70)	9.50(3.16)	1.67(1.46)	18.00(4.29)	
Interaction M and T T and M Experimental Mean	S3	244.50(15.58)	29.00(5.39)	53.50(7.32)	327.00(18.02)		9.00(3.08)	14.83(3.91)	1.83(1.52)	25.67(5.11)	
	S4	124.50(11.11)	14.50(3.80)	41.50(6.41)	180.50(13.34)		5.83(2.51)	8.00(2.91)	1.17(1.28)	15.00(3.93)	
	S5	1164.00(34.05)	83.00(9.13)	300.00(17.33)	1547.00(39.28)		27.33(5.27)	44.00(6.67)	2.83(1.82)	74.17(8.64)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
	CD(0.05)	0.77	0.3	0.35	0.71		0.12	0.12	0.18	0.13	
	CV%	4.13	5.33	3.88	3.32		3.56	2.97	10.47	2.33	
	Interaction										
	M and T	1.09	0.42	0.49	1.00		NS	0.18	NS	0.18	
	T and M	1.08	0.5	0.66	0.94		NS	0.28	NS	0.25	
	Experimental Mean	15.42	4.67	7.46	17.7		2.85	3.46	1.39	4.55	

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Contd.

ZONE-III Chiplima									
Main plot	Sub plot Treatments	Active Tillering Stage				Panicle Initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	5.00(2.34)	7.00(2.72)	13.00(3.67)	25.00(5.05)	0.00(0.71)	2.33(1.68)	4.33(2.12)	6.67(2.64)
	S2	9.00(3.07)	13.00(3.66)	18.00(4.30)	40.00(6.36)	0.33(0.88)	2.67(1.77)	7.67(2.83)	10.67(3.33)
	S3	18.67(4.36)	26.00(5.13)	37.00(6.12)	81.67(9.05)	4.00(2.11)	12.67(3.63)	17.67(4.25)	34.33(5.90)
	S4	12.33(3.57)	17.67(4.24)	20.67(4.59)	50.67(7.15)	1.00(1.17)	8.00(2.91)	8.67(3.02)	17.67(4.26)
	S5	19.67(4.46)	43.00(6.59)	65.67(8.12)	128.33(11.33)	6.67(2.67)	15.67(4.01)	23.00(4.84)	45.33(6.76)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	12.33(3.57)	14.00(3.81)	24.33(4.97)	50.67(7.15)	1.67(1.44)	0.00(0.71)	7.67(2.82)	9.33(3.09)
	S2	15.00(3.94)	18.33(4.34)	26.00(5.14)	59.33(7.73)	1.67(1.46)	0.33(2.60)	10.33(3.29)	18.33(4.34)
	S3	24.67(4.99)	31.00(5.59)	48.00(6.95)	103.67(10.18)	6.33(2.60)	18.00(4.30)	22.33(4.78)	46.67(6.87)
	S4	14.00(3.79)	21.67(4.71)	25.00(5.04)	60.67(7.81)	3.00(1.86)	10.67(3.34)	13.33(3.71)	27.00(5.24)
	S5	32.67(5.76)	80.00(8.96)	97.00(9.86)	209.67(14.49)	10.00(3.23)	28.33(5.36)	30.33(5.54)	68.67(8.31)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1									
M1	M1	10.78(3.09)	17.78(3.84)	25.72(4.59)	54.28(6.61)	2.00(1.37)	6.89(2.45)	10.22(2.96)	19.11(3.93)
	M2	16.44(3.79)	27.50(4.68)	36.72(5.44)	80.67(8.01)	3.78(1.88)	10.56(2.84)	14.00(3.47)	28.33(4.76)
CD(0.05)	CD(0.05)	0.24	0.39	0.31	0.2	0.33	0.3	0.12	0.14
	CV%	4.89	6.39	4.37	1.87	13.93	7.79	2.51	2.17
Mean of Factor-2									
S1	S1	8.67(2.96)	10.50(3.26)	18.67(4.32)	37.83(6.10)	0.83(1.07)	1.17(1.19)	6.00(2.47)	8.00(2.86)
	S2	12.00(3.50)	15.67(4.00)	22.00(4.72)	49.67(7.05)	1.00(1.17)	4.50(2.19)	9.00(3.06)	14.50(3.83)
	S3	21.67(4.68)	28.50(5.36)	42.50(6.54)	92.67(9.61)	5.17(2.36)	15.33(3.96)	20.00(4.51)	40.50(6.38)
	S4	13.17(3.68)	19.67(4.48)	22.83(4.81)	55.67(7.48)	2.00(1.51)	9.33(3.13)	11.00(3.36)	22.33(4.75)
	S5	26.17(5.11)	61.50(7.77)	81.33(8.99)	169.00(12.91)	8.33(2.95)	22.00(4.68)	26.67(5.19)	57.00(7.54)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)	CD(0.05)	0.41	0.46	0.37	0.49	0.31	0.25	0.44	0.39
	CV%	9.83	8.89	6.15	5.57	16.05	7.77	11.44	7.38
Interaction	Interaction								
	M and T	NS	0.65	0.53	0.69	NS	0.35	NS	0.55
T and M	T and M	NS	0.66	0.54	0.65	NS	0.39	NS	0.51
	Experimental Mean	3.44	4.26	5.02	7.31	1.63	2.64	3.22	4.34

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-VII Gangavathi									
Main plot	Sub plot Treatments	Active Tillering Stage				Panicle Initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	4.80(2.30)	6.00(2.55)	0.00(0.71)	10.80(3.36)	2.08(1.59)	5.02(2.35)	1.62(1.37)	8.72(3.01)
	S2	5.24(2.39)	6.80(2.70)	0.00(0.71)	12.04(3.54)	1.72(1.48)	4.66(2.27)	1.34(1.28)	7.72(2.87)
	S3	2.60(1.62)	5.20(2.38)	0.67(1.05)	8.47(2.98)	2.00(1.47)	1.84(1.51)	0.00(0.71)	3.84(2.07)
	S4	10.70(3.34)	31.07(5.60)	0.67(1.05)	42.43(6.54)	2.66(1.63)	16.00(4.06)	0.00(0.71)	18.66(4.38)
	S5	26.24(5.16)	55.33(7.46)	1.22(1.31)	82.79(9.13)	46.67(6.85)	28.66(5.39)	5.72(2.49)	81.05(9.03)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	20.47(4.58)	12.70(3.63)	10.72(3.35)	43.89(6.66)	6.99(2.74)	12.38(3.59)	2.64(1.77)	22.01(4.74)
	S2	20.79(4.61)	12.02(3.54)	10.50(3.32)	43.31(6.62)	5.76(2.45)	12.80(3.65)	2.20(1.52)	20.76(4.59)
	S3	8.30(2.76)	7.00(2.73)	0.00(0.71)	15.30(3.93)	6.67(2.60)	4.38(2.21)	0.00(0.71)	11.05(3.37)
	S4	38.82(6.25)	25.20(5.06)	5.74(2.50)	69.76(8.38)	19.46(4.46)	16.72(4.15)	6.66(2.52)	42.84(6.58)
	S5	152.00(12.35)	64.60(8.07)	20.00(4.53)	236.60(15.40)	63.20(7.94)	32.38(5.73)	13.24(3.70)	108.82(10.44)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1									
M1		8.26(2.59)	17.40(3.57)	0.43(0.92)	26.09(4.37)	9.19(2.29)	9.36(2.71)	1.45(1.21)	20.00(3.68)
	M2	40.06(5.21)	20.25(3.95)	7.83(2.52)	68.14(6.95)	17.01(3.48)	13.11(3.34)	4.12(1.82)	34.25(5.07)
CD(0.05)		0.71	0.19	0.41	0.58	0.46	0.5	NS	0.21
CV%		12.69	3.51	16.67	7.13	11.15	11.57	28.71	3.32
Mean of Factor-2									
S1		12.63(3.44)	9.35(3.09)	5.36(2.03)	27.34(5.01)	4.54(2.16)	8.70(2.97)	2.13(1.57)	15.37(3.88)
	S2	13.02(3.50)	9.41(3.12)	5.25(2.01)	27.68(5.08)	3.74(1.96)	8.73(2.96)	1.77(1.40)	14.24(3.73)
S3		5.45(2.19)	6.10(2.55)	0.33(0.88)	11.88(3.46)	4.33(2.03)	3.11(1.86)	0.00(0.71)	7.44(2.72)
S4		24.76(4.79)	28.13(5.33)	3.20(1.77)	56.10(7.46)	11.06(3.05)	16.36(4.10)	3.33(1.61)	30.75(5.48)
S5		89.12(8.76)	59.97(7.77)	10.61(2.92)	159.70(12.26)	54.93(7.39)	30.52(5.56)	9.48(3.10)	94.93(9.73)
S6		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		0.6	0.35	0.16	0.37	0.64	0.19	0.58	0.42
CV%		12.75	7.65	7.53	5.45	18.3	5.16	31.54	7.91
Interaction									
M and T		0.85	0.49	0.22	0.53	0.9	0.27	NS	0.59
	T and M	0.95	0.47	0.37	0.66	0.9	0.46	NS	0.56
Experimental Mean		3.9	3.76	1.72	5.66	2.88	3.03	1.52	4.37

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot		GONE-V Jagdalpur			
Sub plot Treatments		Panicle Initiation Stage			
		Grasses	Sedges	BLW	Total
M1	S1	6.78(2.69)	3.33(1.93)	2.43(1.55)	12.54(3.57)
	S2	3.72(2.05)	3.53(1.93)	2.73(1.78)	9.99(3.19)
	S3	9.96(3.23)	4.21(2.14)	13.48(3.68)	27.65(5.26)
	S4	7.38(2.75)	6.10(2.50)	14.79(3.87)	28.27(5.35)
	S5	59.62(7.64)	14.91(3.90)	60.57(7.78)	135.10(11.60)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	8.63(2.99)	5.88(2.49)	5.18(2.27)	19.69(4.42)
	S2	16.53(4.07)	6.45(2.53)	8.33(2.81)	31.31(5.63)
	S3	21.33(4.64)	10.50(3.26)	20.63(4.59)	52.47(7.28)
	S4	29.42(5.39)	14.00(3.76)	24.58(4.98)	67.99(8.20)
	S5	82.22(9.07)	19.50(4.43)	73.29(8.48)	175.01(13.19)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1		14.58(3.18)	5.35(2.18)	15.67(3.23)	35.59(4.95)
Mean of Factor-2	M1	26.35(4.48)	9.39(2.86)	22.00(3.97)	57.74(6.57)
	M2	0.55	0.17	NS	1.32
	CD(0.05)	10.01	4.57	23.85	15.95
	CV%				
	S1	7.70(2.84)	4.61(2.21)	3.80(1.91)	16.11(3.99)
	S2	10.13(3.06)	4.99(2.23)	5.53(2.29)	20.65(4.41)
Interaction	S3	15.65(3.93)	7.35(2.70)	17.06(4.14)	40.06(6.27)
	S4	18.40(4.07)	10.05(3.13)	19.68(4.43)	48.13(6.77)
	S5	70.92(8.35)	17.20(4.16)	66.93(8.13)	155.05(12.39)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	CD(0.05)	0.89	0.8	0.98	1.01
	CV%	19.27	26.28	22.62	14.55
Experimental Mean	M and T	NS	NS	NS	NS
	T and M	NS	NS	NS	NS
		3.83	2.52	3.6	5.76
	Experimental Mean				

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-I Malan									
Main plot	Sub plot Treatments	Active Tillering Stage				Panicle Initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	8.67(3.02)	6.00(2.55)	5.33(2.41)	20.00(4.53)	12.00(3.53)	8.00(2.90)	8.00(2.92)	28.00(5.34)
	S2	8.67(3.01)	6.67(2.67)	6.00(2.53)	21.33(4.66)	11.33(3.42)	7.33(2.79)	8.00(2.90)	26.67(5.21)
	S3	10.00(3.20)	8.67(3.01)	8.67(3.02)	27.33(5.25)	10.67(3.34)	10.00(3.23)	10.00(3.21)	30.67(5.58)
	S4	8.00(2.90)	8.00(2.92)	9.33(3.11)	25.33(5.08)	10.00(3.23)	9.33(3.12)	11.33(3.44)	30.67(5.58)
	S5	24.67(5.00)	24.67(5.00)	23.33(4.88)	72.67(8.54)	27.33(5.27)	25.33(5.08)	26.67(5.21)	79.33(8.93)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	7.33(2.74)	6.67(2.67)	5.33(2.39)	19.33(4.40)	10.67(3.32)	9.33(3.12)	8.00(2.90)	28.00(5.31)
	S2	8.00(2.90)	6.00(2.53)	5.33(2.35)	19.33(4.44)	11.33(3.43)	8.67(3.00)	7.33(2.76)	27.33(5.27)
	S3	9.33(3.13)	8.00(2.92)	7.33(2.78)	24.67(5.01)	11.33(3.44)	9.33(3.13)	9.33(3.13)	30.00(5.52)
	S4	8.00(2.90)	7.33(2.79)	6.67(2.64)	22.00(4.74)	9.33(3.13)	12.00(3.53)	9.33(3.12)	30.67(5.58)
	S5	27.33(5.24)	29.33(5.46)	22.00(4.73)	78.67(8.90)	26.67(5.19)	36.67(6.05)	22.00(4.70)	85.33(9.24)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1									
M1	M1	10.00(2.97)	9.00(2.81)	8.78(2.77)	27.78(4.80)	11.89(3.25)	10.00(2.97)	10.67(3.06)	32.56(5.22)
	M2	10.00(2.94)	9.56(2.85)	7.78(2.60)	27.33(4.70)	11.56(3.20)	12.67(3.26)	9.33(2.89)	33.56(5.27)
CD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
	CV%	19.52	6.27	6.47	9.94	11.83	10.71	8.89	2.39
Mean of Factor-2									
S1	S1	8.00(2.88)	6.33(2.61)	5.33(2.40)	19.67(4.47)	11.33(3.42)	8.67(3.01)	8.00(2.91)	28.00(5.33)
	S2	8.33(2.96)	6.33(2.60)	5.67(2.44)	20.33(4.55)	11.33(3.42)	8.00(2.90)	7.67(2.83)	27.00(5.24)
	S3	9.67(3.17)	8.33(2.96)	8.00(2.90)	26.00(5.13)	11.00(3.39)	9.67(3.18)	9.67(3.17)	30.33(5.55)
	S4	8.00(2.90)	7.67(2.85)	8.00(2.87)	23.67(4.91)	9.67(3.18)	10.67(3.33)	10.33(3.28)	30.67(5.58)
	S5	26.00(5.12)	27.00(5.23)	22.67(4.80)	75.67(8.72)	27.00(5.23)	31.00(5.56)	24.33(4.95)	82.33(9.09)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
	CV%	13.98	8.13	15.53	8.65	10.17	13.12	12.69	7.6
Interaction									
M and T	M and T	NS	NS	NS	NS	NS	NS	NS	NS
	T and M	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		2.96	2.83	2.69	4.75	3.23	3.11	2.97	5.25

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

		ZONE-VII Moncompu									
Main plot	Sub plot Treatments	Active Tillering Stage					Panicle Initiation Stage				
		Grasses	Sedges	BLW	Total	Total	Grasses	Sedges	BLW	Total	Total
M1	S1	6.00(2.29)	2.67(1.44)	0.00(0.71)	8.67(2.64)	14.67(3.84)	3.33(1.55)	0.00(0.71)	0.00(0.71)	18.00(4.17)	
	S2	8.00(2.56)	9.33(2.72)	0.00(0.71)	17.33(4.13)	50.67(6.07)	4.00(1.65)	0.00(0.71)	0.00(0.71)	54.67(7.01)	
	S3	25.33(4.85)	15.33(2.74)	0.00(0.71)	40.67(5.77)	52.00(6.84)	10.67(2.37)	0.00(0.71)	0.00(0.71)	62.67(7.45)	
	S4	6.00(2.12)	13.33(2.59)	0.00(0.71)	19.33(3.76)	56.00(7.40)	12.67(2.54)	0.00(0.71)	0.00(0.71)	68.67(8.03)	
	S5	46.33(6.60)	48.67(6.65)	12.00(2.49)	107.00(10.24)	49.00(6.76)	33.67(5.74)	13.33(2.59)	0.00(0.71)	96.00(9.79)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
M2	S1	16.00(3.52)	6.00(2.29)	0.00(0.71)	22.00(4.64)	5.33(2.18)	12.00(3.47)	0.00(0.71)	0.00(0.71)	17.33(4.19)	
	S2	20.00(3.87)	8.67(2.67)	0.00(0.71)	28.67(5.23)	22.67(4.14)	17.00(4.00)	0.00(0.71)	0.00(0.71)	39.67(6.28)	
	S3	53.33(7.31)	0.00(0.71)	0.00(0.71)	53.33(7.31)	42.33(6.25)	6.00(1.91)	0.00(0.71)	0.00(0.71)	48.33(6.66)	
	S4	10.67(2.37)	21.33(4.57)	2.67(1.44)	34.67(5.78)	44.67(6.08)	25.00(4.99)	5.33(1.83)	0.00(0.71)	75.00(8.48)	
	S5	13.33(2.59)	85.67(9.26)	9.33(2.59)	108.33(10.37)	90.00(9.48)	104.67(10.24)	10.67(2.86)	0.00(0.71)	205.33(14.35)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean	M1	15.28(3.19)	14.89(2.81)	2.00(1.00)	32.17(4.54)	37.06(5.27)	10.72(2.43)	2.22(1.02)	50.00(6.19)		
	M2	18.89(3.39)	20.28(3.37)	2.00(1.14)	41.17(5.67)	34.17(4.80)	27.44(4.22)	2.67(1.25)	64.28(6.78)		
	CD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	CV%	89.92	36.61	140.79	41.03	30.69	59.14	143.53	30.54		
	S1	11.00(2.91)	4.33(1.87)	0.00(0.71)	15.33(3.64)	10.00(3.01)	7.67(2.51)	0.00(0.71)	17.67(4.18)		
	S2	14.00(3.21)	9.00(2.69)	0.00(0.71)	23.00(4.68)	36.67(5.10)	10.50(2.83)	0.00(0.71)	47.17(6.65)		
	S3	39.33(6.08)	7.67(1.73)	0.00(0.71)	47.00(6.54)	47.17(6.54)	8.33(2.14)	0.00(0.71)	55.50(7.05)		
	S4	8.33(2.24)	17.33(3.58)	1.33(1.08)	27.00(4.77)	50.33(6.74)	18.83(3.76)	2.67(1.27)	71.83(8.26)		
	S5	29.83(4.60)	67.17(7.96)	10.67(2.54)	107.67(10.30)	69.50(8.12)	69.17(7.99)	12.00(2.73)	150.67(12.07)		
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		
	CD(0.05)	2.18	2.19	NS	1.96	2.63	1.77	NS	2.15		
	CV%	55.11	58.91	103.2	31.83	43.35	44.11	106.3	27.55		
	Interaction										
	M and T	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	T and M	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	Experimental Mean	3.29	3.09	1.07	5.11	5.03	3.32	1.14	6.48		

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

		ZONE-VI Nawagam									
Main plot	Sub plot Treatments	Active Tillering Stage					Panicle Initiation Stage				
		Grasses	Sedges	BLW	Total	Total	Grasses	Sedges	BLW	Total	Total
M1	S1	34.33(5.73)	27.33(5.19)	16.33(3.90)	78.00(8.82)	78.00(8.82)	38.00(5.86)	42.33(6.16)	14.33(3.63)	94.67(9.50)	94.67(9.50)
	S2	42.00(6.35)	29.67(5.40)	15.00(3.78)	86.67(9.34)	86.67(9.34)	46.00(6.42)	46.67(6.55)	11.67(3.39)	104.33(10.23)	104.33(10.23)
	S3	46.67(6.78)	43.67(6.44)	23.00(4.63)	113.33(10.59)	113.33(10.59)	52.67(7.07)	52.33(7.01)	26.67(4.93)	131.67(11.47)	131.67(11.47)
	S4	65.00(7.92)	29.67(5.33)	32.00(5.52)	126.67(11.15)	126.67(11.15)	72.67(8.17)	34.00(5.77)	16.33(3.88)	123.00(11.06)	123.00(11.06)
	S5	247.67(15.54)	114.67(10.70)	58.00(7.35)	420.33(20.49)	420.33(20.49)	283.33(16.66)	135.67(11.45)	77.00(8.49)	496.00(22.16)	496.00(22.16)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	39.33(6.20)	31.33(5.56)	24.67(4.98)	95.33(9.72)	95.33(9.72)	41.00(6.23)	45.00(6.59)	25.33(4.98)	111.33(10.53)	111.33(10.53)
	S2	39.00(6.13)	31.00(5.44)	23.00(4.58)	93.00(9.52)	93.00(9.52)	46.00(6.79)	51.33(6.69)	24.00(4.65)	121.33(10.74)	121.33(10.74)
	S3	66.00(8.13)	37.67(5.82)	26.00(4.87)	129.67(11.35)	129.67(11.35)	71.33(8.33)	57.33(7.39)	45.33(6.59)	174.00(13.07)	174.00(13.07)
	S4	87.33(9.37)	34.33(5.72)	35.00(5.86)	156.67(12.52)	156.67(12.52)	100.67(9.91)	43.33(6.28)	28.33(5.03)	172.33(13.11)	172.33(13.11)
	S5	242.00(15.54)	139.67(11.71)	64.67(8.02)	446.33(21.08)	446.33(21.08)	307.67(17.48)	164.67(12.60)	74.67(8.44)	547.00(23.34)	547.00(23.34)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1											
M1	M1	72.61(7.17)	40.83(5.63)	24.06(4.31)	137.50(10.18)	137.50(10.18)	82.11(7.48)	51.83(6.28)	24.33(4.17)	158.28(10.85)	158.28(10.85)
	M2	78.94(7.68)	45.67(5.83)	28.89(4.84)	153.50(10.81)	153.50(10.81)	94.44(8.24)	60.28(6.71)	32.94(5.07)	187.67(11.91)	187.67(11.91)
CD(0.05)		NS	NS	NS	NS	NS	0.53	NS	0.82	0.1	0.1
CV%		16.26	27.48	44.26	9.21	9.21	4.72	18	12.33	0.61	0.61
Mean of Factor-2											
S1	S1	36.83(5.97)	29.33(5.37)	20.50(4.44)	86.67(9.27)	86.67(9.27)	39.50(6.05)	43.67(6.38)	19.83(4.31)	103.00(10.01)	103.00(10.01)
	S2	40.50(6.24)	30.33(5.42)	19.00(4.18)	89.83(9.43)	89.83(9.43)	46.00(6.60)	49.00(6.62)	17.83(4.02)	112.83(10.48)	112.83(10.48)
	S3	56.33(7.46)	40.67(6.13)	24.50(4.75)	121.50(10.97)	121.50(10.97)	62.00(7.70)	54.83(7.20)	36.00(5.76)	152.83(12.27)	152.83(12.27)
	S4	76.17(8.64)	32.00(5.52)	33.50(5.69)	141.67(11.84)	141.67(11.84)	86.67(9.04)	38.67(6.02)	22.33(4.46)	147.67(12.09)	147.67(12.09)
	S5	244.83(15.54)	127.17(11.21)	61.33(7.69)	433.33(20.78)	433.33(20.78)	295.50(17.07)	150.17(12.03)	75.83(8.47)	521.50(22.75)	521.50(22.75)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)	CD(0.05)	1.88	1.86	1.81	1.63	1.63	2.78	2.94	2.32	2.43	2.43
	CV%	21.04	27.01	32.93	12.91	12.91	29.33	37.62	41.65	17.76	17.76
Interaction											
M and T	M and T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	T and M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		7.43	5.73	4.58	10.5	10.5	7.86	6.49	4.62	11.38	11.38

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

		ZONE-II Panthnagar									
Main plot	Sub plot Treatments	Active Tillering Stage					Panicle Initiation Stage				
		Grasses	Sedges	BLW	Total	Grasses	Sedges			Total	
M1	S1	6.00(2.53)	22.67(4.81)	22.67(4.78)	51.33(7.20)	12.00(3.53)	7.67(2.86)	9.67(3.18)		29.33(5.46)	
	S2	7.33(2.79)	12.67(3.63)	4.00(2.08)	24.00(4.95)	9.00(3.08)	9.33(3.13)	7.00(2.73)		25.33(5.08)	
	S3	10.00(3.23)	6.67(2.67)	6.00(2.49)	22.67(4.80)	9.00(3.08)	9.00(3.07)	8.33(2.97)		26.33(5.18)	
	S4	6.33(2.61)	4.67(2.26)	0.00(0.71)	11.00(3.39)	8.00(2.88)	8.00(2.90)	7.00(2.73)		23.00(4.83)	
	S5	14.00(3.80)	16.00(4.05)	4.67(2.26)	34.67(5.93)	32.67(5.76)	25.33(5.08)	23.67(4.92)		81.67(9.06)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)	
M2	S1	7.33(2.76)	11.33(3.44)	2.67(1.61)	21.33(4.65)	14.33(3.85)	14.33(3.84)	12.00(3.52)		40.67(6.40)	
	S2	4.00(2.08)	1.33(1.18)	0.00(0.71)	5.33(2.35)	15.33(3.97)	15.33(3.98)	14.33(3.84)		45.00(6.74)	
	S3	4.67(2.26)	5.67(2.47)	8.00(2.90)	18.33(4.34)	9.67(3.18)	10.00(3.21)	10.00(3.21)		29.67(5.45)	
	S4	10.67(3.33)	8.67(3.02)	8.33(2.97)	27.67(5.30)	12.33(3.58)	13.33(3.71)	12.00(3.54)		37.67(6.18)	
	S5	35.33(5.99)	38.33(6.23)	24.00(4.95)	97.67(9.91)	38.67(6.26)	32.00(5.70)	31.00(5.61)		101.67(10.11)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)	
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2	M1	7.28(2.61)	10.44(3.02)	6.22(2.17)	23.94(4.50)	11.78(3.17)	9.89(2.96)	9.28(2.87)		30.94(5.05)	
	M2	10.33(2.85)	10.89(2.84)	7.17(2.31)	28.39(4.54)	15.06(3.59)	14.17(3.52)	13.22(3.40)		42.44(5.93)	
	CD(0.05)	ns	ns	ns	ns	0.15	0.12	0.43		0.27	
	CV%	11.37	15.76	10.53	3.82	3.03	2.6	9.51		3.4	
	S1	6.67(2.64)	17.00(4.12)	12.67(3.20)	36.33(5.92)	13.17(3.69)	11.00(3.35)	10.83(3.35)		35.00(5.93)	
	S2	5.67(2.44)	7.00(2.40)	2.00(1.40)	14.67(3.65)	12.17(3.53)	12.33(3.55)	10.67(3.29)		35.17(5.91)	
	S3	7.33(2.75)	6.17(2.57)	7.00(2.70)	20.50(4.57)	9.33(3.13)	9.50(3.14)	9.17(3.09)		28.00(5.32)	
	S4	8.50(2.97)	6.67(2.64)	4.17(1.84)	19.33(4.35)	10.17(3.23)	10.67(3.31)	9.50(3.13)		30.33(5.50)	
	S5	24.67(4.89)	27.17(5.14)	14.33(3.61)	66.17(7.92)	35.67(6.01)	28.67(5.39)	27.33(5.26)		91.67(9.58)	
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00(0.71)	
	CD(0.05)	0.39	0.35	0.52	0.41	0.3	0.29	0.32		0.39	
	CV%	11.77	9.98	19.11	7.55	7.41	7.38	8.51		5.9	
	Interaction										
	M and T	0.55	0.5	0.73	0.58	ns	0.41	ns		0.55	
	T and M	0.61	0.69	0.72	0.56	ns	0.38	ns		0.55	
	Experimental Mean	2.73	2.93	2.24	4.52	3.38	3.24	3.14		5.49	

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

		ZONE-VII Pattambi						
Main plot	Sub plot Treatments	Active Tillering Stage				Panicle Initiation Stage		
		Grasses	Sedges	BLW	Total	Grasses	Sedges	Total
M1	S1	30.00(5.50)	51.00(7.17)	0.00(0.71)	81.00(9.02)	55.67(7.48)	51.00(7.17)	106.67(10.35)
	S2	40.33(6.39)	0.00(0.71)	0.00(0.71)	40.33(6.39)	66.00(8.15)	0.00(0.71)	66.00(8.15)
	S3	81.00(9.00)	0.00(0.71)	0.00(0.71)	81.00(9.00)	106.67(10.34)	0.00(0.71)	106.67(10.34)
	S4	69.33(8.32)	0.00(0.71)	0.00(0.71)	69.33(8.32)	95.00(9.76)	0.00(0.71)	95.00(9.76)
	S5	177.67(13.35)	249.33(15.81)	60.33(7.80)	487.33(22.09)	203.33(14.27)	249.33(15.81)	452.67(21.29)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	25.33(5.06)	71.33(8.47)	25.67(5.11)	122.33(11.08)	51.00(7.17)	71.33(8.47)	122.33(11.08)
	S2	8.00(2.90)	150.33(12.28)	45.33(6.77)	203.67(14.29)	33.67(5.83)	150.33(12.28)	184.00(13.58)
	S3	78.67(8.90)	63.00(7.97)	24.33(4.98)	166.00(12.90)	104.33(10.24)	63.00(7.97)	167.33(12.95)
	S4	69.33(8.35)	0.00(0.71)	0.00(0.71)	69.33(8.35)	95.00(9.77)	0.00(0.71)	95.00(9.77)
	S5	352.00(18.77)	121.33(11.04)	0.00(0.71)	473.33(21.77)	377.67(19.44)	121.33(11.04)	499.00(22.35)
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1	M1	66.39(7.21)	50.06(4.30)	10.06(1.89)	126.50(9.25)	87.78(8.45)	50.06(4.30)	137.83(10.10)
	M2	88.89(7.45)	67.67(6.86)	15.89(3.16)	172.44(11.52)	110.28(8.86)	67.67(6.86)	177.94(11.74)
	CD(0.05)	NS	0.19	0.03	0.6	NS	0.19	0.46
	CV%	8.08	2.39	0.95	4.04	5.75	2.39	2.95
	Mean of Factor-2	S1	61.17(7.82)	12.83(2.91)	101.67(10.05)	53.33(7.33)	61.17(7.82)	114.50(10.71)
		S2	24.17(4.65)	22.67(3.74)	122.00(10.34)	49.83(6.99)	75.17(6.49)	125.00(10.87)
		S3	79.83(8.95)	12.17(2.84)	123.50(10.95)	105.50(10.29)	31.50(4.34)	137.00(11.65)
		S4	69.33(8.33)	0.00(0.71)	69.33(8.33)	95.00(9.76)	0.00(0.71)	95.00(9.76)
		S5	264.83(16.06)	185.33(13.42)	480.33(21.93)	290.50(16.86)	185.33(13.42)	475.83(21.82)
		S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)	M1	0.56	0.16	0.09	0.5	0.46	0.16	0.42
	M2	6.36	2.41	3	4.03	4.4	2.41	3.18
	CV%							
	Interaction	M and T	0.79	0.23	0.71	0.65	0.23	0.59
		T and M	0.98	0.26	0.8	0.81	0.26	0.65
		Experimental Mean	7.33	5.58	10.38	8.66	5.58	10.92

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar									
		Active Tillering Stage					Panicle Initiation Stage				
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total		
M1	S1	23.00(4.84)	17.67(4.26)	15.67(4.01)	56.33(7.54)	39.00(6.28)	33.33(5.81)	48.67(7.00)	121.00(11.02)		
	S2	21.00(4.63)	13.67(3.76)	15.67(4.00)	50.33(7.13)	46.67(6.86)	41.00(6.43)	41.67(6.46)	129.33(11.38)		
	S3	22.33(4.77)	13.33(3.72)	13.33(3.69)	49.00(7.03)	39.00(6.27)	54.00(7.36)	50.00(7.09)	143.00(11.96)		
	S4	18.67(4.37)	16.33(4.10)	14.00(3.80)	49.00(7.03)	44.33(6.69)	36.67(6.09)	43.67(6.64)	124.67(11.19)		
	S5	35.67(6.01)	22.67(4.81)	23.00(4.83)	81.33(9.04)	50.67(7.13)	63.00(7.96)	70.67(8.42)	184.33(13.59)		
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		
M2	S1	28.00(5.33)	20.67(4.59)	17.00(4.18)	65.67(8.13)	42.00(6.50)	49.33(7.05)	42.33(6.54)	133.67(11.57)		
	S2	29.67(5.49)	26.67(5.21)	16.33(4.10)	72.67(8.55)	51.00(7.17)	35.00(5.95)	55.67(7.48)	141.67(11.92)		
	S3	29.00(5.42)	32.33(5.73)	20.33(4.56)	81.67(9.06)	66.33(8.17)	50.00(7.08)	39.67(6.34)	156.00(12.51)		
	S4	24.33(4.98)	15.67(4.02)	13.00(3.67)	53.00(7.31)	41.33(6.46)	58.67(7.68)	48.67(7.01)	148.67(12.21)		
	S5	46.33(6.82)	39.00(6.27)	53.33(7.30)	138.67(11.76)	63.67(8.00)	71.67(8.49)	64.33(8.01)	199.67(14.15)		
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		
Mean of Factor-1	M1	20.11(4.22)	13.94(3.56)	13.61(3.51)	47.67(6.41)	36.61(5.66)	38.00(5.73)	42.44(6.05)	117.06(9.97)		
	M2	26.22(4.79)	22.39(4.42)	20.00(4.09)	68.61(7.59)	44.06(6.17)	44.11(6.16)	41.78(6.01)	129.94(10.51)		
	CD(0.05)	NS	0.47	NS	0.47	0.49	NS	NS	NS		
	CV%	8.98	8.13	13.78	4.71	5.81	7.13	4.47	4.26		
	Mean of Factor-2										
	S1	25.50(5.09)	19.17(4.42)	16.33(4.09)	61.00(7.83)	40.50(6.39)	41.33(6.43)	45.50(6.77)	127.33(11.29)		
Mean of Factor-2	S2	25.33(5.06)	20.17(4.49)	16.00(4.05)	61.50(7.84)	48.83(7.01)	38.00(6.19)	48.67(6.97)	135.50(11.65)		
	S3	25.67(5.10)	22.83(4.72)	16.83(4.13)	65.33(8.05)	52.67(7.22)	52.00(7.22)	44.83(6.71)	149.50(12.23)		
	S4	21.50(4.67)	16.00(4.06)	13.50(3.74)	51.00(7.17)	42.83(6.58)	47.67(6.89)	46.17(6.83)	136.67(11.70)		
	S5	41.00(6.42)	30.83(5.54)	38.17(6.07)	110.00(10.40)	57.17(7.56)	67.33(8.23)	67.50(8.22)	192.00(13.87)		
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		
	CD(0.05)	0.39	0.25	0.4	0.46	0.51	0.56	0.67	0.56		
Interaction	CV%	7.12	5.28	8.8	5.41	7.09	7.83	9.22	4.5		
	M and T	NS	0.36	0.57	0.65	0.71	0.79	NS	NS		
	T and M	NS	0.49	0.78	0.7	0.76	0.87	NS	NS		
	Experimental Mean	4.51	3.99	3.8	7	5.91	5.94	6.03	10.24		

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot		Sub plot Treatments		ZONE-IV Titabar									
		Active Tillering Stage					Panicle Initiation Stage						
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total				
M1	S1	18.33(4.34)	5.67(2.47)	5.00(2.30)	29.00(5.41)	17.00(4.18)	7.00(2.73)	7.67(2.84)	31.67(5.67)				
	S2	23.00(4.85)	7.33(2.77)	7.00(2.71)	37.33(6.15)	22.67(4.81)	9.33(3.13)	9.67(3.18)	41.67(6.49)				
	S3	26.33(5.17)	9.00(3.06)	8.67(3.02)	44.00(6.65)	27.00(5.24)	11.00(3.39)	12.00(3.52)	50.00(7.10)				
	S4	32.67(5.75)	11.00(3.37)	10.67(3.33)	54.33(7.40)	32.33(5.72)	13.00(3.67)	14.67(3.89)	60.00(7.77)				
	S5	39.00(6.28)	12.67(3.62)	12.67(3.62)	64.33(8.04)	39.33(6.30)	16.33(4.10)	17.33(4.21)	73.00(8.57)				
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)				
M2	S1	25.33(5.08)	7.33(2.79)	7.00(2.72)	39.67(6.33)	23.00(4.83)	9.67(3.19)	9.67(3.18)	42.33(6.54)				
	S2	31.00(5.61)	7.67(2.84)	9.00(3.06)	47.67(6.93)	28.00(5.33)	13.00(3.67)	11.00(3.38)	52.00(7.24)				
	S3	38.33(6.22)	10.00(3.23)	11.00(3.37)	59.33(7.73)	33.00(5.77)	14.67(3.89)	14.00(3.80)	61.67(7.88)				
	S4	45.00(6.73)	12.67(3.62)	12.67(3.61)	70.33(8.41)	39.67(6.33)	16.33(4.10)	16.67(4.13)	72.67(8.55)				
	S5	51.00(7.17)	15.67(4.01)	15.33(3.97)	82.00(9.08)	48.00(6.96)	18.67(4.37)	20.67(4.59)	87.33(9.37)				
	S6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)				
Mean of Factor-1													
M1		23.22(4.51)	7.61(2.67)	7.33(2.61)	38.17(5.73)	23.06(4.49)	9.44(2.96)	10.22(3.06)	42.72(6.05)				
M2		31.78(5.25)	8.89(2.87)	9.17(2.91)	49.83(6.53)	28.61(4.99)	12.06(3.32)	12.00(3.30)	52.67(6.72)				
CD(0.05)		0.19	NS	0.14	0.27	0.2	0.29	0.05	0.21				
CV%		2.65	8.07	3.56	3.05	2.97	6.47	1.17	2.27				
Mean of Factor-2													
S1		21.83(4.71)	6.50(2.63)	6.00(2.51)	34.33(5.87)	20.00(4.50)	8.33(2.96)	8.67(3.01)	37.00(6.10)				
S2		27.00(5.23)	7.50(2.81)	8.00(2.89)	42.50(6.54)	25.33(5.07)	11.17(3.40)	10.33(3.28)	46.83(6.87)				
S3		32.33(5.70)	9.50(3.14)	9.83(3.19)	51.67(7.19)	30.00(5.50)	12.83(3.64)	13.00(3.66)	55.83(7.49)				
S4		38.83(6.24)	11.83(3.50)	11.67(3.47)	62.33(7.90)	36.00(6.03)	14.67(3.88)	15.67(4.01)	66.33(8.16)				
S5		45.00(6.72)	14.17(3.81)	14.00(3.79)	73.17(8.56)	43.67(6.63)	17.50(4.24)	19.00(4.40)	80.17(8.97)				
S6		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)				
CD(0.05)		0.28	0.21	0.23	0.3	0.21	0.13	0.19	0.16				
CV%		4.79	6.21	6.85	4.05	3.68	3.41	4.92	2.03				
Interaction													
M and T		NS	NS	NS	NS	NS	0.18	NS	0.22				
T and M		NS	NS	NS	NS	NS	0.28	NS	0.26				
Experimental Mean		4.88	2.77	2.76	6.13	4.74	3.14	3.18	6.38				

*(Values in parentheses are transformed values)

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Summary on Species wise Weed biomass g./m² of Long term trial on weed dynamics in rice under different establishment methods, Kharif 2025...

Main plot	Sub plot Treatments	ZONE-VII Gangavathi						
		Active tillering stage						
		Grasses		Sedges			BLW	
		<i>Echinochloa spp</i>	<i>Leptochloa spp</i>	<i>Cynodon spp</i>	<i>Cyperus rotundus</i>	<i>Cynotis spp</i>	Total	
M1	S1	1.67	0.00	0.00	2.41	0.00	4.09	
	S2	1.74	0.00	0.00	2.53	0.00	4.27	
	S3	0.87	0.00	0.00	2.20	0.12	3.19	
	S4	3.65	0.00	0.00	5.85	0.18	9.69	
	S5	5.64	0.00	0.00	13.00	0.32	18.97	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	
M2	S1	3.18	0.69	3.06	5.86	2.98	15.78	
	S2	3.60	0.43	3.30	4.86	2.55	14.74	
	S3	1.31	0.00	1.24	2.91	0.00	5.46	
	S4	5.66	0.77	4.25	7.69	1.68	20.06	
	S5	21.94	6.52	5.43	15.23	6.22	55.33	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	
Mean of Factor-1								
Mean of Factor-2	M1	2.26	0.00	0.00	4.33	0.10	6.70	
	M2	5.95	1.40	2.88	6.09	2.24	18.56	
	CD(0.05)	0.64	0.86	0.91	0.06	0.63	0.43	
	CV%	10.83	85.11	44.22	0.83	37.70	2.40	
	S1	2.43	0.34	1.53	4.14	1.49	9.93	
	S2	2.67	0.21	1.65	3.70	1.27	9.50	
CD(0.05)	S3	1.09	0.00	0.62	2.56	0.06	4.33	
	S4	4.66	0.38	2.13	6.77	0.93	14.87	
	S5	13.79	3.26	2.71	14.11	3.27	37.15	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	
	Interaction	1.01	0.48	0.52	0.55	0.34	0.94	
	CV%	20.42	57.11	30.02	8.82	24.26	6.21	
Experimental Mean	M and T	1.43	0.68	0.74	0.78	0.48	1.34	
	T and M	1.40	0.91	0.98	0.72	0.66	1.27	
	Experimental Mean	4.11	0.70	1.44	5.21	1.17	12.63	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

		ZONE-VII Gangavathi					
		Panicle Initiation Stage					
Main plot	Sub plot Treatments	Grasses		Sedges	BLW	Total	
		<i>Echinochloa spp</i>	<i>Leptochloa spp</i>	<i>Cynodon spp</i>	<i>Cyperus rotundus</i>		<i>Cynotis spp</i>
M1	S1	0.31	0.17	0.00	2.14	0.67	3.30
	S2	0.23	0.13	0.00	1.98	0.52	2.86
	S3	0.58	0.00	0.00	0.55	0.00	1.13
	S4	0.61	0.23	0.00	5.01	0.00	5.86
	S5	7.07	3.42	1.59	7.81	2.91	22.78
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	0.60	0.63	1.18	3.67	1.45	7.53
	S2	0.62	0.26	0.98	3.70	0.93	6.50
	S3	0.56	0.79	1.30	1.45	0.00	4.10
	S4	3.06	1.91	1.64	5.94	1.92	14.48
	S5	9.02	3.57	2.51	8.51	3.77	27.39
	S6	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1		1.47	0.66	0.26	2.91	0.68	5.99
M1		2.31	1.19	1.27	3.88	1.34	10.00
M2		0.43	0.12	0.19	0.75	ns	0.34
CD(0.05)		15.97	8.73	17.50	15.42	50.22	2.93
Mean of Factor-2		0.46	0.40	0.59	2.91	1.06	5.42
S1		0.43	0.19	0.49	2.84	0.72	4.68
S2		0.57	0.40	0.65	1.00	0.00	2.61
S3		1.84	1.07	0.82	5.48	0.96	10.17
S4		8.04	3.50	2.05	8.16	3.34	25.08
S5		0.00	0.00	0.00	0.00	0.00	0.00
S6		0.51	1.76	0.30	0.35	0.75	1.60
CD(0.05)		22.60	158.27	32.71	8.61	61.76	16.63
CV%							
Interaction							
M and T		0.73	ns	0.43	0.50	ns	2.26
T and M		0.75	ns	0.42	0.74	ns	2.08
Experimental Mean		1.89	0.93	0.77	3.40	1.01	7.99

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-V Jagdalpur					
		Grasses		Panicle Initiation Stage		BLW	
				Sedges			
		<i>Echinochloa spp</i>	<i>Cynodon dactylon</i>	<i>Cyperus spp</i>	<i>Alternanthera spp</i>	<i>Ludwigia spp</i>	Total
M1	S1	10.00	0.17	0.80	1.92	1.73	14.60
	S2	5.33	0.25	0.63	1.73	2.38	10.31
	S3	14.67	0.27	1.35	11.22	9.00	36.51
	S4	10.85	0.72	1.90	9.68	12.50	35.65
	S5	89.33	0.93	5.65	40.35	50.50	186.77
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	12.67	0.28	5.33	3.26	4.50	26.04
	S2	24.67	0.13	1.23	6.00	6.50	38.52
	S3	32.00	0.00	2.08	12.45	18.50	65.03
	S4	44.00	0.13	2.60	12.07	22.23	81.03
	S5	122.67	1.33	10.55	48.31	61.63	244.48
	S6	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1							
Mean of Factor-2	M1	21.70	0.39	1.72	10.82	12.68	47.31
	M2	39.33	0.31	3.63	13.68	18.89	75.85
	CD(0.05)	11.49	NS	NS	NS	NS	NS
	CV%	26.26	31.99	175.03	47.85	72.84	37.09
	S1	11.33	0.22	3.07	2.59	3.11	20.32
	S2	15.00	0.19	0.93	3.86	4.44	24.41
	S3	23.33	0.14	1.71	11.84	13.75	50.77
	S4	27.42	0.42	2.25	10.87	17.37	58.34
	S5	106.00	1.13	8.10	44.33	56.06	215.63
	S6	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	17.83	0.38	2.94	7.47	14.38	27.21
	CV%	48.52	90.05	91.35	50.65	75.60	36.70
	Interaction						
	M and T	NS	NS	NS	NS	NS	NS
Experimental Mean	T and M	NS	NS	NS	NS	NS	NS
		30.52	0.35	2.68	12.25	15.79	61.58

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot		Sub plot Treatments	ZONE-I Malan									
			Active Tillering Stage									
			Grasses			Sedges			BLW			
			<i>Echinochloa colonum</i>	<i>Echinochlo crusgalli</i>	<i>Panicum spp.</i>	<i>Cyperus iria</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Alternanthera spp.</i>	<i>Eclipta alba</i>	<i>Monochoria vaginalis</i>	Total
M1		S1	4.05	1.67	1.43	1.65	1.67	1.43	0.97	0.53	0.56	13.97
		S2	4.01	2.28	0.95	1.71	1.67	1.95	0.76	1.12	0.66	15.11
		S3	3.39	2.74	1.95	2.21	2.13	2.43	1.20	1.36	0.93	18.33
		S4	2.30	2.28	1.85	2.34	2.74	1.43	1.19	1.37	1.27	16.77
		S5	9.19	7.44	3.37	6.10	6.69	6.75	2.28	4.09	3.41	49.33
		S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2		S1	3.09	1.67	1.43	2.34	1.67	1.43	0.99	0.59	0.63	13.84
		S2	2.71	1.67	1.95	1.71	1.52	1.43	0.65	0.57	0.93	13.15
		S3	3.43	2.29	1.85	1.71	2.28	2.43	0.97	1.11	0.93	16.99
		S4	2.34	2.29	1.91	2.34	2.13	1.43	0.64	1.36	0.93	15.35
		S5	9.78	7.90	4.61	6.73	9.90	6.51	2.27	2.71	4.27	54.67
		S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1												
Mean of Factor-2	M1		3.82	2.74	1.59	2.34	2.48	2.33	1.07	1.41	1.14	18.92
	M2		3.56	2.64	1.96	2.47	2.92	2.20	0.92	1.06	1.28	19.00
	CD(0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	CV%		42.23	45.11	53.12	32.09	41.57	54.80	22.18	26.36	21.04	24.26
	S1		3.57	1.67	1.43	1.99	1.67	1.43	0.98	0.56	0.60	13.90
	S2		3.36	1.98	1.45	1.71	1.60	1.69	0.71	0.85	0.79	14.13
	S3		3.41	2.51	1.90	1.96	2.20	2.43	1.09	1.23	0.93	17.66
	S4		2.32	2.28	1.88	2.34	2.43	1.43	0.91	1.37	1.10	16.06
	S5		9.49	7.67	3.99	6.41	8.30	6.63	2.27	3.40	3.84	52.00
	S6		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)		1.92	1.89	1.01	1.18	1.85	1.22	0.65	0.75	0.60	3.66
	CV%		43.09	58.31	47.14	40.80	57.00	44.83	54.64	50.72	40.98	16.04
Interaction												
M and T T and M Experimental Mean	M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Experimental Mean		3.69	2.69	1.77	2.40	2.70	2.27	0.99	1.23	1.21	18.96

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-I Malan									
		Panicle Initiation Stage									
		Grasses				Sedges		BLW			Total
		<i>Echinochloa colonum</i>	<i>Echinochloa crusgalli</i>	<i>Panicum spp.</i>	<i>Cyperus iria</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Alternanthera spp.</i>	<i>Eclipta alba</i>	Monochoria vaginalis	
M1	S1	8.21	4.73	3.75	2.53	1.90	3.17	2.08	2.25	1.66	30.28
	S2	9.03	4.71	1.88	1.90	2.53	2.53	2.11	1.80	2.22	28.71
	S3	6.43	4.69	3.79	3.80	2.53	3.17	2.63	2.32	2.76	32.11
	S4	5.33	3.77	4.73	3.80	2.53	2.53	3.67	1.39	3.88	31.64
	S5	16.53	14.03	7.52	6.97	8.87	8.23	5.17	7.41	7.74	82.47
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	7.40	3.77	3.75	3.17	3.17	2.53	2.05	1.91	2.25	30.00
	S2	6.41	3.75	5.63	3.17	3.17	1.90	2.63	0.93	2.19	29.77
	S3	4.52	6.60	4.73	3.17	3.17	2.53	2.60	1.84	2.76	31.92
	S4	6.43	3.77	2.83	3.80	2.53	5.07	4.13	1.91	1.10	31.57
	S5	13.77	13.27	10.39	10.77	11.40	12.67	5.72	6.92	3.85	88.75
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1											
Mean of Factor-2	M1	7.59	5.32	3.61	3.17	3.06	3.27	2.61	2.53	3.04	34.20
	M2	6.42	5.19	4.55	4.01	3.91	4.12	2.86	2.25	2.03	35.33
	CD(0.05)	NS	NS	0.05	0.45	NS	NS	NS	NS	0.83	1.08
	CV%	20.19	63.95	0.86	8.82	24.05	70.16	28.56	35.08	22.75	2.17
	S1	7.81	4.25	3.75	2.85	2.53	2.85	2.07	2.08	1.96	30.14
	S2	7.72	4.23	3.75	2.53	2.85	2.22	2.37	1.37	2.21	29.24
CD(0.05) CV%	S3	5.47	5.65	4.26	3.48	2.85	2.85	2.61	2.08	2.76	32.02
	S4	5.88	3.77	3.78	3.80	2.53	3.80	3.90	1.65	2.49	31.60
	S5	15.15	13.65	8.95	8.87	10.13	10.45	5.45	7.16	5.80	85.61
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Interaction	3.69	3.77	2.03	1.88	1.97	2.30	1.18	1.55	1.21	6.45
	M and T T and M	43.70	59.56	41.24	43.59	46.89	51.71	35.73	53.75	39.72	15.41
Experimental Mean											
M1-Puddled Wet direct seeding M2-Un-puddled Dry direct seeding	M and T	NS	NS	NS	NS	NS	NS	NS	NS	1.71	NS
	T and M	NS	NS	NS	NS	NS	NS	NS	NS	1.70	NS
	Experimental Mean	7.01	5.26	4.08	3.59	3.48	3.69	2.73	2.39	2.54	34.77
	S1- Herbicide Application										
	S2 – Rotational application										
	S3- Farmers practice (mention the practice followed - manual weeding)										
M1-Puddled Wet direct seeding M2-Un-puddled Dry direct seeding	S4- Mechanical weeding / weeder (2-3 times)										
	S5-Weedy check										
	S6- Weed free										

Trial 4.4.1: Contd.

ZONE-VII Moncompu									
Main plot	Sub plot Treatments	Active Tillering Stage							
		Grasses			Sedges			BLW	
		<i>Isachnae miliaceae</i>	<i>Echinochloa stagnina</i>	<i>O.sativa f.sp. spontanea</i>	<i>Cyperus difformis</i>	<i>Fimbristylis miliaceae</i>	<i>Ludwigia hyssopifolia</i>	<i>Monochoria vaginalis</i>	Total
M1	S1	0.00	0.00	18.33	0.00	5.00	0.00	0.00	23.33
	S2	0.00	0.00	41.33	4.00	5.00	0.00	0.00	50.33
	S3	12.47	0.00	39.12	4.67	15.00	0.00	0.00	71.25
	S4	0.00	14.29	0.00	5.35	13.33	0.00	0.00	32.97
	S5	47.36	36.84	4.00	31.09	29.00	8.00	12.00	168.29
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	15.33	0.00	5.00	0.00	14.11	0.00	0.00	34.44
	S2	21.01	0.00	0.00	10.37	18.33	0.00	0.00	49.72
	S3	93.77	0.00	0.00	0.00	0.00	0.00	0.00	93.77
	S4	14.95	0.00	0.00	0.00	31.31	2.67	0.00	48.92
	S5	20.28	0.00	0.00	37.40	53.55	0.00	8.00	119.23
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1									
Mean of Factor-2	M1	9.97	8.52	17.13	7.52	11.22	1.33	2.00	57.70
	M2	27.56	0.00	0.83	7.96	19.55	0.44	1.33	57.68
	CD(0.05)	NS	NS	8.71	NS	NS	NS	NS	NS
	CV%	158.79	173.20	67.62	121.22	66.59	540.83	523.07	45.36
	S1	7.67	0.00	11.67	0.00	9.55	0.00	0.00	28.89
	S2	10.51	0.00	20.67	7.19	11.67	0.00	0.00	50.03
	S3	53.12	0.00	19.56	2.33	7.50	0.00	0.00	82.51
	S4	7.47	7.15	0.00	2.67	22.32	1.33	0.00	40.95
	S5	33.82	18.42	2.00	34.25	41.27	4.00	10.00	143.76
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interaction M and T and M	CD(0.05)	23.92	NS	NS	17.52	16.00	NS	NS	32.49
	CV%	105.84	332.25	203.22	187.98	86.35	474.34	432.67	46.76
	Experimental Mean	33.83	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		45.45	NS	NS	NS	NS	NS	NS	NS
		18.76	4.26	8.98	7.74	15.39	0.89	1.67	57.69

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-VII Moncompu									
Main plot	Sub plot Treatments	Panicle Initiation Stage							
		Grasses		Sedges				BLW	
		<i>Isachnae miliaceae</i>	<i>Echinochloa stagnina</i>	<i>O.sativa f.sp. spontanea</i>	<i>Cyperus difformis</i>	<i>Cyperus haspan</i>	<i>Fimbristylis miliaceae</i>	<i>Ludwigia hyssopifolia</i>	<i>Monochoria vaginalis</i>
M1	S1	0.0	8.3	50.0	0.0	0.0	8.0	0.0	0.0
	S2	35.6	0.0	29.7	0.0	0.0	11.7	0.0	0.0
	S3	32.2	0.0	30.0	0.0	0.0	14.7	0.0	0.0
	S4	33.0	19.3	0.0	9.0	0.0	17.6	0.0	0.0
	S5	28.1	31.0	0.0	17.4	8.4	34.6	16.0	14.4
	S6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M2	S1	0.0	0.0	39.3	0.0	0.0	15.7	0.0	0.0
	S2	24.2	0.0	12.0	8.3	0.0	18.7	0.0	0.0
	S3	38.7	16.7	12.0	0.0	0.0	2.7	0.0	0.0
	S4	44.1	28.0	15.3	0.0	0.0	35.3	10.7	0.0
	S5	54.3	50.0	16.3	34.9	0.0	98.2	0.0	13.3
	S6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean of Factor-1		21.5	9.8	18.3	4.4	1.4	14.4	2.7	2.4
Mean of Factor-2	M1	26.9	15.8	15.8	7.2	0.0	28.4	1.8	2.2
	M2	NS	NS	NS	NS	NS	NS	NS	NS
	CD(0.05)	90.9	111.5	112.2	53.4	600.0	50.8	523.1	519.8
	CV%	0.0	4.2	44.6	0.0	0.0	11.9	0.0	0.0
	S1	29.9	0.0	20.8	4.1	0.0	15.2	0.0	0.0
	S2	35.5	8.3	21.0	0.0	0.0	8.7	0.0	0.0
	S3	38.6	23.7	7.7	4.5	0.0	26.5	5.3	0.0
	S4	41.2	40.5	8.2	26.1	4.2	66.4	8.0	13.9
	S5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	S6	28.0	NS	25.3	10.0	NS	29.7	NS	NS
	CD(0.05)	96.2	274.5	122.9	143.6	600.0	114.9	432.7	424.6
	CV%	NS	NS	NS	NS	NS	NS	NS	NS
	Interaction M and T	NS	NS	NS	NS	NS	NS	NS	NS
	T and M	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		24.2	12.8	17.1	5.8	0.7	21.4	2.2	2.3

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-VI Nawagam											
Main plot	Sub plot Treatments	Active Tillering Stage									
		Grasses				Sedges			BLW		
		<i>Echinochloa crusgalli</i>	<i>Echinochloa colonum</i>	<i>Cynodon dactylon</i>	<i>Chloris barbata</i>	<i>Cyperus rotundus</i>	<i>Cyperus iria</i>	<i>Cyperus esculentus</i>	<i>Eclipta alba</i>	<i>Ipomoea aquatic</i>	<i>Trianthema monogyna</i>
M1	S1	3.23	2.62	0.69	1.39	1.39	2.00	2.92	2.37	1.00	1.09
	S2	1.62	2.77	2.62	2.69	2.16	2.24	2.46	2.00	0.46	1.64
	S3	2.01	5.29	1.43	3.02	3.61	1.18	6.21	1.46	2.37	2.46
	S4	3.52	4.40	3.52	5.72	0.62	5.90	1.32	5.98	0.88	1.58
	S5	15.58	16.55	13.55	19.71	10.47	10.56	9.24	4.84	3.17	7.31
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	4.79	1.79	2.59	2.59	1.20	3.89	4.29	1.10	1.40	4.88
	S2	1.30	2.79	5.78	1.79	3.49	2.79	2.99	2.79	1.20	2.89
	S3	7.57	3.59	4.19	4.39	2.29	5.38	3.59	1.60	2.59	3.59
	S4	3.76	9.02	3.97	11.38	3.33	1.39	6.33	1.50	5.15	4.61
	S5	19.75	21.47	15.56	21.14	14.49	12.02	18.46	8.59	6.98	5.26
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1											
CD(0.05) CV%	M1	4.33	5.27	3.63	5.42	3.04	3.65	3.69	2.77	1.31	2.35
	M2	6.19	6.44	5.35	6.88	4.13	4.25	5.94	2.60	2.89	3.54
	CV%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Mean of Factor-2	95.59	64.91	74.88	35.72	189.33	47.98	45.53	58.20	107.72	128.80
	S1	4.01	2.21	1.64	1.99	1.29	2.94	3.60	1.73	1.20	2.99
	S2	1.46	2.78	4.20	2.24	2.82	2.51	2.73	2.40	0.83	2.26
CD(0.05) CV%	S3	4.79	4.44	2.81	3.71	2.95	3.28	4.90	1.53	2.48	3.02
	S4	3.64	6.71	3.75	8.55	1.97	3.65	3.83	3.74	3.01	3.10
	S5	17.66	19.01	14.56	20.43	12.48	11.29	13.85	6.72	5.07	6.28
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	5.44	4.85	4.78	4.54	5.20	3.62	5.52	2.72	2.90	NS
	CV%	85.83	68.73	88.36	61.26	120.48	76.14	95.09	84.01	114.88	107.90
Interaction M and T T and M Experimental Mean	Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	M and T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	T and M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Experimental Mean	5.26	5.86	4.49	6.15	3.59	3.95	4.82	2.69	2.10	2.94

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-VI Nawagam												
Main plot	Sub plot Treatments	Panicle initiation stage										
		Grasses				Sedges			BLW			
		<i>Echinochloa crusgalli</i>	<i>Echinochloa colonum</i>	<i>Cynodon dactylon</i>	<i>Chloris barbata</i>	<i>Cyperus rotundus</i>	<i>Cyperus iria</i>	<i>Cyperus esculentus</i>	<i>Eclipta alba</i>	<i>Ipomoea aquatic</i>	<i>Trianthema monogyna</i>	Total
M1	S1	2.09	1.18	4.28	2.82	2.69	4.08	3.00	0.82	1.27	1.82	24.07
	S2	2.09	5.73	1.28	3.46	1.62	4.39	4.77	0.64	1.55	1.00	26.53
	S3	4.46	4.91	2.37	2.64	4.28	5.21	3.70	1.73	1.00	4.55	34.85
	S4	7.15	3.34	8.01	2.29	1.58	5.19	2.20	1.49	2.20	0.61	34.07
	S5	19.73	21.26	17.83	22.21	11.88	12.23	11.70	6.25	7.57	6.51	137.17
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	3.01	5.69	0.97	3.54	6.28	4.28	2.89	1.10	4.09	2.39	34.23
	S2	3.22	3.43	6.23	1.93	5.28	4.69	5.38	1.90	2.59	2.69	37.35
	S3	9.55	3.12	4.40	5.90	6.24	1.69	6.58	1.10	4.09	8.37	51.04
	S4	7.40	3.65	12.99	8.37	1.86	5.31	3.79	3.54	1.83	3.75	52.50
	S5	16.85	23.94	28.87	29.41	14.25	9.45	17.96	5.80	7.08	11.16	164.77
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1												
Mean of Factor-2	M1	5.92	6.07	5.63	5.57	3.68	5.18	4.23	1.82	2.27	2.42	42.78
	M2	6.67	6.64	8.91	8.19	5.65	4.24	6.10	2.24	3.28	4.73	56.65
	CD(0.05)	NS	NS	NS	2.45	NS	NS	NS	NS	NS	NS	2.08
	CV%	15.06	22.81	78.12	24.81	100.99	68.32	56.43	103.31	61.30	85.61	2.91
	S1	2.55	3.44	2.62	3.18	4.49	4.18	2.95	0.96	2.68	2.11	29.15
	S2	2.66	4.58	3.75	2.69	3.45	4.54	5.08	1.27	2.07	1.85	31.94
	S3	7.01	4.02	3.38	4.27	5.26	3.45	5.14	1.41	2.54	6.46	42.94
	S4	7.28	3.49	10.50	5.33	1.72	5.25	3.00	2.52	2.01	2.18	43.28
	S5	18.29	22.60	23.35	25.81	13.07	10.84	14.83	6.02	7.33	8.84	150.97
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	6.59	4.86	8.17	6.00	4.68	4.87	7.06	2.54	4.21	5.76	21.15
	CV%	86.89	63.49	93.39	72.36	83.26	85.89	113.43	103.72	126.20	133.88	35.32
	Interaction M and T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	T and M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean	6.30	6.35	7.27	6.88	4.66	4.71	5.17	2.03	2.77	3.57	49.71	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-II Panthnagar					
		Active Tillering Stage					
		Grasses		Sedges		BLW	
		<i>Echinochloa Colona</i>	Cyperus iria	Cyperus difformis	Alternanthera sessilis	Commelina Diffusa	Total
M1	S1	3.93	1.43	1.80	2.30	2.70	12.17
	S2	19.13	1.60	1.93	2.13	3.37	28.17
	S3	5.03	1.43	5.03	1.23	1.93	14.67
	S4	4.93	0.27	2.00	3.57	0.23	11.00
	S5	12.20	15.10	10.50	11.87	6.97	56.63
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	4.27	2.20	1.60	1.77	1.53	11.37
	S2	5.13	1.60	1.93	1.47	2.37	12.50
	S3	4.93	2.20	1.17	1.83	3.33	13.47
	S4	4.60	9.07	10.63	10.87	5.40	40.57
	S5	13.63	10.00	9.50	8.37	5.87	47.37
	S6	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean		7.54	3.31	3.54	3.52	2.53	20.44
		5.43	4.18	4.14	4.05	3.08	20.88
		NS	0.65	NS	NS	0.27	NS
		110.06	12.06	12.15	44.27	6.80	41.98
		4.10	1.82	1.70	2.03	2.12	11.77
		12.13	1.60	1.93	1.80	2.87	20.33
		4.98	1.82	3.10	1.53	2.63	14.07
		4.77	4.67	6.32	7.22	2.82	25.78
		12.92	12.55	10.00	10.12	6.42	52.00
		0.00	0.00	0.00	0.00	0.00	0.00
		8.91	0.58	0.90	2.01	1.04	8.40
		114.09	12.84	19.51	44.21	30.90	33.75
		NS	0.82	1.28	2.85	1.48	11.87
		NS	0.90	1.28	3.21	1.37	14.57
		6.48	3.74	3.84	3.78	2.81	20.66

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

ZONE-II Pantnagar									
Main plot	Sub plot Treatments	Panicle Initiation Stage							
		Grasses		Sedges			BLW		
		<i>Echinochloa colonum</i>	<i>Eleusine indica</i>	Cyperus iria	Cyperus difformis	Alternanthera sessilis	Commelina diffusa	Total	
M1	S1	6.27	7.27	2.52	2.23	2.60	3.77	24.65	
	S2	5.80	5.83	3.23	3.63	4.27	3.93	26.70	
	S3	9.20	7.13	5.17	3.40	4.40	5.60	34.90	
	S4	8.93	7.93	5.73	5.93	4.60	6.23	39.37	
	S5	14.53	20.40	17.20	17.67	19.50	17.73	107.03	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
M2	S1	6.60	6.93	3.52	3.23	3.60	4.77	28.65	
	S2	4.80	6.17	4.23	4.63	3.93	21.27	45.03	
	S3	5.87	6.13	5.50	4.40	5.73	4.27	31.90	
	S4	6.27	5.93	5.73	5.93	4.60	5.57	34.03	
	S5	14.53	20.40	17.20	17.67	19.50	17.73	107.03	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean		7.46	8.09	5.64	5.48	5.89	6.21	38.77	
		6.34	7.59	6.03	5.98	6.23	8.93	41.11	
		0.63	0.41	NS	0.00	NS	NS	NS	
		6.39	3.68	5.71	0.01	4.76	104.57	18.16	
		6.43	7.10	3.02	2.73	3.10	4.27	26.65	
		5.30	6.00	3.73	4.13	4.10	12.60	35.87	
		7.53	6.63	5.33	3.90	5.07	4.93	33.40	
		7.60	6.93	5.73	5.93	4.60	5.90	36.70	
		14.53	20.40	17.20	17.67	19.50	17.73	107.03	
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		1.75	1.23	0.96	1.52	1.63	10.23	11.16	
		21.11	12.97	13.59	21.96	22.34	112.15	23.20	
		NS	NS	NS	NS	NS	NS	NS	
		NS	NS	NS	NS	NS	NS	NS	
		6.90	7.84	5.84	5.73	6.06	7.57	39.94	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

		ZONE-VII Pattambi							
		Active Tillering Stage							
Main plot	Sub plot Treatments	Grasses	Sedges			BLW			Total
		Isachne milliaceae	Cyperus difformis	Cyperus laevigatus	Fimbristylis milliaceae	Monochoria vaginalis	Sagittaria guayensis	Vallisneria spp	
M1	S1	13.00	0.00	0.00	51.00	0.00	0.00	0.00	64.00
	S2	30.33	0.00	0.00	0.00	0.00	0.00	0.00	30.33
	S3	24.67	0.00	0.00	0.00	0.00	0.00	0.00	24.67
	S4	59.33	0.00	0.00	0.00	0.00	0.00	0.00	59.33
	S5	76.00	59.00	78.33	37.00	0.00	15.33	5.00	270.67
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	28.33	11.33	10.00	0.00	0.00	0.00	0.00	49.67
	S2	15.33	14.33	37.33	23.67	0.00	1.67	3.67	96.00
	S3	67.67	7.33	5.67	0.00	3.33	0.00	0.00	84.00
	S4	71.00	0.00	0.00	0.00	0.00	0.00	0.00	71.00
	S5	116.00	7.33	3.00	36.00	0.00	0.00	0.00	162.33
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1	M1	33.89	9.83	13.06	14.67	0.00	2.56	0.83	74.83
	M2	49.72	6.72	9.33	9.94	0.56	0.28	0.61	77.17
CD(0.05)	CV%	3.23	0.48	2.28	4.08	ns	1.04	ns	ns
	Mean of Factor-2	5.39	4.03	14.20	23.14	158.75	51.28	46.15	5.48
Mean of Factor-2	S1	20.67	5.67	5.00	25.50	0.00	0.00	0.00	56.83
	S2	22.83	7.17	18.67	11.83	0.00	0.83	1.83	63.17
	S3	46.17	3.67	2.83	0.00	1.67	0.00	0.00	54.33
	S4	65.17	0.00	0.00	0.00	0.00	0.00	0.00	65.17
	S5	96.00	33.17	40.67	36.50	0.00	7.67	2.50	216.50
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CD(0.05)	CV%	10.49	1.91	3.65	2.94	0.53	1.08	0.40	10.10
	Interaction	20.84	19.14	27.09	19.87	158.75	63.35	46.15	11.03
Experimental Mean	M and T	14.84	2.70	5.16	4.16	0.75	1.53	0.57	14.28
	T and M	13.78	2.49	5.04	4.97	0.85	1.62	0.64	13.86
	Experimental Mean	41.81	8.28	11.19	12.31	0.28	1.42	0.72	76.00

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	Pattambi				
		Panicle Initiation Stage				
		Grasses	Sedges			Total
			Isachne miliaceae	Cyperus difformis	Cyperus laevigatus	
M1	S1	28.37	0.00	0.00	67.70	96.07
	S2	45.70	0.00	0.00	0.00	45.70
	S3	91.37	0.00	0.00	0.00	91.37
	S4	74.70	0.00	0.00	0.00	74.70
	S5	40.03	74.90	94.23	52.90	262.07
	S6	0.00	0.00	0.00	0.00	0.00
M2	S1	43.70	23.03	21.70	0.00	88.43
	S2	30.70	31.03	54.03	40.37	156.13
	S3	83.03	15.13	13.47	0.00	111.63
	S4	86.37	0.00	0.00	0.00	86.37
	S5	131.37	22.23	17.90	50.90	222.40
	S6	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean		46.69	12.48	15.71	20.10	94.98
		62.53	15.24	17.85	15.21	110.83
		3.23	0.48	NS	4.08	5.34
		4.13	2.40	9.48	16.13	3.62
		36.03	11.52	10.85	33.85	92.25
		38.20	15.52	27.02	20.18	100.92
		87.20	7.57	6.73	0.00	101.50
		80.53	0.00	0.00	0.00	80.53
		85.70	48.57	56.07	51.90	242.23
		0.00	0.00	0.00	0.00	0.00
		10.42	1.91	3.65	2.94	9.73
		15.85	11.43	18.07	13.85	7.85
		14.74	2.70	5.16	4.16	13.77
		13.70	2.49	5.04	4.97	13.25
		54.61	13.86	16.78	17.66	102.91

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar						
		Active Tillering Stage						
		Grasses						
		<i>Cynodon dactylon</i>	<i>Digitaria sanguinalis</i>	<i>Echinochloa colona</i>	<i>Echinochloa crusgalli</i>	<i>Panicum repence</i>	<i>Eleusine indica</i>	<i>Dactyloctenium aegyptium</i>
M1	S1	0.53	0.99	1.14	1.06	0.91	0.15	0.46
	S2	0.3	0.91	1.06	1.06	0.84	0.23	0.38
	S3	0.46	0.99	0.91	0.99	0.84	0.46	0.46
	S4	0.27	0.4	0.94	0.9	0.87	0.2	0.2
	S5	0.3	1.14	1.75	2.13	1.67	0.68	0.46
	S6	0	0	0	0	0	0	0
M2	S1	0.91	0.53	0.68	0.99	0.68	1.29	1.29
	S2	1.6	0.68	0.61	0.76	0.84	1.44	0.84
	S3	1.29	0.61	0.68	0.68	0.68	1.52	1.14
	S4	1.52	0.3	0.53	0.23	0.68	1.29	0.99
	S5	2.2	0.99	0.91	1.06	1.37	2.13	1.9
	S6	0	0	0	0	0	0	0
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean		0.31	0.74	0.97	1.02	0.85	0.29	0.32
		1.25	0.52	0.57	0.62	0.71	1.28	1.03
		0.27	ns	0.14	0.36	ns	0.42	0.33
		24	71.44	12.85	30.52	68.14	37.53	33.74
		0.72	0.76	0.91	1.03	0.8	0.72	0.87
		0.95	0.8	0.84	0.91	0.84	0.84	0.61
		0.87	0.8	0.8	0.84	0.76	0.99	0.8
		0.89	0.35	0.73	0.56	0.78	0.75	0.59
		1.25	1.06	1.33	1.6	1.52	1.41	1.18
		0	0	0	0	0	0	0
		0.39	0.34	0.41	0.38	0.46	0.39	0.36
		41.27	44.46	44.6	38.46	49.09	41.17	44.82
		0.55	ns	ns	ns	ns	ns	ns
		0.54	ns	ns	ns	ns	ns	ns
		0.78	0.63	0.77	0.82	0.78	0.78	0.68

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot		ZONE-VII ARI-Rajendranagar									
Sub plot Treatments		Active Tillering Stage									
		sedges		BLW							
		<i>Cyperus difformis</i>	<i>Cyperus iria</i>	<i>Ammania baccifera</i>	<i>Bergia capensis</i>	<i>Eclipta alaba</i>	<i>Ludwigia parviflora</i>	<i>Marsilea quadrifolia</i>	Total		
M1	S1	2.2	1.82	1.06	1.14	0.46	0.46	0.46	12.85	0.46	12.85
	S2	1.6	1.52	1.22	0.68	0.46	0.53	0.68	11.48	0.53	11.48
	S3	1.29	1.75	1.22	0.91	0.38	0.15	0.38	11.18	0.15	11.18
	S4	1.74	1.54	1.14	0.74	0.33	0.13	0.47	9.86	0.13	9.86
	S5	2.96	2.2	1.82	1.44	0.53	0.53	0.91	18.55	0.53	18.55
	S6	0	0	0	0	0	0	0	0	0	0
M2	S1	2.89	1.82	1.29	1.06	0.61	0.3	0.61	14.98	0.3	14.98
	S2	3.57	2.51	1.37	0.91	0.46	0.68	0.3	16.57	0.68	16.57
	S3	4.41	2.96	1.52	1.22	0.61	0.38	0.91	18.63	0.38	18.63
	S4	2.05	1.52	0.84	0.68	0.84	0.23	0.38	12.09	0.23	12.09
	S5	5.78	3.12	4.49	3.42	1.6	1.44	1.22	31.63	1.44	31.63
	S6	0	0	0	0	0	0	0	0	0	0
Mean of Factor-1											
Mean of Factor-2	M1	1.63	1.47	1.08	0.82	0.36	0.3	0.48	10.65	0.3	10.65
	M2	3.12	1.99	1.58	1.22	0.68	0.51	0.57	15.65	0.51	15.65
	CD(0.05)	1.11	0.2	0.43	NS	0.28	NS	NS	2.57	NS	2.57
	CV%	32.48	8.1	22.62	32.72	37.87	51	78.65	13.63	51	13.63
Experimental Mean	S1	2.55	1.82	1.18	1.1	0.53	0.38	0.53	13.91	0.38	13.91
	S2	2.58	2.01	1.29	0.8	0.46	0.61	0.49	14.03	0.61	14.03
	S3	2.85	2.36	1.37	1.06	0.49	0.27	0.65	14.9	0.27	14.9
	S4	1.9	1.53	0.99	0.71	0.59	0.18	0.42	10.97	0.18	10.97
	S5	4.37	2.66	3.15	2.43	1.06	0.99	1.06	25.09	0.99	25.09
	S6	0	0	0	0	0	0	0	0	0	0
	CD(0.05)	0.57	0.52	0.61	0.44	0.29	0.36	0.37	2.27	0.36	2.27
	CV%	19.87	25.15	38.3	35.66	45.92	73.47	58.63	14.34	73.47	14.34
	Interaction M and T	0.8	ns	0.87	0.62	0.41	ns	ns	3.21	ns	3.21
	T and M	1.13	ns	0.86	0.68	0.43	ns	ns	3.56	ns	3.56
	Experimental Mean	2.37	1.73	1.33	1.02	0.52	0.4	0.53	13.15	0.4	13.15

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar						
		Panicle Initiation Stage						
		Grasses						
		<i>Cynodon dactylon</i>	<i>Digitaria sanguinalis</i>	<i>Echinochloa colona</i>	<i>Echinochloa crusgalli</i>	<i>Panicum repence</i>	<i>Eleusine indica</i>	<i>Dactyloctenium aegyptium</i>
M1	S1	0.56	2.96	3.8	4.5	2.96	0.84	0.84
	S2	1.55	4.08	3.8	5.77	2.82	0.99	0.7
	S3	0.56	2.96	3.8	4.5	2.96	0.84	0.84
	S4	1.55	3.52	4.08	5.63	2.39	0.7	0.84
	S5	2.09	4.87	6.44	7.49	2.61	1.39	1.57
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	3.83	3.13	2.61	3.13	3.48	4.18	1.57
	S2	5.22	3.48	2.44	4	3.31	5.57	2.61
	S3	6.27	3.31	4.35	5.4	5.92	5.75	3.66
	S4	3.66	3.48	2.26	2.79	3.48	4.53	1.39
	S5	6.85	4.15	4.98	6.22	6.64	7.68	3.11
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean	M1	1.05	3.06	3.65	4.65	2.29	0.8	0.8
	M2	4.3	2.93	2.77	3.59	3.8	4.62	2.06
	CD(0.05)	2.11	NS	0.43	0.94	0.67	2.11	0.57
	CV%	54.92	35.69	9.41	15.84	15.36	54.45	27.86
	S1	2.2	3.05	3.21	3.82	3.22	2.51	1.21
	S2	3.39	3.78	3.12	4.89	3.06	3.28	1.66
	S3	3.42	3.13	4.08	4.95	4.44	3.3	2.25
	S4	2.6	3.5	3.17	4.21	2.94	2.62	1.12
	S5	4.47	4.51	5.71	6.85	4.62	4.53	2.34
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	1.79	1.45	1.33	1.13	0.9	1.09	0.85
	CV%	55.52	40.23	34.43	22.77	24.62	33.49	49.32
	Interaction							
	M and T	NS	NS	NS	NS	1.28	1.54	NS
	T and M	NS	NS	NS	NS	1.28	2.17	NS
	Experimental Mean	2.68	3	3.21	4.12	3.05	2.71	1.43

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar							
		Panicle Initiation Stage							
		sedges		BLW					
		<i>Cyperus difformis</i>	<i>Cyperus iria</i>	<i>Ammania baccifera</i>	<i>Bergia capensis</i>	<i>Eclipta alaba</i>	<i>Ludwigia parviflora</i>	<i>Marsilea quadrifolia</i>	Total
M1	S1	7.88	6.19	5.07	6.05	3.66	2.53	3.24	51.1
	S2	9.01	8.31	4.5	4.65	4.22	1.69	2.53	54.62
	S3	13.09	9.71	7.6	5.77	3.66	1.97	2.11	60.39
	S4	7.74	7.74	5.77	5.63	3.66	1.27	2.11	52.65
	S5	19.5	13.41	14.62	12.88	5.57	1.39	2.44	96.28
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	14.97	10.79	5.57	5.57	4.87	3.13	2.96	69.82
	S2	9.75	8.53	8.18	7.14	5.4	4.35	4	73.99
	S3	16.71	9.4	5.4	5.75	3.83	2.79	2.96	81.48
	S4	19.15	11.49	7.31	6.79	5.4	3.13	2.79	77.65
	S5	26.76	17.84	13.07	9.96	9.13	3.94	3.94	124.26
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1									
Mean of Factor-2	M1	9.54	7.56	6.26	5.83	3.46	1.48	2.07	52.51
	M2	14.56	9.68	6.59	5.87	4.77	2.89	2.78	71.2
	CD(0.05)	0.98	NS	NS	NS	0.13	0.6	NS	6.7
	CV%	5.65	25.6	23.28	30.05	2.21	19.14	39.59	7.55
	S1	11.43	8.49	5.32	5.81	4.27	2.83	3.1	60.46
	S2	9.38	8.42	6.34	5.89	4.81	3.02	3.27	64.31
	S3	14.9	9.56	6.5	5.76	3.75	2.38	2.54	70.94
	S4	13.45	9.62	6.54	6.21	4.53	2.2	2.45	65.15
	S5	23.13	15.62	13.85	11.42	7.35	2.67	3.19	110.27
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	2.72	2.46	2.24	2.21	1.62	1.63	1.44	6.26
	CV%	18.73	23.74	28.96	31.34	32.72	61.88	49.47	8.4
Interaction									
M and T T and M Experimental Mean	M and T	3.84	NS	NS	NS	NS	NS	NS	8.85
	T and M	3.59	NS	NS	NS	NS	NS	NS	9.64
	Experimental Mean	12.05	8.62	6.43	5.85	4.12	2.18	2.42	61.85

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-IV Titabar									
		Active Tillering Stage					Panicle Initiation Stage				
		Grasses			BLW	Total	Grasses			BLW	Total
		<i>Echinochloa crusgalli</i>	<i>Leersia hexandra</i>	Sedges			<i>Echinochloa crusgalli</i>	<i>Leersia hexandra</i>	Sedges		
M1	S1	2.10	1.93	1.83	1.77	7.63	2.07	2.20	1.90	1.70	7.87
	S2	2.40	2.33	2.27	2.13	9.13	2.47	2.87	2.27	2.07	9.67
	S3	3.50	3.03	2.70	2.47	11.70	3.23	3.40	2.67	2.57	11.87
	S4	4.67	3.47	3.27	2.77	14.17	3.73	3.90	3.10	3.10	13.83
	S5	5.77	5.13	4.93	3.73	19.57	5.73	5.53	4.57	3.77	19.60
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	2.37	2.40	2.20	2.10	9.07	2.47	2.67	2.07	2.33	9.53
	S2	2.60	2.83	2.63	2.47	10.53	2.93	3.40	2.57	2.67	11.57
	S3	3.87	3.70	3.00	2.80	13.37	3.67	3.87	3.13	3.07	13.73
	S4	5.10	4.10	3.67	3.07	15.93	4.10	4.50	3.60	3.53	15.73
	S5	6.30	6.03	5.67	5.47	23.47	6.17	6.10	5.03	5.20	22.50
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1		3.07	2.65	2.50	2.14	10.37	2.87	2.98	2.42	2.20	10.47
M1		3.07	2.65	2.50	2.14	10.37	2.87	2.98	2.42	2.20	10.47
M2		3.37	3.18	2.86	2.65	12.06	3.22	3.42	2.73	2.80	12.18
CD(0.05)		NS	0.31	NS	NS	1.30	0.18	NS	0.25	NS	0.41
CV%		12.64	7.44	10.01	18.39	8.11	4.13	14.46	6.73	17.32	2.55
Mean of Factor-2											
S1		2.23	2.17	2.02	1.93	8.35	2.27	2.43	1.98	2.02	8.70
S2		2.50	2.58	2.45	2.30	9.83	2.70	3.13	2.42	2.37	10.62
S3		3.68	3.37	2.85	2.63	12.53	3.45	3.63	2.90	2.82	12.80
S4		4.88	3.78	3.47	2.92	15.05	3.92	4.20	3.35	3.32	14.78
S5		6.03	5.58	5.30	4.60	21.52	5.95	5.82	4.80	4.48	21.05
S6		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CD(0.05)		0.56	0.33	0.37	0.51	1.05	0.36	0.47	0.33	0.28	0.65
CV%		14.43	9.36	11.60	17.61	7.75	9.77	12.27	10.73	9.34	4.77
Interaction M and T		NS	NS	NS	NS	NS	NS	NS	NS	0.40	0.92
T and M		NS	NS	NS	NS	NS	NS	NS	NS	0.60	0.90
Experimental Mean		3.22	2.91	2.68	2.40	11.21	3.05	3.20	2.58	2.50	11.33

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Summary on Group wise Weed biomass g. /m² of Long term trial on weed dynamics in rice under different establishment methods, Kharif 2025.

Main plot	Sub plot Treatments	ZONE-VII Gangavathi							
		Active Tillering Stage				Panicle initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	1.67	2.41	0.00	4.09	0.49	2.14	0.67	3.30
	S2	1.74	2.53	0.00	4.27	0.36	1.98	0.52	2.86
	S3	0.87	2.20	0.12	3.19	0.58	0.55	0.00	1.13
	S4	3.65	5.85	0.18	9.69	0.84	5.01	0.00	5.86
	S5	5.64	13.00	0.32	18.97	12.07	7.81	2.91	22.78
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	6.93	5.86	2.98	15.78	2.40	3.67	1.45	7.53
	S2	7.32	4.86	2.55	14.74	1.87	3.70	0.93	6.50
	S3	2.55	2.91	0.00	5.46	2.64	1.45	0.00	4.10
	S4	10.68	7.69	1.68	20.06	6.62	5.94	1.92	14.48
	S5	33.88	15.23	6.22	55.33	15.10	8.51	3.77	27.39
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1									
Mean of Factor-2	M1	2.26	4.33	0.10	6.70	2.39	2.91	0.68	5.99
	M2	10.23	6.09	2.24	18.56	4.77	3.88	1.34	10.00
	CD(0.05)	1.13	0.06	0.63	0.43	0.36	0.75	NS	0.34
	CV%	12.62	0.83	37.70	2.40	6.93	15.42	50.22	2.93
	S1	4.30	4.14	1.49	9.93	1.45	2.91	1.06	5.42
	S2	4.53	3.70	1.27	9.50	1.11	2.84	0.72	4.68
	S3	1.71	2.56	0.06	4.33	1.61	1.00	0.00	2.61
	S4	7.17	6.77	0.93	14.87	3.73	5.48	0.96	10.17
	S5	19.76	14.11	3.27	37.15	13.59	8.16	3.34	25.08
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	1.01	0.55	0.34	0.94	1.68	0.35	0.75	1.60
	CV%	13.46	8.82	24.26	6.21	38.99	8.61	61.76	16.63
Interaction									
M and T T and M Experimental Mean	M and T	1.43	0.78	0.48	1.34	NS	0.50	NS	2.26
	T and M	1.58	0.72	0.66	1.27	NS	0.74	NS	2.08
	Experimental Mean	6.25	5.21	1.17	12.63	3.58	3.40	1.01	7.99

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-V Jagdalpur			
		Panicle initiation Stage			
		Grasses	Sedges	BLW	Total
M1	S1	10.16	0.80	3.64	14.60
	S2	5.58	0.63	4.10	10.31
	S3	14.94	1.35	20.23	36.51
	S4	11.57	1.90	22.18	35.65
	S5	90.27	5.65	90.85	186.77
	S6	0.00	0.00	0.00	0.00
M2	S1	12.95	5.33	7.76	26.04
	S2	24.79	1.23	12.50	38.52
	S3	32.00	2.08	30.95	65.03
	S4	44.13	2.60	34.30	81.03
	S5	124.00	10.55	109.93	244.48
	S6	0.00	0.00	0.00	0.00
Mean of Factor-1					
Mean of Factor-2	M1	22.09	1.72	23.50	47.31
	M2	39.64	3.63	32.57	75.85
	CD(0.05)	11.66	NS	NS	NS
	CV%	26.33	175.03	61.75	37.09
	S1	11.56	3.07	5.70	20.32
	S2	15.19	0.93	8.30	24.41
	S3	23.47	1.71	25.59	50.77
	S4	27.85	2.25	28.24	58.34
	S5	107.13	8.10	100.39	215.63
	S6	0.00	0.00	0.00	0.00
	CD(0.05)	17.96	2.94	18.85	27.21
	CV%	48.33	91.35	55.82	36.70
	Interaction				
	M and T	NS	NS	NS	NS
	T and M	NS	NS	NS	NS
Experimental Mean		30.87	2.68	28.04	61.58

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-I Malan							
		Active Tillering Stage				Panicle initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	7.15	4.75	2.07	13.97	16.69	7.60	5.99	30.28
	S2	7.24	5.33	2.54	15.11	15.61	6.97	6.13	28.71
	S3	8.07	6.77	3.49	18.33	14.91	9.50	7.71	32.11
	S4	6.43	6.51	3.83	16.77	13.84	8.87	8.93	31.64
	S5	20.01	19.54	9.79	49.33	38.08	24.07	20.32	82.47
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	6.19	5.44	2.21	13.84	14.92	8.87	6.21	30.00
	S2	6.33	4.66	2.15	13.15	15.79	8.23	5.75	29.77
	S3	7.57	6.42	3.01	16.99	15.85	8.87	7.20	31.92
	S4	6.53	5.89	2.93	15.35	13.03	11.40	7.14	31.57
	S5	22.29	23.13	9.24	54.67	37.43	34.83	16.49	88.75
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean		8.15	7.15	3.62	18.92	16.52	9.50	8.18	34.20
		8.15	7.59	3.26	19.00	16.17	12.03	7.13	35.33
		NS	NS	NS	NS	NS	NS	NS	1.08
		43.91	12.18	13.95	24.26	28.51	28.36	20.13	2.17
		6.67	5.09	2.14	13.90	15.81	8.23	6.10	30.14
		6.79	5.00	2.35	14.13	15.70	7.60	5.94	29.24
		7.82	6.59	3.25	17.66	15.38	9.18	7.45	32.02
		6.48	6.20	3.38	16.06	13.43	10.13	8.04	31.60
		21.15	21.34	9.51	52.00	37.75	29.45	18.41	85.61
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		3.27	1.86	1.15	3.66	4.61	4.38	2.59	6.45
		33.35	20.99	27.87	16.04	23.41	33.79	28.07	15.41
		NS	NS	NS	NS	NS	NS	NS	NS
		NS	NS	NS	NS	NS	NS	NS	NS
		8.15	7.37	3.44	18.96	16.35	10.77	7.66	34.77

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Moncompu								
		Active Tillering Stage				Panicle initiation Stage				
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	
M1	S1	18.33	5.00	0.00	23.33	58.3	8.0	0.0	66.3	
	S2	41.33	9.00	0.00	50.33	65.2	11.7	0.0	77.0	
	S3	51.59	19.67	0.00	71.25	62.2	14.7	0.0	76.9	
	S4	14.29	18.68	0.00	32.97	52.4	26.7	0.0	79.0	
	S5	88.20	60.09	20.00	168.29	59.1	60.3	30.4	149.8	
	S6	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	
M2	S1	20.33	14.11	0.00	34.44	39.3	15.7	0.0	55.0	
	S2	21.01	28.71	0.00	49.72	36.2	26.9	0.0	63.1	
	S3	93.77	0.00	0.00	93.77	67.4	2.7	0.0	70.1	
	S4	14.95	31.31	2.67	48.92	87.5	35.3	10.7	133.5	
	S5	20.28	90.95	8.00	119.23	120.6	133.1	13.3	267.1	
	S6	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean		35.62	18.74	3.33	57.70	49.5	20.2	5.1	74.8	
		28.39	27.51	1.78	57.68	58.5	35.6	4.0	98.1	
		NS	NS	NS	NS	NS	NS	NS	NS	
		89.11	77.55	527.58	45.36	78.5	62.6	520.8	29.0	
		19.33	9.55	0.00	28.89	48.8	11.9	0.0	60.7	
		31.17	18.85	0.00	50.03	50.7	19.3	0.0	70.0	
		72.68	9.83	0.00	82.51	64.8	8.7	0.0	73.5	
		14.62	24.99	1.33	40.95	69.9	31.0	5.3	106.3	
		54.24	75.52	14.00	143.76	89.9	96.7	21.9	208.4	
		0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	
		25.74	30.00	NS	32.49	39.2	29.8	NS	39.0	
		66.76	107.73	420.80	46.76	60.2	88.6	375.5	37.4	
		36.39	NS	NS	NS	NS	NS	NS	NS	
		46.13	NS	NS	NS	NS	NS	NS	NS	
		32.01	23.13	2.56	57.69	54.0	27.9	4.5	86.5	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VI Nawagam							
		Active Tillering Stage				Panicle initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	7.93	6.31	4.46	18.70	10.38	9.78	3.91	24.07
	S2	9.70	6.86	4.10	20.65	12.56	10.78	3.19	26.53
	S3	11.76	11.00	6.28	29.04	14.38	13.19	7.28	34.85
	S4	17.17	7.83	8.44	33.44	20.78	8.98	4.31	34.07
	S5	65.38	30.27	15.32	110.97	81.03	35.81	20.33	137.17
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	11.76	9.37	7.38	28.51	13.20	13.45	7.58	34.23
	S2	11.66	9.27	6.88	27.81	14.81	15.35	7.18	37.35
	S3	19.74	11.26	7.78	38.78	22.97	14.51	13.56	51.04
	S4	28.13	11.06	11.27	50.45	32.41	10.96	9.12	52.50
	S5	77.92	44.97	20.82	143.72	99.07	41.66	24.04	164.77
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean									

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-II Panthnagar							
		Active Tillering Stage				Panicle initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	3.93	3.23	5.00	12.17	13.53	4.75	6.37	24.65
	S2	19.13	3.53	5.50	28.17	11.63	6.87	8.20	26.70
	S3	5.03	6.47	3.17	14.67	16.33	8.57	10.00	34.90
	S4	4.93	2.27	3.80	11.00	16.87	11.67	10.83	39.37
	S5	12.20	25.60	18.83	56.63	34.93	34.87	37.23	107.03
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	4.27	3.80	3.30	11.37	13.53	6.75	8.37	28.65
	S2	5.13	3.53	3.83	12.50	10.97	8.87	25.20	45.03
	S3	4.93	3.37	5.17	13.47	12.00	9.90	10.00	31.90
	S4	4.60	19.70	16.27	40.57	12.20	11.67	10.17	34.03
	S5	13.63	19.50	14.23	47.37	34.93	34.87	37.23	107.03
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1 M1 M2 CD(0.05) CV% Mean of Factor-2 S1 S2 S3 S4 S5 S6 CD(0.05) CV% Interaction M and T T and M Experimental Mean		7.54	6.85	6.05	20.44	15.55	11.12	12.11	38.77
		5.43	8.32	7.13	20.88	13.94	12.01	15.16	41.11
		NS	1.25	NS	NS	0.24	0.48	NS	NS
		110.06	11.46	26.94	41.98	1.13	2.88	56.27	18.16
		4.10	3.52	4.15	11.77	13.53	5.75	7.37	26.65
		12.13	3.53	4.67	20.33	11.30	7.87	16.70	35.87
		4.98	4.92	4.17	14.07	14.17	9.23	10.00	33.40
		4.77	10.98	10.03	25.78	14.53	11.67	10.50	36.70
		12.92	22.55	16.53	52.00	34.93	34.87	37.23	107.03
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		8.91	0.95	2.42	8.40	1.38	1.60	10.68	11.16
		114.09	10.38	30.45	33.75	7.75	11.52	65.05	23.20
		NS	1.34	3.42	11.87	1.95	NS	NS	NS
		NS	1.57	3.71	14.57	1.79	NS	NS	NS
		6.48	7.58	6.59	20.66	14.74	11.56	13.63	39.94

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Pattambi						
		Active Tillering Stage			Panicle initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	Total
M1	S1	13.00	51.00	0.00	64.00	28.37	67.70	96.07
	S2	30.33	0.00	0.00	30.33	45.70	0.00	45.70
	S3	24.67	0.00	0.00	24.67	91.37	0.00	91.37
	S4	59.33	0.00	0.00	59.33	74.70	0.00	74.70
	S5	76.00	174.33	20.33	270.67	40.03	222.03	262.07
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	28.33	21.33	0.00	49.67	43.70	44.73	88.43
	S2	15.33	75.33	5.33	96.00	30.70	125.43	156.13
	S3	67.67	13.00	3.33	84.00	83.03	28.60	111.63
	S4	71.00	0.00	0.00	71.00	86.37	0.00	86.37
	S5	116.00	46.33	0.00	162.33	131.37	91.03	222.40
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1								
Mean of Factor-2	M1	33.89	37.56	3.39	74.83	46.69	48.29	94.98
	M2	49.72	26.00	1.44	77.17	62.53	48.30	110.83
	CD(0.05)							
	CV%	3.23	3.57	0.63	NS	3.23	NS	5.34
	S1	5.39	7.83	18.25	5.48	4.13	5.15	3.62
	S2	20.67	36.17	0.00	56.83	36.03	56.22	92.25
	S3	22.83	37.67	2.67	63.17	38.20	62.72	100.92
	S4	46.17	6.50	1.67	54.33	87.20	14.30	101.50
	S5	65.17	0.00	0.00	65.17	80.53	0.00	80.53
	S6	96.00	110.33	10.17	216.50	85.70	156.53	242.23
	CD(0.05)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CV%	10.49	2.94	1.06	10.10	10.42	2.94	9.73
Interaction		20.84	7.67	36.36	11.03	15.85	5.05	7.85
Experimental Mean	M and T	14.84	4.15	1.50	14.28	14.74	4.15	13.77
	T and M	13.78	4.71	1.45	13.86	13.70	4.71	13.25
		41.81	31.78	2.42	76.00	54.61	48.29	102.91

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar							
		Active Tillering Stage				Panicle initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	5.25	4.03	3.57	12.85	16.47	14.08	20.55	51.1
	S2	4.79	3.12	3.57	11.48	19.71	17.31	17.6	54.62
	S3	5.09	3.04	3.04	11.18	16.47	22.8	21.12	60.39
	S4	3.77	3.28	2.81	9.86	18.72	15.48	18.44	52.65
	S5	8.13	5.17	5.25	18.55	26.46	32.91	36.91	96.28
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	6.39	4.71	3.88	14.98	21.94	25.77	22.11	69.82
	S2	6.77	6.08	3.73	16.57	26.64	18.28	29.08	73.99
	S3	6.61	7.37	4.64	18.63	34.65	26.12	20.72	81.48
	S4	5.55	3.57	2.96	12.09	21.59	30.64	25.42	77.65
	S5	10.57	8.89	12.16	31.63	39.62	44.6	40.04	124.26
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1									
Mean of Factor-2	M1	4.51	3.11	3.04	10.65	16.31	17.1	19.1	52.51
	M2	5.98	5.11	4.56	15.65	24.07	24.23	22.89	71.2
	CD(0.05)	NS	1.25	1.11	2.57	2.65	3.37	3.11	6.7
	CV%	20.61	21.16	20.34	13.63	9.16	11.38	10.34	7.55
	S1	5.82	4.37	3.73	13.91	19.2	19.92	21.33	60.46
	S2	5.78	4.6	3.65	14.03	23.17	17.8	23.34	64.31
Interaction	S3	5.85	5.21	3.84	14.9	25.56	24.46	20.92	70.94
	S4	4.66	3.43	2.89	10.97	20.16	23.06	21.93	65.15
	S5	9.35	7.03	8.7	25.09	33.04	38.75	38.47	110.27
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	0.99	0.61	1.16	2.27	3.75	3.89	5.1	6.26
	CV%	15.71	12.3	25.35	14.34	15.44	15.65	20.15	8.4
Experimental Mean									
M1-Puddled Wet direct seeding M2-Un-puddled Dry direct seeding	M and T	NS	0.86	1.64	3.21	5.31	5.51	NS	8.85
	T and M	NS	1.25	1.73	3.56	5.27	5.68	NS	9.64
	Experimental Mean	5.24	4.11	3.8	13.15	20.19	20.67	21	61.85

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)
S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-IV Titabar							
		Active Tillering Stage				Panicle initiation Stage			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
M1	S1	4.03	1.83	1.77	7.63	4.27	1.90	1.70	7.87
	S2	4.73	2.27	2.13	9.13	5.33	2.27	2.07	9.67
	S3	6.53	2.70	2.47	11.70	6.63	2.67	2.57	11.87
	S4	8.13	3.27	2.77	14.17	7.63	3.10	3.10	13.83
	S5	10.90	4.93	3.73	19.57	11.27	4.57	3.77	19.60
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	4.77	2.20	2.10	9.07	5.13	2.07	2.33	9.53
	S2	5.43	2.63	2.47	10.53	6.33	2.57	2.67	11.57
	S3	7.57	3.00	2.80	13.37	7.53	3.13	3.07	13.73
	S4	9.20	3.67	3.07	15.93	8.60	3.60	3.53	15.73
	S5	12.33	5.67	5.47	23.47	12.27	5.03	5.20	22.50
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Factor-1									
Mean of Factor-2	M1	5.72	2.50	2.14	10.37	5.86	2.42	2.20	10.47
	M2	6.55	2.86	2.65	12.06	6.64	2.73	2.80	12.18
	CD(0.05)	0.38	NS	NS	1.30	0.66	0.25	NS	0.41
	CV%	4.37	10.01	18.39	8.11	7.31	6.73	17.32	2.55
	S1	4.40	2.02	1.93	8.35	4.70	1.98	2.02	8.70
	S2	5.08	2.45	2.30	9.83	5.83	2.42	2.37	10.62
	S3	7.05	2.85	2.63	12.53	7.08	2.90	2.82	12.80
	S4	8.67	3.47	2.92	15.05	8.12	3.35	3.32	14.78
	S5	11.62	5.30	4.60	21.52	11.77	4.80	4.48	21.05
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD(0.05)	0.60	0.37	0.51	1.05	0.54	0.33	0.28	0.65
	Interaction	8.05	11.60	17.61	7.75	7.22	10.73	9.34	4.77
	M and T	NS	NS	NS	NS	NS	NS	0.40	0.92
	T and M	NS	NS	NS	NS	NS	NS	0.60	0.90
Experimental Mean		6.14	2.68	2.40	11.21	6.25	2.58	2.50	11.33

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Summary on Species wise Relative Weed Density % of Long term trial on weed dynamics in rice under different establishment methods, Kharif 2025.

Main plot	Sub plot Treatments	ZONE-VII Aduthurai							
		Active Tillering Stage							
		Grasses					Sedges		
		<i>Echinochloa colona</i>	<i>Echinochloa crusgalli</i>	<i>Leptochloa chinensis</i>	<i>Panicum repens</i>	<i>Cynodon dactylon</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Fimbristylis miliacea</i>
M1	S1	29.80	11.15	18.66	14.35	5.57	3.83	2.33	0.00
	S2	18.78	18.99	17.33	13.62	6.80	2.27	1.72	1.72
	S3	23.75	11.93	17.68	14.36	7.62	4.07	2.90	1.11
	S4	17.64	20.08	15.83	10.95	6.69	2.23	2.23	2.23
	S5	28.61	14.42	15.47	10.08	4.92	3.17	1.36	1.01
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	26.90	18.55	13.61	11.56	8.45	3.65	1.81	1.78
	S2	12.13	38.03	13.97	10.37	8.00	4.47	2.05	0.00
	S3	21.15	11.77	16.71	15.07	9.38	4.22	3.43	1.83
	S4	18.58	17.27	13.28	10.62	7.97	3.10	3.10	2.66
	S5	25.41	14.50	18.38	9.88	8.45	2.77	1.53	0.94
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-VII Aduthurai				
		Active Tillering Stage				
		BLW				
		<i>Ammania baccifera</i>	<i>Bergia capensis</i>	<i>Eclipta alba</i>	<i>Euphorbia prostrata</i>	<i>Marselia quadrifolia</i>
M1	S1	3.29	1.44	4.19	2.87	2.51
	S2	1.72	0.00	9.70	5.64	1.72
	S3	3.65	2.21	4.33	3.32	3.06
	S4	2.23	2.23	10.34	5.07	2.23
	S5	3.09	0.93	9.25	6.03	1.65
	S6	0.00	0.00	0.00	0.00	0.00
M2	S1	2.85	1.81	4.37	2.59	2.07
	S2	2.24	1.41	3.47	1.84	2.01
	S3	3.42	2.09	4.47	3.47	2.97
	S4	3.09	3.53	8.42	5.30	3.09
	S5	2.54	1.12	8.25	4.82	1.41
	S6	0.00	0.00	0.00	0.00	0.00

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Gangavathi				
		Active Tillering Stage				
		Grasses		Sedges	BLW	
		<i>Echinochloa spp</i>	<i>Leptochloa spp</i>			
M1	S1	44.54	0.00	<i>Cynodon spp</i>	<i>Cyperus rotundus</i>	<i>Cynotis spp</i>
	S2	43.69	0.00	0.00	55.46	0.00
	S3	26.69	0.00	0.00	56.31	0.00
	S4	25.22	0.00	0.00	66.46	6.84
	S5	31.80	0.00	0.00	72.98	1.79
	S6	0.00	0.00	0.00	66.73	1.47
M2	S1	16.73	4.44	0.00	0.00	0.00
	S2	17.38	2.96	25.52	28.89	24.42
	S3	21.94	0.00	27.69	27.74	24.23
	S4	33.73	2.77	25.06	52.99	0.00
	S5	43.25	12.57	18.84	36.39	8.27
	S6	0.00	0.00	8.43	27.28	8.47

Main plot	Sub plot Treatments	ZONE-VII Gangavathi				
		Panicle Initiation Stage				
		Grasses		Sedges	BLW	
		<i>Echinochloa spp</i>	<i>Leptochloa spp</i>			
M1	S1	16.94	6.34	<i>Cynodon spp</i>	<i>Cyperus rotundus</i>	<i>Cynotis spp</i>
	S2	14.51	7.77	0.00	61.15	15.57
	S3	44.03	0.00	0.00	60.36	17.36
	S4	10.24	3.38	0.00	55.97	0.00
	S5	37.17	14.31	0.00	86.38	0.00
	S6	0.00	0.00	5.80	35.63	7.09
M2	S1	9.15	9.02	0.00	0.00	0.00
	S2	9.78	3.76	13.59	56.26	11.98
	S3	15.13	15.13	12.85	64.26	9.35
	S4	23.44	10.91	26.08	43.67	0.00
	S5	39.58	12.29	11.21	39.12	15.33
	S6	0.00	0.00	5.65	30.01	12.47

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-I Malan									
		Active Tillering Stage									
		Grasses			Sedges			BLW			
		<i>Echinochloa colonum</i>	<i>Echinochloa crusgalli</i>	<i>Panicum spp.</i>	<i>Cyperus iria</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Alternanthera spp.</i>	<i>Eclipta alba</i>	<i>Monochoria vaginalis</i>	
M1	S1	23.33	10.00	10.00	10.00	10.00	10.00	13.33	6.67	6.67	
	S2	22.05	12.29	5.81	9.51	9.51	12.54	9.51	12.29	6.48	
	S3	14.03	11.94	9.72	9.86	9.72	11.94	13.19	11.94	7.64	
	S4	10.47	10.68	10.68	10.68	13.03	7.91	13.03	13.25	10.26	
	S5	14.98	12.58	6.37	10.02	11.15	12.74	8.36	13.69	10.11	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
M2	S1	13.69	11.31	11.31	13.69	11.31	11.31	13.69	4.76	8.93	
	S2	16.20	10.65	14.35	10.65	10.19	10.65	9.72	6.94	10.65	
	S3	16.38	10.57	10.97	8.19	10.97	13.60	10.57	10.57	8.19	
	S4	12.47	12.17	12.17	12.47	11.92	9.14	5.56	14.95	9.14	
	S5	14.38	11.73	8.43	10.28	15.48	11.73	7.73	8.41	11.84	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Main plot	Sub plot Treatments	ZONE-I Malan									
		Panicle Initiation Stage									
		Grasses			Sedges			BLW			
		<i>Echinochloa colonum</i>	<i>Echinochloa crusgalli</i>	<i>Panicum spp.</i>	<i>Cyperus iria</i>	<i>Cyperus rotundus</i>	<i>Cyperus difformis</i>	<i>Alternanthera spp.</i>	<i>Eclipta alba</i>	<i>Monochoria vaginalis</i>	
M1	S1	21.34	11.77	9.73	9.55	7.17	11.77	9.73	11.77	7.17	
	S2	25.00	12.30	4.76	7.54	9.92	9.92	10.32	10.32	9.92	
	S3	15.51	10.75	8.94	13.13	8.52	10.91	10.75	10.75	10.75	
	S4	13.39	8.63	10.71	12.80	8.93	8.63	15.18	6.55	15.18	
	S5	15.27	12.39	6.68	9.21	11.91	10.94	8.48	13.37	11.74	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
M2	S1	17.59	10.19	10.19	12.04	12.04	9.26	9.26	10.19	9.26	
	S2	17.63	9.51	14.16	12.55	12.07	7.43	12.29	4.86	9.51	
	S3	11.29	15.46	10.99	10.99	11.15	9.07	10.99	8.91	11.15	
	S4	15.18	8.93	6.55	12.80	8.63	17.56	17.26	8.63	4.46	
	S5	11.68	11.81	8.87	13.13	13.82	15.33	8.65	11.17	5.52	
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Moncompu						
		Active Tillering Stage						
		Grasses			Sedges		BLW	
		<i>Isachnae miliaceae</i>	<i>Echinochloa stagnina</i>	<i>O.sativa f.sp. spontanea</i>	<i>Cyperus difformis</i>	<i>Fimbristylis miliaceae</i>	<i>Ludwigia hyssopifolia</i>	<i>Monochoria vaginalis</i>
M1	S1	0.00	0.00	51.85	0.00	14.81	0.00	0.00
	S2	0.00	0.00	55.56	11.11	33.33	0.00	0.00
	S3	17.02	0.00	66.67	2.84	13.48	0.00	0.00
	S4	0.00	34.92	0.00	6.35	25.40	0.00	0.00
	S5	26.63	12.67	2.69	15.02	25.85	11.43	5.71
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	47.62	0.00	9.52	0.00	42.86	0.00	0.00
	S2	60.00	0.00	0.00	16.67	23.33	0.00	0.00
	S3	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	S4	19.05	0.00	0.00	0.00	66.14	14.81	0.00
	S5	10.50	0.00	0.00	16.41	64.78	1.75	6.56
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-VII Moncompu							
		Panicle Initiation Stage							
		Grasses			Sedges			BLW	
		Isachnae miliaceae	Echinochloa stagnina	O.sativa f.sp. spontanea	Cyperus difformis	Cyperus haspan	Fimbristylis miliaceae	Ludwigia hyssopifolia	Monochoria vaginalis
M1	S1	0.00	8.89	80.00	0.00	0.00	11.11	0.00	0.00
	S2	56.14	0.00	10.53	0.00	0.00	33.33	0.00	0.00
	S3	48.72	0.00	39.68	0.00	0.00	11.59	0.00	0.00
	S4	77.48	11.78	0.00	2.26	0.00	8.47	0.00	0.00
	S5	33.57	14.32	0.00	6.17	1.52	26.42	12.61	5.41
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	0.00	0.00	30.16	0.00	0.00	69.84	0.00	0.00
	S2	47.77	0.00	3.92	17.78	0.00	30.53	0.00	0.00
	S3	56.99	12.82	20.51	0.00	0.00	9.68	0.00	0.00
	S4	44.06	3.70	1.75	0.00	0.00	35.67	14.81	0.00
	S5	35.08	5.39	3.56	15.33	0.00	35.51	1.35	3.77
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VI Nawagam									
		Active Tillering Stage					Sedges				
		Grasses									
		<i>Echinochloa crusgalli</i>	<i>Echinochloa colonum</i>	<i>Cynodon dactylon</i>	<i>Chloris barbata</i>	<i>Cyperus rotundus</i>	<i>Cyperus iria</i>	<i>Cyperus esculentus</i>	<i>Eclipta alba</i>	<i>Ipomoea aquatic</i>	<i>Trianthema monogyna</i>
M1	S1	17.73	14.18	3.78	7.51	7.98	9.74	19.63	4.21	5.26	9.97
	S2	8.20	13.86	13.10	13.56	10.67	11.28	12.11	1.93	6.82	8.49
	S3	7.95	18.53	4.86	9.70	15.00	4.04	20.64	7.08	7.63	4.58
	S4	9.51	13.02	10.06	18.23	2.37	18.69	4.23	2.69	5.26	15.94
	S5	13.45	14.41	12.16	17.65	9.67	9.88	8.25	2.94	6.99	4.60
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	14.89	7.18	9.94	7.85	4.79	14.79	12.88	5.60	18.16	3.91
	S2	4.07	10.37	20.19	6.04	10.62	10.16	12.93	5.75	10.97	8.90
	S3	21.00	9.35	12.37	11.04	5.35	14.06	8.10	7.02	7.97	3.74
	S4	7.35	18.65	8.49	22.16	6.44	2.89	12.10	10.92	8.23	2.78
	S5	13.88	14.95	10.71	15.29	9.63	8.81	12.26	4.56	3.71	6.20
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-VI Nawagam									
		Panicle Initiation Stage					Sedges				
		Grasses									
		<i>Echinochloa crusgalli</i>	<i>Echinochloa colonum</i>	<i>Cynodon dactylon</i>	<i>Chloris barbata</i>	<i>Cyperus rotundus</i>	<i>Cyperus iria</i>	<i>Cyperus esculentus</i>	<i>Eclipta alba</i>	<i>Ipomoea aquatic</i>	<i>Trianthema monogyna</i>
M1	S1	9.56	6.03	13.22	7.74	12.13	14.60	15.46	7.01	10.11	4.13
	S2	6.85	19.96	4.30	11.13	7.16	19.04	19.88	5.84	3.52	2.32
	S3	12.25	12.91	6.00	6.97	14.31	16.47	12.15	2.57	11.96	4.41
	S4	19.72	9.28	20.82	6.81	4.63	16.70	7.67	7.70	1.90	4.76
	S5	14.86	14.51	11.91	14.96	10.00	9.60	9.63	5.55	4.40	4.59
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	7.46	15.70	2.79	8.89	21.81	12.74	8.47	12.55	6.42	3.16
	S2	14.56	9.49	16.90	4.73	13.49	10.91	12.35	5.97	6.22	5.39
	S3	16.16	5.08	9.54	9.95	15.52	4.58	14.21	6.62	15.63	2.69
	S4	14.89	6.43	21.50	14.81	4.02	13.62	9.68	3.22	5.77	6.05
	S5	9.60	13.30	17.03	17.24	10.01	7.21	12.58	3.75	6.04	3.25
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-II Panthagar						
		Active Tillering Stage						
		Grasses		Sedges			BLW	
		<i>Echinochloa Colona</i>	<i>Eleusine indica</i>	Cyperus iria	Cyperus difformis	Fimbristylis millicaea	Alternanthera sessilis	Commelina Diffusa
M1	S1	9.14	2.67	26.07	14.27	4.00	18.07	25.78
	S2	16.67	13.89	25.00	13.89	13.89	11.11	5.56
	S3	23.43	20.87	2.56	6.48	20.87	23.22	2.56
	S4	15.25	42.63	0.00	0.00	42.12	0.00	0.00
	S5	13.44	27.36	19.03	7.68	19.15	7.68	5.68
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	15.36	17.92	33.45	9.76	12.79	8.16	2.56
	S2	27.78	55.56	0.00	0.00	16.67	0.00	0.00
	S3	25.39	0.00	12.90	18.37	0.00	25.39	17.96
	S4	21.34	16.90	12.38	6.74	12.30	15.75	14.60
	S5	19.83	16.36	17.06	7.51	14.68	12.25	12.31
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-II Panthagar					
		Panicle Initiation Stage					
		Grasses		Sedges		BLW	
		<i>Echinochloa colonum</i>	<i>Eleusine indica</i>	Cyperus iria	Cyperus difformis	Alternanthera sessilis	Commelina diffusa
M1	S1	15.91	24.90	11.21	14.92	19.38	13.68
	S2	17.16	18.30	17.06	19.63	18.40	9.46
	S3	16.54	17.68	16.44	17.68	15.21	16.44
	S4	11.33	22.66	27.83	7.63	11.33	19.22
	S5	22.40	17.55	15.61	15.39	13.23	15.82
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	18.29	17.22	18.76	16.39	14.85	14.48
	S2	16.23	17.92	19.25	14.84	17.80	13.97
	S3	17.22	15.89	18.56	14.89	15.89	17.56
	S4	16.70	16.09	17.66	17.66	19.41	12.48
	S5	20.47	17.53	16.43	15.04	13.82	16.71
	S6	0.00	0.00	0.00	0.00	0.00	0.00

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Pattambi						
		Active Tillering Stage						
		Sedges			BLW			
		Grasses	Cyperus difformis	Cyperus laevigatus	Fimbristylis milliaceae	Monochoria vaginalis	Sagittaria guayensis	Vallisneria spp
M1	S1	36.73	0.00	0.00	63.27	0.00	0.00	0.00
	S2	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	S3	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	S4	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	S5	36.45	17.24	80.48	12.72	0.00	15.67	19.52
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	20.58	29.77	57.64	0.00	0.00	0.00	42.36
	S2	3.92	19.30	72.41	23.90	0.00	13.87	27.59
	S3	47.39	19.48	100.00	0.00	14.66	0.00	0.00
	S4	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	S5	74.35	6.84	100.00	12.90	0.00	0.00	0.00
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-VII Pattambi				
		Panicle Initiation Stage				
		Grasses		Sedges		
		Isachne milliaceae	Cyperus difformis	<i>Cyperus laevigatus</i>	<i>Fimbristylis milliaceae</i>	
M1	S1	52.08	0.00	0.00	47.92	
	S2	100.00	0.00	0.00	0.00	
	S3	100.00	0.00	0.00	0.00	
	S4	100.00	0.00	0.00	0.00	
	S5	44.90	18.56	24.09	23.38	
	S6	0.00	0.00	0.00	0.00	
M2	S1	41.61	29.76	33.23	0.00	
	S2	18.26	21.36	40.23	59.25	
	S3	62.36	19.32	20.08	0.00	
	S4	100.00	0.00	0.00	0.00	
	S5	75.67	6.48	6.38	13.92	
	S6	0.00	0.00	0.00	0.00	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar													
		Active Tillering Stage													
		Grasses						Sedges							
		<i>Cynodon dactylon</i>	<i>Digitaria sanguinalis</i>	<i>Echinochloa colona</i>	<i>Echinochloa crusgalli</i>	<i>Panicum repence</i>	<i>Eleusine indica</i>	<i>Dactyloctenium aegyptium</i>	<i>Cyperus difformis</i>	<i>Cyperus iria</i>	<i>Ammania baccifera</i>	<i>Bergia capensis</i>	BLW <i>Eclipta alaba</i>	<i>Ludwigia parviflora</i>	<i>Marsilea quadrifolia</i>
M1	S1	4.12	7.62	8.91	8.26	7.09	1.21	3.50	17.26	14.11	8.35	8.87	3.59	3.58	3.53
	S2	2.62	8.06	9.14	9.43	7.34	2.01	3.25	13.87	13.35	10.52	5.90	4.07	4.55	5.90
	S3	4.23	8.79	8.30	8.59	7.45	4.01	4.38	11.42	15.86	10.97	7.92	3.61	1.28	3.19
	S4	2.75	4.18	9.41	8.70	8.90	2.13	2.01	17.61	15.73	11.54	7.44	3.41	1.39	4.80
	S5	1.56	6.14	9.58	11.50	8.94	3.78	2.41	16.03	11.94	9.83	7.84	2.81	2.84	4.79
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	6.05	3.54	4.51	6.74	4.54	8.62	8.63	19.29	12.03	8.69	7.17	4.04	2.08	4.07
	S2	9.50	4.28	3.73	4.60	4.93	8.72	5.03	21.47	15.25	8.35	5.47	2.73	4.10	1.84
	S3	6.90	3.25	3.64	3.70	3.70	8.10	6.13	23.64	15.98	8.17	6.56	3.29	2.04	4.89
	S4	12.67	2.45	4.41	1.85	5.64	10.75	8.02	16.87	12.67	6.93	5.64	7.00	1.93	3.15
	S5	7.12	3.08	2.95	3.27	4.29	6.76	6.03	18.34	9.91	14.10	10.86	5.09	4.48	3.73
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-VII ARI-Rajendranagar													
		Panicle Initiation Stage													
		Grasses						sedges				BLW			
		Cynodon dactylon	Digitaria sanguinalis	Echinochloa colona	Echinochloa crusgalli	Panicum repence	Eleusine indica	Dactyloctenium aegyptium	Cyperus difformis	Cyperus iria	Ammania baccifera	Bergia capensis	Eclipta alaba	Ludwigia parviflora	Marsilea quadrifolia
M1	S1	1.15	5.72	7.55	8.74	5.76	1.70	1.68	15.45	12.15	9.96	11.73	7.10	4.95	6.33
	S2	2.88	7.58	6.85	10.77	5.19	1.84	1.37	16.48	15.10	8.15	8.45	7.65	3.09	4.59
	S3	0.99	4.97	6.26	7.60	4.91	1.36	1.42	21.63	16.01	12.52	9.53	6.05	3.21	3.55
	S4	2.93	6.68	7.78	10.67	4.53	1.36	1.59	14.68	14.77	10.93	10.69	6.96	2.44	3.99
	S5	2.22	5.04	6.74	7.72	2.77	1.49	1.63	20.22	13.90	15.16	13.36	5.78	1.45	2.53
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	5.43	4.47	3.72	4.47	5.00	5.92	2.33	21.36	15.53	7.96	7.98	7.08	4.41	4.33
	S2	7.01	4.81	3.27	5.45	4.51	7.49	3.49	13.27	11.44	10.96	9.73	7.36	5.83	5.37
	S3	7.72	4.11	5.36	6.66	7.32	7.01	4.49	20.49	11.40	6.64	7.04	4.70	3.43	3.61
	S4	4.79	4.48	2.93	3.58	4.45	5.87	1.80	24.60	14.77	9.45	8.73	6.99	4.00	3.55
	S5	5.51	3.33	4.02	5.01	5.36	6.20	2.50	21.52	14.39	10.47	8.04	7.37	3.14	3.15
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

M1-Puddled Wet direct seeding

M2-Un-puddled Dry direct seeding

S1- Herbicide Application

S2 – Rotational application

S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)

S5-Weedy check

S6- Weed free

Trial 4.4.1: Summary on Group wise Relative Weed Density of Long term trial on weed dynamics in rice under different establishment methods, Kharif 2025.

Main plot	Sub plot Treatments	ZONE-VII Aduthurai				ZONE-VII Gangavathi			
		Active Tillering Stage			BLW	Active Tillering Stage			BLW
		Grasses	Sedges	BLW		Grasses	Sedges	Grasses	
M1	S1	79.53	6.17	14.30	0.00	44.54	55.46	23.28	61.15
	S2	75.52	5.70	18.78	0.00	43.69	56.31	22.28	60.36
	S3	75.35	8.08	16.58	0.00	26.69	66.46	44.03	55.97
	S4	71.20	6.69	22.11	0.00	25.22	72.98	13.62	86.38
	S5	73.50	5.54	20.96	0.00	31.80	66.73	57.28	35.63
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	79.07	7.25	13.69	0.00	46.69	28.89	31.76	56.26
	S2	82.50	6.53	10.97	0.00	48.03	27.74	26.39	64.26
	S3	74.08	9.48	16.43	0.00	47.01	52.99	56.33	43.67
	S4	67.72	8.86	23.43	0.00	55.34	36.39	45.56	39.12
	S5	76.62	5.25	18.13	0.00	64.25	27.28	57.52	30.01
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-I Malan				Panicle Initiation Stage			
		Active Tillering Stage			BLW	Panicle Initiation Stage			BLW
		Grasses	Sedges	BLW		Grasses	Sedges	Grasses	
M1	S1	43.33	30.00	26.67	28.67	42.84	28.49	28.67	28.67
	S2	40.15	31.57	28.28	30.56	42.06	27.38	30.56	30.56
	S3	35.69	31.53	32.78	32.24	35.20	32.56	32.24	32.24
	S4	31.84	31.62	36.54	36.90	32.74	30.36	36.90	36.90
	S5	33.93	33.91	32.16	33.59	34.34	32.07	33.59	33.59
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	36.31	36.31	27.38	28.70	37.96	33.33	28.70	28.70
	S2	41.20	31.48	27.31	26.66	41.29	32.05	26.66	26.66
	S3	37.91	32.76	29.33	31.05	37.74	31.21	31.05	31.05
	S4	36.82	33.54	29.65	30.36	30.65	38.99	30.36	30.36
	S5	34.54	37.48	27.97	25.34	32.37	42.29	25.34	25.34
	S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-VII Moncompu					
		Active Tillering Stage			Panicle Initiation Stage		
		Grasses	Sedges	BLW	Grasses	Sedges	BLW
M1	S1	51.85	14.81	0.00	88.89	11.11	0.00
	S2	55.56	44.44	0.00	66.67	33.33	0.00
	S3	83.69	16.31	0.00	88.41	11.59	0.00
	S4	34.92	31.75	0.00	89.27	10.73	0.00
	S5	41.99	40.87	17.14	47.88	34.10	18.02
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	57.14	42.86	0.00	30.16	69.84	0.00
	S2	60.00	40.00	0.00	51.69	48.31	0.00
	S3	100.00	0.00	0.00	90.32	9.68	0.00
	S4	19.05	66.14	14.81	49.52	35.67	14.81
	S5	10.50	81.19	8.31	44.03	50.85	5.12
	S6	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-VI Nawagam					
		Active Tillering Stage			Panicle Initiation Stage		
		Grasses	Sedges	BLW	Grasses	Sedges	BLW
M1	S1	43.20	37.35	19.45	36.55	42.19	21.25
	S2	48.71	34.05	17.23	42.24	46.08	11.68
	S3	41.04	39.68	19.28	38.13	42.93	18.94
	S4	50.82	25.29	23.89	56.63	29.00	14.36
	S5	57.68	27.80	14.53	56.24	29.23	14.54
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	39.86	32.47	27.67	34.84	43.02	22.13
	S2	40.67	33.72	25.62	45.67	36.75	17.58
	S3	53.76	27.51	18.73	40.74	34.31	24.95
	S4	56.64	21.43	21.93	57.64	27.33	15.04
	S5	54.83	30.70	14.47	57.16	29.80	13.04
	S6	0.00	0.00	0.00	0.00	0.00	0.00

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	ZONE-II Pantnagar					
		Active Tillering Stage			Panicle Initiation Stage		
		Grasses	Sedges	BLW	Grasses	Sedges	BLW
M1	S1	11.80	44.35	43.85	40.80	26.13	33.06
	S2	30.56	52.78	16.67	35.46	36.69	27.85
	S3	44.30	29.91	25.78	34.22	34.12	31.65
	S4	57.88	42.12	0.00	34.00	35.46	30.55
	S5	40.80	45.85	13.35	39.96	31.00	29.05
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	33.28	56.00	10.72	35.51	35.15	29.33
	S2	83.33	16.67	0.00	34.15	34.09	31.76
	S3	25.39	31.27	43.34	33.11	33.44	33.44
	S4	38.24	31.42	30.34	32.79	35.31	31.89
	S5	36.19	39.25	24.56	37.99	31.48	30.53
	S6	0.00	0.00	0.00	0.00	0.00	0.00

Main plot	Sub plot Treatments	ZONE-VII Pattambi					
		Active Tillering Stage			Panicle Initiation Stage		
		Grasses	Sedges	BLW	Grasses	Sedges	
M1	S1	36.73	63.27	0.00	52.08	47.92	
	S2	100.00	0.00	0.00	100.00	0.00	
	S3	100.00	0.00	0.00	100.00	0.00	
	S4	100.00	0.00	0.00	100.00	0.00	
	S5	36.45	51.17	12.38	44.90	55.10	
	S6	0.00	0.00	0.00	0.00	0.00	
M2	S1	20.58	58.39	21.03	41.61	58.39	
	S2	3.92	73.81	22.27	18.26	81.74	
	S3	47.39	37.95	14.66	62.36	37.64	
	S4	100.00	0.00	0.00	100.00	0.00	
	S5	74.35	25.65	0.00	75.67	24.33	
	S6	0.00	0.00	0.00	0.00	0.00	

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Contd.

Main plot	Sub plot Treatments	Zone-VII ARI-Rajendranagar					
		Active Tillering Stage			Panicle Initiation Stage		
		Grasses	Sedges	BLW	Grasses	Sedges	BLW
M1	S1	40.72	31.37	27.91	32.31	27.61	40.08
	S2	41.85	27.21	30.94	36.49	31.58	31.93
	S3	45.75	27.28	26.97	27.50	37.64	34.86
	S4	38.09	33.33	28.58	35.54	29.45	35.01
	S5	43.91	27.97	28.12	27.61	34.12	38.27
	S6	0.00	0.00	0.00	0.00	0.00	0.00
M2	S1	42.62	31.33	26.06	31.34	36.89	31.77
	S2	40.79	36.72	22.49	36.02	24.71	39.26
	S3	35.43	39.62	24.95	42.67	31.89	25.43
	S4	45.80	29.55	24.65	27.91	39.37	32.72
	S5	33.49	28.25	38.27	31.92	35.92	32.16
	S6	0.00	0.00	0.00	0.00	0.00	0.00

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1: Summary on Weed Control Efficiency % & Weed Index of Long term trial on weed dynamics in rice under different establishment methods, Kharif 2025.

Main plot	Sub plot Treatments	Weed Control Efficiency %													
		Active tillering stage						Panicle initiation stage							
		ZONE-VII Gangavathi	ZONE-I Malan	ZONE-VII Moncompu	ZONE-VI Nawagam	ZONE-VII Pattambi	ZONE-VII ARI- Rajendranagar	ZONE-VII Gangavathi	ZONE- VJagdalpur	ZONE- IMalan	ZONE-VII Moncompu	ZONE-VI Nawagam	ZONE-VII Pattambi	ZONE-VII ARI- Rajendranagar	
M1	S1	78.37	71.39	85.08	83.18	76.32	30.15	85.70	92.42	63.03	48.73	79.71	63.35	46.58	
	S2	77.45	69.20	66.54	81.24	88.76	38.05	87.43	94.41	65.08	47.11	79.24	82.56	43.32	
	S3	83.25	63.09	55.95	74.12	90.90	39.78	95.08	80.61	60.94	45.38	74.22	65.17	36.63	
	S4	48.77	65.72	79.22	69.21	77.96	46.55	74.15	80.60	61.44	37.87	74.37	71.46	45.15	
	S5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	S6	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
M2	S1	71.47	75.07	72.90	79.68	69.39	51.92	72.26	89.38	65.02	79.27	79.29	60.24	43.86	
	S2	73.38	75.71	57.56	80.01	40.83	46.41	76.50	83.78	65.99	76.23	77.01	29.76	40.35	
	S3	90.11	68.85	19.50	72.92	48.22	39.73	84.53	72.06	63.68	73.28	67.22	49.78	34.40	
	S4	63.73	71.84	55.10	64.11	56.13	61.11	46.44	64.24	63.83	49.17	67.55	61.02	37.43	
	S5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	S6	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	

Main plot	Sub plot Treatments	Weed Index %				
		ZONE-VII Gangavathi	ZONE-V Jagdalpur	ZONE-I Malan	ZONE-VII Moncompu	ZONE-VII ARI- Rajendranagar
		6.00	10.40	8.17	5.37	10.58
M1	S1	8.00	5.53	7.24	12.84	13.18
	S2	4.80	17.70	19.89	22.83	27.85
	S3	29.52	22.74	14.62	18.71	25.83
	S4	50.78	63.91	27.22	34.94	35.78
	S5	-	-	-	-	-
	S6	7.12	16.76	3.39	18.15	5.63
M2	S1	8.58	10.36	3.27	16.63	9.80
	S2	4.91	27.79	25.93	28.06	21.09
	S3	19.86	31.65	23.79	8.75	25.49
	S4	55.41	70.78	30.98	38.28	37.39
	S5	-	-	-	-	-
	S6	-	-	-	-	-

M1-Puddled Wet direct seeding
M2-Un-puddled Dry direct seeding

S1- Herbicide Application
S2 – Rotational application
S3- Farmers practice (mention the practice followed - manual weeding)

S4- Mechanical weeding / weeder (2-3 times)
S5-Weedy check
S6- Weed free

Trial 4.4.1(R): Yield parameters and grain yield of long term trial on weed dynamics in rice based cropping systems under different establishment methods, Rabi 2024-2025.

Main plot Treatments	Sub plot Treatments	Karaikal								
		Grain yield t/ha	Straw t/ha	Panicle weight(g)	Test weight(g)	No of panicles/m ²	Total dry matter g/m ² at Active tillering stage	Total dry matter g/m ² at Panicle Initiation stage	Benefit -Cost ratio	Cost of cultivation Rs/ha
M1	S1	4.09	5.72	3.59	26.27	350	421.90	628.40	2.26	43000
	S2	4.72	6.98	3.98	26.80	541	499.20	769.30	2.26	50000
	S3	4.89	7.12	3.90	26.48	504	519.90	803.80	2.50	46757
M2	S1	3.35	4.77	3.37	26.11	295	425.30	668.90	1.86	43000
	S2	3.65	6.15	3.48	25.81	462	435.20	749.30	1.78	50000
	S3	4.19	5.88	3.45	25.82	453	480.90	755.30	2.13	46757
M3	S1	2.50	3.72	3.14	26.66	221	237.60	291.30	1.39	43000
	S2	3.59	5.63	3.42	25.53	442	349.50	617.30	1.73	50000
	S3	3.64	5.43	3.50	26.04	422	395.70	647.30	1.79	48633
Mean of Factor-1										
M1		4.56	6.61	3.82	26.51	465	480.33	733.83	2.34	
M2		3.73	5.60	3.43	25.91	403	447.13	724.50	1.92	
M3		3.24	4.93	3.35	26.08	362	327.60	518.63	1.64	
CD(0.05)		0.19	NS	NS	NS	NS	32.67	62.43	0.10	
CV(%)		6.03	20.55	10.37	4.30	18	9.33	11.32	6.28	
Mean of Factor-2										
S1		3.31	4.74	3.36	26.35	289	361.60	529.53	1.84	
S2		3.99	6.25	3.62	26.05	482	427.97	711.97	1.92	
S3		4.24	6.14	3.62	26.11	460	465.50	735.47	2.14	
CD(0.05)		0.47	0.66	NS	NS	78	42.89	77.20	0.22	
CV(%)		11.96	11.32	10.27	3.05	19	9.98	11.41	11.00	
Interaction										
M and T		NS	NS	NS	NS	NS	NS	NS	NS	
T and M		NS	NS	NS	NS	NS	NS	NS	NS	
Experimental Mean		3.85	5.71	3.54	26.17	410	418.36	658.99	1.97	
Applied N:P:K:Zn Kg/ha		150:50:50								
Avail N:P:K (kg/ha)		110:65:203								
Name of the variety		KKKL(R)2								
Soil type		Clay loam								
pH		6.5								
EC (dsm-1)										
Soil Organic carbon		30.00%								

M1- Mechanised transplanting/Transplanting (if transplanters not available)

M2-Puddled direct seeding (preferably line sowing by drumseeder)

M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check

S2-Mechanical weeding using weeder

S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Contd.

Main plot Treatments	Sub plot Treatments	Pattambi								
		Grain yield t/ha	Straw t/ha	No of panicles/m ²	Panicle weight(g)	Test weight(g)	Total dry matter g/m ² at at Active tillering stage	Total dry matter g/m ² at at Panicle Initiation stage	Benefit - Cost ratio	Cost of cultivation Rs/ha
M1	S1	4.90	20.77	158	4.83	20.57	101.87	219.30	0.90	63025
	S2	5.97	18.97	174	5.73	20.13	108.20	255.30	0.85	75220
	S3	7.77	20.93	187	6.93	18.90	118.87	275.87	1.21	66180
M2	S1	5.33	13.03	167	3.90	20.27	112.53	317.63	0.82	65450
	S2	9.73	22.43	203	5.15	20.43	115.63	397.47	1.26	77320
	S3	11.50	25.70	224	7.53	19.90	126.60	469.30	1.68	68050
M3	S1	4.50	12.83	152	4.83	18.80	108.27	259.50	0.66	71260
	S2	10.97	19.70	189	5.53	21.83	117.27	332.87	1.25	83620
	S3	7.93	20.07	187	6.63	21.77	120.90	367.30	1.08	74850
Mean of Factor-1										
M1		6.21	20.22	173	5.83	19.87	109.64	250.16	0.99	
M2		8.86	20.39	198	5.53	20.20	118.26	394.80	1.25	
M3		7.80	17.53	176	5.67	20.80	115.48	319.89	1.00	
CD(0.05)		0.90	1.46	NS	NS	NS	4.06	36.00	0.11	
CV(%)		14.15	9.01	9	7.85	5.74	4.23	13.37	11.80	
Mean of Factor-2										
S1		4.91	15.54	159	4.52	19.88	107.56	265.48	0.80	
S2		8.89	20.37	189	5.47	20.80	113.70	328.54	1.12	
S3		9.07	22.23	199	7.03	20.19	122.12	370.82	1.32	
CD(0.05)		0.69	1.29	18	0.39	NS	3.60	25.31	0.07	
CV(%)		8.87	6.48	10	6.73	9.23	3.06	7.66	6.71	
Interaction										
M and T		1.20	2.23	NS	NS	NS	NS	NS	0.13	
T and M		1.13	2.02	NS	NS	NS	NS	NS	0.12	
Experimental Mean		7.62	19.38	182	5.68	20.29	114.46	321.61	1.08	
Applied N:P:K:Zn Kg/ha		90:45:45								
Avail N:P:K (kg/ha)										
Name of the variety		Aiswarya								
Soil type										
pH										
EC (dsm-1)										
Soil Organic carbon										

M1- Mechanised transplanting/Transplanting (if transplanters not available)

M2-Puddled direct seeding (preferably line sowing by drumseeder)

M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check

S2-Mechanical weeding using weeder

S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Summary on Species wise weed population no/m² of Long term trial on weed dynamics in rice under different establishment methods, Rabi 2024-2025.

Main plot	Sub plot Treatments	Karaikal												
		Active tillering stage						Panicle initiation stage						
		Grasses	Sedges	BLW				Total	Grasses	sedges	BLW			Total
				Aeschynomene indica	Bergia capensis	Hydrolea zeylanica	Aeschynomene indica				Bergia capensis	Hydrolea zeylanica		
		<i>Echinochloa colona</i>	Cyperus iria	Aeschynomene indica	Bergia capensis	Hydrolea zeylanica	Total	<i>Echinochloa colonom</i>	Cyperus iria	Aeschynomene indica	Bergia capensis	Hydrolea zeylanica	Total	
M1	S1	14.67(3.89)	9.67(3.19)	6.67(2.64)	3.33(1.93)	8.33(2.94)	42.67(6.57)	15.33(3.91)	16.33(4.06)	6.67(2.67)	5.67(2.46)	8.33(2.97)	52.33(7.22)	
	S2	11.67(3.45)	6.67(2.62)	2.33(1.57)	0.00(0.71)	1.67(1.39)	22.33(4.77)	5.33(2.40)	7.00(2.69)	5.67(2.48)	8.00(2.88)	5.67(2.48)	31.67(5.64)	
	S3	13.00(3.63)	5.33(2.41)	3.67(1.79)	0.00(0.71)	3.67(1.86)	25.67(5.08)	10.33(3.17)	6.67(2.67)	6.67(2.64)	6.67(2.64)	6.00(2.50)	36.33(6.06)	
M2	S1	46.00(6.82)	29.67(5.48)	9.67(3.19)	9.33(3.13)	11.33(3.43)	106.00(10.31)	35.67(5.97)	28.33(5.34)	16.67(4.14)	13.33(3.70)	18.67(4.37)	112.67(10.62)	
	S2	24.67(5.01)	14.33(3.84)	8.33(2.88)	9.33(3.02)	8.33(2.92)	65.00(8.08)	23.67(4.87)	18.67(4.34)	11.00(3.38)	10.33(3.29)	9.33(3.13)	73.00(8.56)	
	S3	17.00(4.15)	9.67(3.17)	7.00(2.71)	2.67(1.64)	3.33(1.55)	39.67(6.33)	10.00(3.22)	11.00(3.39)	8.00(2.89)	7.33(2.77)	7.67(2.84)	44.00(6.67)	
M3	S1	100.67(10.05)	109.00(10.46)	11.67(3.48)	10.00(3.24)	9.33(3.13)	240.67(15.53)	77.00(8.70)	38.00(6.13)	33.33(5.80)	30.00(5.47)	30.00(5.50)	208.33(14.40)	
	S2	46.00(6.79)	18.67(4.34)	5.33(2.31)	6.67(2.40)	6.00(2.49)	82.67(9.12)	27.33(5.25)	20.00(4.50)	15.00(3.90)	18.33(4.33)	18.67(4.33)	99.33(9.98)	
	S3	5.00(2.30)	15.33(3.91)	2.33(1.57)	1.67(1.25)	3.00(1.72)	27.33(5.23)	20.33(4.53)	11.00(3.24)	3.67(2.00)	3.33(1.90)	4.00(2.10)	42.33(6.50)	
Mean of Factor-1		M1	13.11(3.66)	7.22(2.74)	4.22(2.00)	1.11(1.12)	4.56(2.06)	30.22(5.47)	10.33(3.16)	10.00(3.14)	6.33(2.60)	6.78(2.66)	40.11(6.31)	
	M2	29.22(5.33)	17.89(4.17)	8.33(2.93)	7.11(2.60)	7.67(2.63)	70.22(8.24)	23.11(4.69)	19.33(4.36)	11.89(3.47)	10.33(3.26)	11.89(3.45)	76.56(8.62)	
	M3	50.56(6.38)	47.67(6.24)	6.44(2.45)	6.11(2.30)	6.11(2.45)	116.89(9.96)	41.56(6.16)	23.00(4.62)	17.33(3.90)	17.22(3.90)	17.56(3.97)	116.67(10.29)	
	CD(0.05)	0.19	0.44	NS	0.52	NS	0.26	0.81	0.56	0.25	0.28	0.46	0.7	
	CV%	4.43	11.88	44.09	30.74	31.9	3.93	20.68	16.48	8.89	10.18	16.34	9.89	
Mean of Factor-2		S1	53.78(6.92)	49.44(6.37)	9.33(3.10)	7.56(2.77)	9.67(3.17)	129.78(10.80)	42.67(6.20)	27.56(5.18)	18.89(4.20)	16.33(3.88)	19.00(4.28)	124.44(10.75)
	S2	27.44(5.08)	13.22(3.60)	5.33(2.25)	5.33(2.04)	5.33(2.26)	56.67(7.32)	18.78(4.18)	15.22(3.84)	10.56(3.25)	12.22(3.50)	11.22(3.31)	68.00(8.06)	
	S3	11.67(3.36)	10.11(3.16)	4.33(2.02)	1.44(1.20)	3.33(1.71)	30.89(5.55)	13.56(3.64)	9.56(3.10)	6.11(2.51)	5.78(2.44)	5.89(2.48)	40.89(6.41)	
	CD(0.05)	0.58	0.5	0.63	0.77	0.75	0.46	0.78	0.85	0.39	0.56	0.45	0.92	
	CV%	10.96	11.18	25.02	37.5	30.81	5.72	16.31	20.53	11.51	16.73	13.09	10.66	
Interaction														
	M and T	1	0.87	NS	NS	NS	0.8	NS	NS	0.68	0.97	0.78	1.59	
	T and M	0.82	0.75	NS	NS	NS	0.67	NS	NS	0.57	0.81	0.69	1.35	
Experimental Mean		5.12	4.38	2.46	2	2.38	7.89	4.67	4.04	3.32	3.27	3.36	8.4	

M1- Mechanised transplanting/Transplanting (if transplanters not available) S1-Weedy check
M2-Puddled direct seeding (preferably line sowing by drumseeder) S2-Mechanical weeding using weeder
M3-Un-puddled dry direct seeding (line sowing) S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Contd.

Main plot	Sub plot Treatments	Pattambi					
		Active tillering stage					
		Grasses	Sedges	BLW			
		Isachne milliaceae	<i>Fimbristylis milliaceae</i>	Marselia quadrifolia	Monochoria vaginalis	Sagittaria nymphoides	Sphenoclea zeylanica
M1	S1	8.67(3.01)	27.00(5.21)	22.00(4.73)	16.67(4.14)	3.33(1.93)	23.33(4.88)
	S2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	11.67(3.48)	69.00(8.31)	16.33(4.08)	5.67(2.48)	1.33(1.34)	36.33(6.07)
	S2	2.33(1.57)	28.33(5.35)	5.33(2.35)	0.00(0.71)	0.00(0.71)	13.33(3.65)
	S3	9.00(3.01)	9.33(3.05)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M3	S1	32.00(5.32)	26.67(5.21)	21.33(4.62)	17.67(4.23)	4.67(2.26)	25.33(5.08)
	S2	23.33(4.82)	19.33(4.45)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S3	16.00(4.04)	10.00(3.20)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1							
M1		2.89(1.47)	9.00(2.21)	7.33(2.05)	5.56(1.85)	1.11(1.12)	7.78(2.10)
M2		7.67(2.69)	35.56(5.57)	7.22(2.38)	1.89(1.30)	0.44(0.92)	16.56(3.48)
M3		23.78(4.73)	18.67(4.29)	7.11(2.01)	5.89(1.88)	1.56(1.22)	8.44(2.16)
CD(0.05)		0.93	0.4	NS	0.22	NS	0.19
CV%		37.3	11.99	23.5	15.55	19.73	8.76
Mean of Factor-2							
S1		17.44(3.94)	40.89(6.24)	19.89(4.47)	13.33(3.62)	3.11(1.84)	28.33(5.34)
S2		8.56(2.36)	15.89(3.50)	1.78(1.25)	0.00(0.71)	0.00(0.71)	4.44(1.69)
S3		8.33(2.59)	6.44(2.32)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		1.04	0.48	0.43	0.24	0.19	0.33
CV%		34.29	11.73	19.71	13.81	17.15	12.31
Interaction							
M and T		NS	0.84	NS	0.41	NS	0.56
T and M		NS	0.72	NS	0.36	NS	0.47
Experimental Mean		2.96	4.02	2.15	1.68	1.09	2.58

*(Values in parentheses are transformed values)

M1- Mechanised transplanting/Transplanting (if transplanters not available) S1-Weedy check
M2-Puddled direct seeding (preferably line sowing by drumseeder) S2-Mechanical weeding using weeder
M3-Un-puddled dry direct seeding (line sowing) S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Contd.

Main plot	Sub plot Treatments	Pattambi					
		Panicle initiation stage					
		Grasses	sedges	BLW			
		Isachne milliaceae	<i>Fimbristylis milliaceae</i>	Marselia quadrifolia	Monochoria vaginalis	Sagittaria nymphoides	Sphenoclea zeylanica
M1	S1	95.33(9.73)	21.67(4.69)	20.67(4.56)	29.33(5.46)	6.33(2.60)	25.67(5.11)
	S2	37.00(5.63)	21.67(4.70)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S3	67.67(7.22)	13.33(3.69)	5.67(2.46)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M2	S1	111.67(10.55)	42.67(6.57)	17.00(4.18)	19.67(4.46)	5.00(2.34)	33.67(5.84)
	S2	35.00(5.75)	18.67(4.21)	13.67(3.73)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S3	20.67(4.54)	4.67(2.18)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
M3	S1	65.00(7.77)	28.33(5.36)	32.33(5.69)	18.67(4.35)	6.33(2.60)	28.67(5.38)
	S2	31.67(5.18)	16.00(4.05)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	S3	81.67(8.97)	6.00(2.51)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Mean of Factor-1							
M1		66.67(7.53)	18.89(4.36)	8.78(2.57)	9.78(2.29)	2.11(1.34)	8.56(2.18)
M2		55.78(6.95)	22.00(4.32)	10.22(2.87)	6.56(1.96)	1.67(1.25)	11.22(2.42)
M3		59.44(7.31)	16.78(3.98)	10.78(2.37)	6.22(1.92)	2.11(1.34)	9.56(2.26)
CD(0.05)		NS	NS	NS	NS	NS	NS
CV%		21.64	20.13	16.36	13.02	10.49	6.22
Mean of Factor-2							
S1		90.67(9.35)	30.89(5.54)	23.33(4.81)	22.56(4.76)	5.89(2.52)	29.33(5.44)
S2		34.56(5.52)	18.78(4.32)	4.56(1.72)	0.00(0.71)	0.00(0.71)	0.00(0.71)
S3		56.67(6.91)	8.00(2.79)	1.89(1.29)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		1.47	0.59	0.48	0.31	0.16	0.26
CV%		19.74	13.64	17.91	14.89	11.74	10.88
Interaction							
M and T		NS	NS	0.83	NS	NS	NS
T and M		NS	NS	0.7	NS	NS	NS
Experimental Mean		7.26	4.22	2.61	2.06	1.31	2.29

*(Values in parentheses are transformed values)

M1- Mechanised transplanting/Transplanting (if transplanters not available)

M2-Puddled direct seeding (preferably line sowing by drumseeder)

M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check

S2-Mechanical weeding using weeder

S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Summary on Group wise Weed population no. /m2 of Long term trial on weed dynamics in rice under different establishment methods, Rabi 2024-2025.

Main plot		Sub plot Treatments		Karaikal						
		Active tillering stage				Panicle initiation stage				
		Grasses	sedges	BLW	total	Grasses	sedges	BLW	total	
M1	S1	14.67(3.89)	9.67(3.19)	18.33(4.30)	42.67(6.57)	15.33(3.91)	16.33(4.06)	20.67(4.59)	52.33(7.22)	
	S2	11.67(3.45)	6.67(2.62)	4.00(2.11)	22.33(4.77)	5.33(2.40)	7.00(2.69)	19.33(4.44)	31.67(5.64)	
	S3	13.00(3.63)	5.33(2.41)	7.33(2.79)	25.67(5.08)	10.33(3.17)	6.67(2.67)	19.33(4.39)	36.33(6.06)	
M2	S1	46.00(6.82)	29.67(5.48)	30.33(5.55)	106.00(10.31)	35.67(5.97)	28.33(5.34)	48.67(7.01)	112.67(10.62)	
	S2	24.67(5.01)	14.33(3.84)	26.00(5.04)	65.00(8.08)	23.67(4.87)	18.67(4.34)	30.67(5.58)	73.00(8.56)	
	S3	17.00(4.15)	9.67(3.17)	13.00(3.63)	39.67(6.33)	10.00(3.22)	11.00(3.39)	23.00(4.84)	44.00(6.67)	
M3	S1	100.67(10.05)	109.00(10.46)	31.00(5.61)	240.67(15.53)	77.00(8.70)	38.00(6.13)	93.33(9.64)	208.33(14.40)	
	S2	46.00(6.79)	18.67(4.34)	18.00(4.22)	82.67(9.12)	27.33(5.25)	20.00(4.50)	52.00(7.22)	99.33(9.98)	
	S3	5.00(2.30)	15.33(3.91)	7.00(2.73)	27.33(5.23)	20.33(4.53)	11.00(3.24)	11.00(3.32)	42.33(6.50)	
Mean of Factor-1										
	M1	13.11(3.66)	7.22(2.74)	9.89(3.07)	30.22(5.47)	10.33(3.16)	10.00(3.14)	19.78(4.48)	40.11(6.31)	
	M2	29.22(5.33)	17.89(4.17)	23.11(4.74)	70.22(8.24)	23.11(4.69)	19.33(4.36)	34.11(5.81)	76.56(8.62)	
	M3	50.56(6.38)	47.67(6.24)	18.67(4.19)	116.89(9.96)	41.56(6.16)	23.00(4.62)	52.11(6.73)	116.67(10.29)	
	CD(0.05)	0.19	0.44	0.5	0.26	0.81	0.56	0.46	0.7	
	CV%	4.43	11.88	14.81	3.93	20.68	16.48	9.78	9.89	
Mean of Factor-2										
	S1	53.78(6.92)	49.44(6.37)	26.56(5.15)	129.78(10.80)	42.67(6.20)	27.56(5.18)	54.22(7.08)	124.44(10.75)	
	S2	27.44(5.08)	13.22(3.60)	16.00(3.79)	56.67(7.32)	18.78(4.18)	15.22(3.84)	34.00(5.75)	68.00(8.06)	
	S3	11.67(3.36)	10.11(3.16)	9.11(3.05)	30.89(5.55)	13.56(3.64)	9.56(3.10)	17.78(4.18)	40.89(6.41)	
	CD(0.05)	0.58	0.5	0.65	0.46	0.78	0.85	0.62	0.92	
	CV%	10.96	11.18	15.73	5.72	16.31	20.53	10.62	10.66	
Interaction										
	M and T	1	0.87	NS	0.8	NS	NS	1.07	1.59	
	T and M	0.82	0.75	NS	0.67	NS	NS	0.91	1.35	
Experimental Mean		5.12	4.38	4	7.89	4.67	4.04	5.67	8.4	

*(Values in parentheses are transformed values)

M1- Mechanised transplanting/Transplanting (if transplanters not available)
M2-Puddled direct seeding (preferably line sowing by drumseeder)
M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check
S2-Mechanical weeding using weeder
S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Contd.

Main plot	Sub plot Treatments	Pattambi									
		Active tillering stage					Panicle initiation stage				
		Grasses	sedges	BLW	total		Grasses	sedges	BLW	total	
M1	S1	8.67(3.01)	27.00(5.21)	65.33(8.11)	101.00(10.05)		95.33(9.73)	21.67(4.69)	82.00(9.07)	199.00(14.10)	
	S2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		37.00(5.63)	21.67(4.70)	0.00(0.71)	58.67(7.45)	
	S3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		67.67(7.22)	13.33(3.69)	5.67(2.46)	86.67(8.69)	
M2	S1	11.67(3.48)	69.00(8.31)	59.67(7.76)	140.33(11.86)		111.67(10.55)	42.67(6.57)	75.33(8.70)	229.67(15.15)	
	S2	2.33(1.57)	28.33(5.35)	18.67(4.29)	49.33(7.02)		35.00(5.75)	18.67(4.21)	13.67(3.73)	67.33(8.08)	
	S3	9.00(3.01)	9.33(3.05)	0.00(0.71)	18.33(4.24)		20.67(4.54)	4.67(2.18)	0.00(0.71)	25.33(5.01)	
M3	S1	32.00(5.32)	26.67(5.21)	69.00(8.33)	127.67(11.27)		65.00(7.77)	28.33(5.36)	86.00(9.29)	179.33(13.33)	
	S2	23.33(4.82)	19.33(4.45)	0.00(0.71)	42.67(6.55)		31.67(5.18)	16.00(4.05)	0.00(0.71)	47.67(6.66)	
	S3	16.00(4.04)	10.00(3.20)	0.00(0.71)	26.00(5.10)		81.67(8.97)	6.00(2.51)	0.00(0.71)	87.67(9.32)	
Mean of Factor-1											
M1	M1	2.89(1.47)	9.00(2.21)	21.78(3.17)	33.67(3.82)		66.67(7.53)	18.89(4.36)	29.22(4.08)	114.78(10.08)	
	M2	7.67(2.69)	35.56(5.57)	26.11(4.25)	69.33(7.71)		55.78(6.95)	22.00(4.32)	29.67(4.38)	107.44(9.41)	
	M3	23.78(4.73)	18.67(4.29)	23.00(3.25)	65.44(7.64)		59.44(7.31)	16.78(3.98)	28.67(3.57)	104.89(9.77)	
CD(0.05)	CD(0.05)	0.93	0.4	0.35	0.79		NS	NS	0.14	NS	
	CV%	37.3	11.99	11.75	14.75		21.64	20.13	4.17	13.37	
Mean of Factor-2											
S1	S1	17.44(3.94)	40.89(6.24)	64.67(8.06)	123.00(11.06)		90.67(9.35)	30.89(5.54)	81.11(9.02)	202.67(14.19)	
	S2	8.56(2.36)	15.89(3.50)	6.22(1.90)	30.67(4.76)		34.56(5.52)	18.78(4.32)	4.56(1.72)	57.89(7.40)	
	S3	8.33(2.59)	6.44(2.32)	0.00(0.71)	14.78(3.35)		56.67(6.91)	8.00(2.79)	1.89(1.29)	66.56(7.67)	
CD(0.05)	CD(0.05)	1.04	0.48	0.4	0.76		1.47	0.59	0.44	1.24	
	CV%	34.29	11.73	11.03	11.61		19.74	13.64	10.6	12.43	
Interaction	Interaction										
	M and T	NS	0.84	0.7	1.32		NS	NS	0.76	NS	
	T and M	NS	0.72	0.6	1.17		NS	NS	0.62	NS	
Experimental Mean		2.96	4.02	3.56	6.39		7.26	4.22	4.01	9.75	

*(Values in parentheses are transformed values)

M1- Mechanised transplanting/Transplanting (if transplanters not available)

M2-Puddled direct seeding (preferably line sowing by drumseeder)

M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check

S2-Mechanical weeding using weeder

S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Summary on Species wise Weed dry biomass g/m² of long term trial on weed dynamics in rice based cropping systems under different establishment methods, Rabi 2024-2025.

Main plot		Sub plot Treatments		Karaikal										
				Active tillering stage					Panicle initiation stage					
		Grasses	sedges	BLW			total	Grasses	sedges	BLW			total	
		<i>Echinochloa colona</i>	Cyperus iria	Aeschynomene indica	Bergia capensis	Hydrolea zeylanica		<i>Echinochloa colona</i>	Cyperus iria	Aeschynomene indica	Bergia capensis	Hydrolea zeylanica		
M1		S1	26.59	7.48	3.12	2.19	3.18	42.55	35.39	12.17	18.67	14.67	17.45	98.35
		S2	10.26	4.71	0.77	0.00	0.54	16.28	4.94	10.04	7.26	8.00	8.70	38.94
		S3	4.46	3.03	2.05	0.00	4.53	14.07	13.67	21.70	9.33	8.00	10.04	62.74
M2		S1	48.39	45.88	6.67	5.45	9.77	116.16	38.87	72.95	24.00	20.00	28.55	184.37
		S2	20.85	16.25	2.58	1.33	2.28	43.30	20.43	20.05	9.47	6.83	9.93	66.72
		S3	14.73	11.98	3.51	2.00	3.33	35.55	5.81	17.25	5.33	5.33	8.29	42.02
M3		S1	92.03	100.70	21.47	16.75	21.65	252.60	54.92	58.78	29.33	30.17	48.17	221.38
		S2	19.46	12.35	2.50	2.33	2.33	38.97	15.94	32.38	18.67	25.33	30.60	122.93
		S3	9.73	13.93	1.26	0.49	3.94	29.36	21.37	31.12	4.00	5.33	7.92	69.75
Mean of Factor-1		M1	13.77	5.07	1.98	0.73	2.75	24.30	18.00	14.64	11.75	10.22	12.07	66.68
		M2	27.99	24.70	4.25	2.93	5.13	65.00	21.71	36.75	12.94	10.72	15.59	97.71
		M3	40.41	42.33	8.41	6.53	9.31	106.98	30.74	40.76	17.33	20.28	28.90	138.02
CD(0.05)			3.99	6.25	1.84	NS	1.76	9.56	NS	10.54	NS	5.11	5.30	11.13
CV%			17.40	31.07	45.06	103.07	36.62	17.46	42.68	40.97	30.00	44.42	33.60	13.19
Mean of Factor-2		S1	55.67	51.36	10.42	8.13	11.53	137.11	43.06	47.97	24.00	21.61	31.39	168.03
		S2	16.86	11.10	1.95	1.22	1.72	32.85	13.77	20.83	11.80	13.39	16.41	76.20
		S3	9.64	9.65	2.27	0.83	3.94	26.33	13.62	23.36	6.22	6.22	8.75	58.17
CD(0.05)			6.87	5.26	2.38	2.81	3.81	12.18	10.72	8.49	4.54	8.82	6.40	18.72
CV%			24.41	21.29	47.46	80.73	64.68	18.12	44.44	26.91	31.54	62.45	33.04	18.08
Interaction		M and T	11.89	9.11	4.12	NS	NS	21.10	NS	14.70	NS	NS	NS	32.43
		T and M	9.92	8.33	3.51	NS	NS	18.00	NS	13.59	NS	NS	NS	27.09
Experimental Mean			27.39	24.04	4.88	3.39	5.73	65.43	23.48	30.72	14.01	13.74	18.85	100.80

M1- Mechanised transplanting/Transplanting (if transplanters not available)
M2-Puddled direct seeding (preferably line sowing by drumseeder)
M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check
S2-Mechanical weeding using weeder
S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Contd.

		Pattambi													
		Active tillering stage							Panicle initiation stage						
Main plot	Sub plot Treatments	Grasses	sedges	BLW				Total	Grasses	sedges	Marselia quadrifolia	Monochoria vaginalis	Sagittaria nymphoides	Sphenoclea zeylanica	Total
		Isachne milliaceae	<i>Fimbristylis milliaceae</i>	Marselia quadrifolia	Monochoria vaginalis	Sagittaria nymphoides	Sphenoclea zeylanica		Isachne milliaceae	<i>Fimbristylis milliaceae</i>					
M1	S1	2.87	7.40	12.33	5.73	1.50	10.23	40.07	20.30	9.90	13.70	7.43	3.57	14.43	69.33
	S2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	7.67	0.00	0.00	0.00	0.00	20.67
	S3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.20	7.50	4.80	0.00	0.00	0.00	30.50
M2	S1	6.13	36.33	6.70	1.13	0.73	9.30	60.33	26.87	14.47	11.83	5.83	3.63	16.30	78.93
	S2	2.10	17.80	2.10	0.00	0.00	7.87	29.87	10.63	8.23	4.50	0.00	0.00	0.00	23.37
	S3	3.00	2.70	0.00	0.00	0.00	0.00	5.70	8.27	6.27	0.00	0.00	0.00	0.00	14.53
M3	S1	6.83	5.93	6.57	4.80	1.67	15.93	41.73	14.00	12.17	9.90	5.20	3.00	13.57	57.83
	S2	8.67	6.83	0.00	0.00	0.00	0.00	15.50	8.17	8.93	0.00	0.00	0.00	0.00	17.10
	S3	5.57	1.47	0.00	0.00	0.00	0.00	7.03	17.33	6.03	0.00	0.00	0.00	0.00	23.37
Mean of Factor-1															
Mean of Factor-2	M1	0.96	2.47	4.11	1.91	0.50	3.41	13.36	17.17	8.36	6.17	2.48	1.19	4.81	40.17
	M2	3.74	18.94	2.93	0.38	0.24	5.72	31.97	15.26	9.66	5.44	1.94	1.21	5.43	38.94
	M3	7.02	4.74	2.19	1.60	0.56	5.31	21.42	13.17	9.04	3.30	1.73	1.00	4.52	32.77
	CD(0.05)	2.31	2.51	ns	0.59	ns	0.91	4.48	NS	ns	0.97	ns	ns	ns	3.19
	CV%	70.65	34.35	50.10	54.26	69.66	22.60	24.04	34.49	22.50	23.37	61.42	36.79	35.73	10.23
Interaction	S1	5.28	16.56	8.53	3.89	1.30	11.82	47.38	20.39	12.18	11.81	6.16	3.40	14.77	68.70
	S2	3.59	8.21	0.70	0.00	0.00	2.62	15.12	10.60	8.28	1.50	0.00	0.00	0.00	20.38
	S3	2.86	1.39	0.00	0.00	0.00	0.00	4.24	14.60	6.60	1.60	0.00	0.00	0.00	22.80
	CD(0.05)	1.58	2.06	1.55	0.74	0.29	1.26	3.31	4.27	0.99	1.26	1.08	0.40	2.07	5.60
	CV%	39.26	22.98	49.01	55.25	64.66	25.52	14.47	27.36	10.68	24.65	51.16	34.13	40.96	14.63
Experimental Mean	M and T	ns	3.56	ns	1.27	ns	2.19	5.73	ns	ns	2.18	ns	ns	ns	ns
	T and M	ns	3.28	ns	1.09	ns	1.85	5.43	ns	ns	1.86	ns	ns	ns	ns
		3.91	8.72	3.08	1.30	0.43	4.81	22.25	15.20	9.02	4.97	2.05	1.13	4.92	37.29

M1- Mechanised transplanting/Transplanting (if transplanters not available) S1-Weedy check
M2-Puddled direct seeding (preferably line sowing by drumseeder) S2-Mechanical weeding using weeder
M3-Un-puddled dry direct seeding (line sowing) S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Summary on Group wise Weed dry biomass g/m2 of Long term trial on weed dynamics in rice under different establishment methods, Rabi 2024-2025.

		Karaikal									
Main plot	Sub plot Treatments	Active tillering stage					Panicle initiation stage				
		Grasses	sedges	BLW	total		Grasses	sedges	BLW	total	
M1	S1	26.59	7.48	8.49	42.55		35.39	12.17	50.79	98.35	
	S2	10.26	4.71	1.32	16.28		4.94	10.04	23.96	38.94	
	S3	4.46	3.03	6.59	14.07		13.67	21.70	27.38	62.74	
M2	S1	48.39	45.88	21.89	116.16		38.87	72.95	72.55	184.37	
	S2	20.85	16.25	6.20	43.30		20.43	20.05	26.24	66.72	
	S3	14.73	11.98	8.84	35.55		5.81	17.25	18.96	42.02	
M3	S1	92.03	100.70	59.87	252.60		54.92	58.78	107.68	221.38	
	S2	19.46	12.35	7.17	38.97		15.94	32.38	74.60	122.93	
	S3	9.73	13.93	5.69	29.36		21.37	31.12	17.26	69.75	
Mean of Factor-1											
	M1	13.77	5.07	5.46	24.30		18.00	14.64	34.04	66.68	
	M2	27.99	24.70	12.31	65.00		21.71	36.75	39.25	97.71	
	M3	40.41	42.33	24.24	106.98		30.74	40.76	66.51	138.02	
	CD(0.05)	3.99	6.25	5.99	9.56		NS	10.54	12.06	11.13	
	CV%	17.40	31.07	51.08	17.46		42.68	40.97	30.90	13.19	
Mean of Factor-2											
	S1	55.67	51.36	30.08	137.11		43.06	47.97	77.00	168.03	
	S2	16.86	11.10	4.89	32.85		13.77	20.83	41.60	76.20	
	S3	9.64	9.65	7.04	26.33		13.62	23.36	21.20	58.17	
	CD(0.05)	6.87	5.26	7.04	12.18		10.72	8.49	15.31	18.72	
	CV%	24.41	21.29	48.96	18.12		44.44	26.91	31.98	18.08	
	Interaction										
	M and T	11.89	9.11	12.20	21.10		NS	14.70	ns	32.43	
	T and M	9.92	8.33	10.50	18.00		NS	13.59	ns	27.09	
Experimental Mean		27.39	24.04	14.01	65.43		23.48	30.72	46.60	100.80	

M1- Mechanised transplanting/Transplanting (if transplanters not available)
M2-Puddled direct seeding (preferably line sowing by drumseeder)
M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check
S2-Mechanical weeding using weeder
S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Contd.

Main plot	Sub plot Treatments	Pattambi							
		Active tillering stage				Panicle initiation stage			
		Grasses	sedges	BLW	total	Grasses	sedges	BLW	total
M1	S1	2.87	7.40	29.80	40.07	20.30	9.90	39.13	69.33
	S2	0.00	0.00	0.00	0.00	13.00	7.67	0.00	20.67
	S3	0.00	0.00	0.00	0.00	18.20	7.50	4.80	30.50
M2	S1	6.13	36.33	17.87	60.33	26.87	14.47	37.60	78.93
	S2	2.10	17.80	9.97	29.87	10.63	8.23	4.50	23.37
	S3	3.00	2.70	0.00	5.70	8.27	6.27	0.00	14.53
M3	S1	6.83	5.93	28.97	41.73	14.00	12.17	31.67	57.83
	S2	8.67	6.83	0.00	15.50	8.17	8.93	0.00	17.10
	S3	5.57	1.47	0.00	7.03	17.33	6.03	0.00	23.37
Mean of Factor-1									
Mean of Factor-2	M1	0.96	2.47	9.93	13.36	17.17	8.36	14.64	40.17
	M2	3.74	18.94	9.28	31.97	15.26	9.66	14.03	38.94
	M3	7.02	4.74	9.66	21.42	13.17	9.04	10.56	32.77
	CD(0.05)	2.31	2.51	ns	4.48	NS	ns	1.44	3.19
	CV%	70.65	34.35	13.49	24.04	34.49	22.50	13.12	10.23
	S1	5.28	16.56	25.54	47.38	20.39	12.18	36.13	68.70
	S2	3.59	8.21	3.32	15.12	10.60	8.28	1.50	20.38
	S3	2.86	1.39	0.00	4.24	14.60	6.60	1.60	22.80
	CD(0.05)	1.58	2.06	1.73	3.31	4.27	0.99	3.18	5.60
	CV%	39.26	22.98	17.46	14.47	27.36	10.68	23.69	14.63
Interaction M and T T and M Experimental Mean	Interaction								
	M and T	ns	3.56	2.99	5.73	ns	ns	ns	ns
	T and M	ns	3.28	2.51	5.43	ns	ns	ns	ns
Experimental Mean		3.91	8.72	9.62	22.25	15.20	9.02	13.08	37.29

M1- Mechanised transplanting/Transplanting (if transplanters not available)

M2-Puddled direct seeding (preferably line sowing by drumseeder)

M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check

S2-Mechanical weeding using weeder

S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Summary on Species wise Relative Weed Density & Weed Control Efficiency % of Long term trial on weed dynamics in rice under different establishment methods, Rabi 2024-2025.

Main plot	Sub plot Treatments	Karaikal									
		Active tillering stage					Panicle initiation stage				
		Grasses	sedges	BLW			Grasses	sedges	BLW		
		<i>Echinochloa colona</i>	Cyperus iria	Aeschynomene indica	Bergia capensis	Hydrolea zeylanica	<i>Echinochloa colona</i>	Cyperus iria	Aeschynomene indica	Bergia capensis	Hydrolea zeylanica
M1	S1	34.91	22.71	15.50	7.68	19.20	28.62	30.84	12.99	10.70	16.85
	S2	51.75	30.48	10.35	0.00	7.43	16.77	21.17	19.15	24.81	18.10
	S3	49.65	21.00	14.42	0.00	14.93	28.21	19.03	18.07	18.07	16.62
M2	S1	43.51	27.83	9.15	8.87	10.64	31.23	24.96	14.92	12.18	16.71
	S2	38.74	22.58	12.49	13.76	12.43	32.24	25.50	14.94	14.44	12.87
	S3	43.13	24.55	18.08	6.49	7.75	22.79	24.97	18.17	16.62	17.45
M3	S1	41.81	45.28	4.87	4.16	3.88	36.11	18.59	16.17	14.58	14.55
	S2	55.69	22.50	6.52	8.08	7.21	28.02	19.93	14.85	18.60	18.59
	S3	17.87	54.92	8.60	6.67	11.94	48.28	23.96	9.10	8.52	10.14

Main plot	Sub plot Treatments	Karaikal								Weed Control Efficiency	
		Active tillering stage				Panicle initiation stage					
		Grasses		sedges		Grasses		sedges			
		BLW		BLW		BLW		BLW			
M1	S1	34.91	22.71	42.38	28.62	30.84	40.53	0.00	0.00		
	S2	51.75	30.48	17.78	16.77	21.17	62.06	61.15	53.18		
	S3	49.65	21.00	29.35	28.21	19.03	52.76	66.01	24.56		
M2	S1	43.51	27.83	28.67	31.23	24.96	43.81	0.00	0.00		
	S2	38.74	22.58	38.68	32.24	25.50	42.25	61.94	64.68		
	S3	43.13	24.55	32.32	22.79	24.97	52.24	68.66	77.76		
M3	S1	41.81	45.28	12.91	36.11	18.59	45.30	0.00	0.00		
	S2	55.69	22.50	21.81	28.02	19.93	52.04	84.75	49.90		
	S3	17.87	54.92	27.21	48.28	23.96	27.76	88.16	71.58		

M1- Mechanised transplanting/Transplanting (if transplanters not available)

M2-Puddled direct seeding (preferably line sowing by drumseeder)

M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check

S2-Mechanical weeding using weeder

S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

Trial 4.4.1(R): Contd.

		Pattambi													
Main plot		Sub plot Treatment s	Active tillering stage						Panicle initiation stage						
			Grasses		sedges		BLW		Grasses		sedges		BLW		
			Isachne milliaceae	<i>Fimbristylis milliaceae</i>	Marselia quadrifolia	Monochoria vaginalis	Sagittaria nymphoides	Sphenocle a zeylanica	Isachne milliaceae	<i>Fimbristylis milliaceae</i>	Marselia quadrifolia	Monochoria vaginalis	Sagittaria nymphoides	Sphenocle a zeylanica	
M1	S1	8.48	26.42	21.65	16.64	4.52	23.45	47.40	10.91	10.54	14.91	3.29	12.96		
	S2	0.00	0.00	0.00	0.00	0.00	0.00	52.95	47.05	0.00	0.00	0.00	0.00		
	S3	0.00	0.00	0.00	0.00	0.00	0.00	60.19	26.77	13.04	0.00	0.00	0.00		
M2	S1	8.41	48.88	11.56	4.08	1.87	26.10	48.29	18.86	7.41	10.49	2.20	14.69		
	S2	5.33	58.40	10.23	0.00	0.00	26.04	50.95	27.42	21.63	0.00	0.00	0.00		
	S3	49.11	50.89	0.00	0.00	0.00	0.00	82.33	17.67	0.00	0.00	0.00	0.00		
M3	S1	22.66	21.72	17.04	13.82	5.17	20.80	33.68	16.29	19.49	8.05	3.88	16.14		
	S2	53.26	46.74	0.00	0.00	0.00	0.00	56.06	43.94	0.00	0.00	0.00	0.00		
	S3	62.24	37.76	0.00	0.00	0.00	0.00	92.19	7.81	0.00	0.00	0.00	0.00		

Main plot	Sub plot Treatments	Pattambi										Weed Control Efficiency	
		Active tillering stage					Panicle initiation stage						
		Grasses	sedges	BLW	Grasses	sedges	BLW	AT stage	PI stage				
M1	S1	8.48	26.42	65.10	47.40	10.91	41.69	0.00	0.00	0.00	0.00		
	S2	0.00	0.00	0.00	52.95	47.05	0.00	100.00	70.25				
	S3	0.00	0.00	0.00	60.19	26.77	13.04	100.00	56.24				
M2	S1	8.41	48.88	42.72	48.29	18.86	32.85	0.00	0.00	0.00	0.00		
	S2	5.33	58.40	36.28	50.95	27.42	21.63	50.52	69.76				
	S3	49.11	50.89	0.00	82.33	17.67	0.00	90.68	81.56				
M3	S1	22.66	21.72	55.62	33.68	16.29	50.03	0.00	0.00	0.00	0.00		
	S2	53.26	46.74	0.00	56.06	43.94	0.00	62.91	72.82				
	S3	62.24	37.76	0.00	92.19	7.81	0.00	83.27	62.59				

M1- Mechanised transplanting/Transplanting (if transplanters not available)

M2-Puddled direct seeding (preferably line sowing by drumseeder)

M3-Un-puddled dry direct seeding (line sowing)

S1-Weedy check

S2-Mechanical weeding using weeder

S3-Chemical weed control* (Herbicide recommendation of respective University may be followed)

4.4.2. Farmers field weed monitoring in different rice establishment systems

To monitor shifts in weed flora, infestation levels, and herbicide efficacy or resistance, a systematic survey was initiated in *Kharif 2025* across diverse rice establishment systems, including transplanted, wet direct-seeded (Wet-DSR), and dry direct-seeded rice (Dry-DSR). Surveys were conducted using a standardized proforma at 11 locations representing seven agro-climatic zones: Bankura, Chinsurah, Chiplita, Karaikal, Ludhiana, Moncompu, Navsari, Pantnagar, Raipur, Titabar, and Vytilla. No data were reported from the remaining locations. The collected information has been summarized, and the results are presented herein.

Zone II

Ludhiana

Diagnostic Survey of Weed Flora and Emerging Problems

The survey reveals a highly competitive weed spectrum dominated by grasses and annual sedges, which are primary constraints in the puddled transplanted and direct-seeded rice (DSR) systems of Punjab. Grassy Weed Dominance: *Echinochloa crus-galli* and *Leptochloa chinensis* are the most consistently ranked top-tier weeds. Notably, *Eleusine aegyptiaca* and *Eleusine indica* were frequently identified as Rank 1 or 2 threats in several villages (Sanaur, Longowal, Ratal), indicating a shift towards more drought-tolerant grassy weeds. Sedge Complex: *Cyperus iria* and *Cyperus difformis* are ubiquitous across all 24 sites. Interestingly, the perennial sedge *Cyperus rotundus* (Purple nutsedge) was documented as a significant problem in villages like Sadhawala, Salempur, and Chatha, which often indicates a history of reduced tillage or moisture stress. Broad-leaved Weeds: Species like *Eclipta alba*, *Ammannia baccifera*, and *Sphenoclea zeylanica* remain secondary but persistent associates.

Documentation of Farmer Practices and Herbicide Use

Ludhiana station demonstrates the highest diversity and intensity of chemical weed control among all surveyed stations, with nearly 100% adoption of Pre-emergence (PE) herbicides. Pre-emergence (PE) Protocols: Farmers utilize a wide range of PE molecules, including Butachlor 50 EC (1200 ml/acre), Pretilachlor 50 EC (650 ml/acre), Rift Plus, and Stomp 30 EC (Pendimethalin). The use of Pendimethalin is particularly prevalent in clusters where *Eleusine* species are dominant. Post-emergence (POE) Interventions: Over 60% of the respondents supplement PE application with a follow-up POE spray, primarily Nominee Gold 10 SC (Bispyribac-sodium) at 100–150 ml/acre. In specific cases targeting grassy weeds, Rice Star (Fenoxaprop-p-ethyl) is employed (Ratal, Talwandi Chaudhrian). Manual Weeding Trends: Unlike other stations, manual weeding is used alternatively rather than additively. Farmers either follow a strict "PE + POE" chemical program or a "PE + 1 Hand Weeding" program. This strategic choice is likely driven by the high cost and scarcity of labor in Punjab.

Economics of Management and Productivity Trends

The data highlights a highly optimized economic structure focused on maximizing grain yield per unit of input. Weed Control Economics: The total weed control cost is relatively moderate, ranging from Rs 800 to Rs 2,600/acre. The lowest costs were observed in "Hand Weeding only"

scenarios, while the highest costs were associated with dual-herbicide programs targeting complex weed floras. Productivity Benchmarks: Grain yields are high and remarkably consistent, ranging from 25 to 33 qtl/acre (roughly 6.2 to 8.2 t/ha). The highest yield of 33 qtl/acre was achieved in Nidhanwala through a "Rift Plus + Nominee Gold" regime, emphasizing the productivity benefits of a robust chemical program. Total Cultivation Cost: Average cultivation costs fluctuate between Rs 16,000 and Rs 23,000/acre, with weed management accounting for approximately 5–12% of the total expenditure.

Strategic Recommendations

The Ludhiana survey underscores a mature Integrated Weed Management (IWM) system that is heavily reliant on chemical tools. Addressing Herbicide Resistance: The heavy and repeated use of Bispyribac-sodium (Nominee Gold) across the region poses a significant risk for the development of resistance in *Echinochloa* species. Promoting a rotation of different Modes of Action (MoA) is critical. Focus on Eleusine Species: The emergence of *Eleusine aegyptiaca* as a Rank 1 weed suggests a need for strengthening Pendimethalin-based pre-emergence protocols, as this weed is often less susceptible to standard post-emergence rice herbicides. DSR Adaptations: For farmers moving towards DSR to save water, the documented success of Rice Star and Stomp 30 EC in this survey provides a strong baseline for developing DSR-specific weed management packages.

Pantnagar

Diagnostic Survey of Weed Flora and Emerging Problems

The weed flora in the Tarai and Bhabar regions of Uttarakhand shows a remarkable consistency across all 24 surveyed locations, dominated by aggressive grasses and a complex of sedges. Grassy Weed Dominance: *Echinochloa colona*, *Echinochloa crus-galli*, and *Echinochloa indica* are the primary competitors, occupying the top three ranks in every village. This persistent grass pressure is characteristic of the intensive rice-wheat cropping systems of North India. Sedge Complex: A "triple-sedge" threat consisting of *Cyperus iria*, *Cyperus difformis*, and *Cyperus rotundus* was documented in nearly all sites. The presence of *C. rotundus* (purple nutsedge) is particularly noteworthy as it is a perennial weed that is more difficult to control than annual sedges.

Documentation of Farmer Practices and Management Decisions

The Pantnagar cluster exhibits the most standardized weed management protocol among all surveyed stations, characterized by a "Three-Tier" approach. Pre-emergence (PE) Application: 100% of the farmers utilize Pretilachlor 37% EW at a dose of 600 ml/acre applied before transplanting. This indicates a high level of technical adoption to tackle the initial weed flush. Post-emergence (POE) Follow-up: To address escapes, farmers consistently apply a follow-up spray 30–35 days after transplanting (DOT). The dominant choice is Nominee Gold (Bispyribac-sodium) 80 ml/acre + MSM (Metsulfuron-methyl) 8 g/acre. In select areas like Gangapur, Council Activ (90 g/acre) is also used. Manual Supplementation: Despite two rounds of chemical intervention, all farmers still perform one manual weeding. This "Insurance

Weeding" ensures the removal of perennial escapes like *Cyperus rotundus* that may have survived the chemical sprays.

Economics of Management and Productivity Trends

The survey reveals a highly efficient and uniform economic structure in this region. Notably, the Total Weed Control Cost is a constant Rs 2,150/ha across all 24 surveyed villages. This suggests a highly organized input market where herbicide prices and labor costs for weeding are standardized. Cost Efficiency: While the total cost of cultivation varies significantly (from Rs 32,058/ha in Bhagwada to Rs 47,358/ha in Gangapur), the weed control cost represents a relatively small and optimized fraction of the total budget (roughly 4.5% to 6.7%). Stable Productivity: Grain yields are consistently high and stable, ranging from 50 to 55 qtl/ha (5.0 to 5.5 t/ha). This stability indicates that the current Integrated Weed Management (IWM) strategy is highly effective in mitigating yield losses due to weed competition.

Strategic Recommendations

The Pantnagar station serves as a model for a "Chemistry-First" IWM approach. However, there are areas for future research: Herbicide Resistance Monitoring: Given the total uniformity in herbicide selection (Pretilachlor followed by Nominee Gold), there is a high risk of weeds (specifically *Echinochloa* species) developing resistance. Rotating molecules or introducing newer mixtures should be prioritized. Perennial Sedge Management: Since *Cyperus rotundus* remains in the dominant weed list despite intensive spraying and manual weeding, targeted subterranean tuber-management strategies may be needed. Refining Manual Weeding: Research could explore if a more potent POE mixture could eliminate the need for the final manual weeding, further reducing the labor dependency of the region.

Zone III

Chinsurah Station (West Bengal)

Diagnostic Survey of Weed Flora and Emerging Problems

The survey reveals a high degree of weed diversity across the surveyed districts, with distinct shifts in dominance based on the crop establishment method (transplanted vs. direct-seeded). Grass Dominance: *Echinochloa colona* and *Echinochloa crus-galli* remain the most problematic grasses across all locations. In Purulia (Rampur and Jamunaband), *Cynodon dactylon* emerged as a significant perennial threat, likely due to different moisture regimes or soil types. Sedge Complex: *Cyperus difformis* and *Cyperus iria* are the primary sedges in Hooghly, while *Cyperus rotundus* is highly ranked in the Purulia sites, indicating a more persistent sedge problem in those areas. Broad-leaved and Aquatic Weeds: *Ludwigia parviflora*, *Monochoria vaginalis*, and *Ammania baccifera* are the major BLWs. Notably, the presence of Algal weeds, *Marsilea quadrifolia*, and *Chara zeylanica* in the Hooghly district (Uttar Simla, Damra) suggests issues with stagnant water or poor drainage management.

Documentation of Farmer Practices and Herbicide Use

Unlike the previous stations, the Chinsurah cluster shows a highly diversified weed management strategy, combining chemical and physical methods. Pre-emergence (PE) Trends:

A significant number of farmers utilize Pyrazosulfuron-ethyl 10 WP (Saathi) at 200 g/ha applied at 2 DAT or 2 DAS (Days After Sowing). This indicates a higher awareness of early-season weed control compared to the Gujarat cluster. Post-emergence (POE) Interventions: Modern molecules are widely used. Farmers are adopting Triafamone + Ethoxysulfuron (Council Activ), Bispyribac-sodium (Nominee Gold), and Ethoxysulfuron (Sunrice). These are often applied between 15 and 20 days after establishment. Integrated Management: Almost all chemical applications are supplemented by at least one hand weeding. In cases where no herbicide is used (e.g., Jamunaband), farmers resort to hand weeding up to three times (at 2, 5, and 8 weeks), highlighting a high labor dependency in the absence of chemical tools.

Economics of Management and Productivity Trends

The data highlights a clear correlation between the district, management intensity, and the resulting grain yield. Regional Productivity Gap: The Hooghly district (Uttar Simla, Damra, Khalsi) consistently achieved higher productivity, with grain yields ranging from 4.90 to 5.30 t/ha. Conversely, the Purulia district (Rampur, Jamunaband) reported lower yields, fluctuating between 3.90 and 4.50 t/ha. Cost vs. Yield Dynamics: The highest weed control cost was recorded in Jamunaband (Rs 31,500/ha), where a triple hand-weeding strategy was employed. Interestingly, some of the highest yields in Damra (5.30 t/ha) were achieved with a PE herbicide and a single hand weeding, costing only Rs 15,100/ha. This demonstrates that chemical-led integrated management is more cost-effective than pure manual weeding. Establishment Method: The transition from transplanting to sowing (DAS) often necessitated more intensive weed control (e.g., hand weeding at 5 and 8 weeks), which increased management costs without always yielding higher returns.

Strategic Decisions

The Chinsurah survey demonstrates that West Bengal farmers are progressively adopting modern herbicides, yet the weed burden remains high. Optimizing Saathi (PE): While Pyrazosulfuron is popular, the high weed control costs suggest that escapes are frequent, necessitating expensive manual labor. Research into "herbicide mixtures" (PE + POE) could further reduce costs. Addressing the "Purulia Gap": The lower yields in Purulia despite high weed control costs (up to Rs 25,100/ha) suggest that weeds like *Cynodon dactylon* and *Cyperus rotundus* are not being adequately managed by current practices. Efficiency Gains: The data suggests that switching from multiple hand weedings to a targeted POE (like Triafamone + Ethoxysulfuron) can save farmers approximately Rs 10,000–12,000/ha while maintaining yields above 5 t/ha.

Zone IV – Titabar

The diagnostic survey data from the Titabar station (covering the Jorhat, Goalpara, and Golaghat districts of Assam) reflects the unique weed challenges of the Brahmaputra valley, characterized by high moisture availability and a reliance on manual labor-intensive management.

Diagnostic Survey of Weed Flora and Emerging Problems

The weed community in the surveyed cluster of Assam shows a high prevalence of aquatic and semi-aquatic species, typical of the humid, rainfed, and lowland rice ecosystems. Dominant Weed Spectrum: *Cyperus spp.* and *Echinochloa spp.* consistently occupy the top two rankings across all 24 surveyed sites in Deogharia and Dihingia. Aquatic and Broad-leaved Weeds: A significant finding is the presence of specialized weeds such as *Ceratophyllum* (an aquatic plant), *Marsilea quadrifolia* (water clover), and *Scirpus*. These species indicate fields with high water retention or poor drainage. Secondary Threats: *Eclipta prostrata*, *Amaranthus spp.*, and *Fimbristylis milicea* were also frequently documented, contributing to the overall complexity of the weed seed bank.

Documentation of Farmer Practices and Management Decisions

The survey documentation reveals that weed management in this region is predominantly physical, with chemical interventions acting only as a secondary supplement. Manual Weeding Dominance: Every single respondent (100%) relies on manual weeding. The labor intensity is high, typically requiring 3 to 6 Man-Days (MD) per session over a period of 3 to 6 days. This represents a traditional, labor-heavy approach compared to the chemically driven systems of North India. Limited Herbicide Adoption: Pre-emergence (PE): Only about 25% of farmers utilize Pyrazosulfuron Ethyl 10% WP, indicating that the majority of the community deals with the initial weed flush manually. Post-emergence (POE): Adoption is even lower, with only a few farmers in Deogharia utilizing Bispyribac Sodium 10% w/v SC. Cultural Context: The high reliance on manual labor suggests either a lack of awareness regarding chemical efficiency or the availability of local farm labor during the critical weeding window.

Economics of Management and Productivity Trends

The economic data highlights a region with low cash investment in weed control but consistent productivity. Low Direct Weed Control Costs: The total weed control cost is remarkably low, ranging from Rs 1,600 to Rs 3,200/ha. This is likely because much of the "manual weeding" may involve family labor or localized labor exchange that does not reflect a high market-rate cash outflow. Cultivation Costs: The total cost of cultivation is fairly uniform, averaging between Rs 50,000 and Rs 56,000/ha. Weed management accounts for only about 3% to 6% of the total budget. Yield Stability: Despite the low chemical input, grain yields are stable, ranging from 3.6 to 4.4 t/ha. This suggests that while manual weeding is labor-intensive, it is currently effective enough to maintain respectable yields in the traditional rice varieties of Assam.

Strategic Recommendations

The Titabar station data highlights a "low-input, high-labor" management system. To improve efficiency, the following is recommended: Promoting Early Intervention: Since *Cyperus* and *Echinochloa* are the primary threats, increasing the adoption of pre-emergence herbicides like Pyrazosulfuron could drastically reduce the requirement for 5–6 Man-Days of labor. Introduction of Mechanical Weeders: Given the reliance on manual labor, the introduction of simple tools like the Mandava weeder or cono-weeder could reduce the physical drudgery for farmers in Dihingia and Deogharia. Managing Aquatic Weeds: Specific focus on *Ceratophyllum* and *Marsilea* is needed, as these are often not well-controlled by standard herbicides used for grasses.

Zone VI – Navsari and Tapi

Based on the survey data from the Navsari station covering villages in the Tapi and Navsari districts of Gujarat, the following results were obtained. The floristic survey reveals a highly consistent weed spectrum across the South Gujarat rice-growing tract. The weed community is primarily composed of grasses and sedges, with broad-leaved weeds appearing as secondary associates. Dominant Grasses: *Echinochloa colonum* (Jungle rice) and *Echinochloa crusgalli* (Barnyard grass) were the most frequently ranked dominant weeds across nearly all 24 surveyed sites. *Dactyloctenium aegyptium* and *Digitaria sanguinalis* were also noted as significant grass competitors. Dominant Sedges: *Cyperus iridea* and *Cyperus difformis* were ubiquitous, consistently appearing in the top three rankings. *Fimbristylis miliacea* was particularly prevalent in villages like Vyara, Kalakava, and Bhnavadi. Emerging Broad-leaved Weeds: *Eclipta alba* was present in almost every village, while *Rotala densiflora* (Sindhali, Upsal) and *Marsilea quadrifolia* (Vyara, Godthal) are emerging as location-specific problems that may require specialized management.

Documentation of Farmer Practices and Management Decisions

The survey highlights a traditional, labour-intensive approach to weed management in this region, which stands in stark contrast to more chemically-driven zones. Zero Herbicide Reliance: Notably, across all 24 surveyed locations, neither pre-emergence nor post-emergence herbicides were utilized. Farmers in this cluster depend entirely on physical/cultural methods. Manual Weeding Patterns: The universal practice is two manual weeding. The first is typically conducted between 30–45 days after transplanting (DAT), and the second coincides with the maximum tillering or panicle initiation stage (50–70 DAT). This timing is critical as it protects the crop during its most sensitive reproductive transition.

Economics of Management and Productivity Trends

The survey data reveals a clear "yield-cost" stratification among the surveyed villages, likely influenced by water availability or soil types in Navsari vs. Tapi. Productivity Gaps: Two distinct yield groups emerged. Villages like Sindhali, Sarav, and Dabhali achieved higher grain yields exceeding 5000 kg/ha. Conversely, a cluster including Panwadi, Bhnavadi, Vandardevi, and Vadapada consistently reported lower yields ranging from 3280 to 3420 kg/ha.

Weed Control Economics: Despite the low yields in the second cluster, the total weed control cost remained relatively high (averaging Rs 8,700 to Rs 9,900/ha). The highest weed management cost was recorded in Mandir and Nagdhara (Rs 10,200/ha).

Total Cultivation Cost: There is a significant disparity in total investment. High-yielding villages often had total cultivation costs exceeding Rs 80,000/ha, whereas the lower-yielding cluster operated on budgets of roughly Rs 62,000 to Rs 63,000/ha. This suggests that while manual weeding is consistent, other input factors (fertilizers/irrigation) are likely limiting the yield in the lower-tier cluster.

Key Recommendations for Targeted Technology Development

The total reliance on manual weeding in South Gujarat presents a significant opportunity for the introduction of Integrated Weed Management (IWM) technologies: Chemical Intervention: Introducing low-dose pre-emergence herbicides (e.g., Pretilachlor or Pendimethalin) could significantly reduce the cost of the first manual weeding (Rs 7,200–10,200/ha), which currently accounts for roughly 12–15% of total cultivation costs. Mechanical Weeding: Since the crop is transplanted, the promotion of Cono-weeders or power weeders could address the labor shortage issues implied by the high cost of manual weeding. Targeted Solutions for *Echinochloa*: Given the dominance of *Echinochloa* species, specific post-emergence options should be demonstrated to farmers to replace the strenuous second manual weeding at the panicle initiation stage.

Zone VII

Karaikal

Diagnostic Survey of Weed Flora and Emerging Problems

The survey identifies a weed community characterized by the heavy dominance of sedges and specialized aquatic broad-leaved weeds, typical of the Cauvery deltaic region. Sedge Dominance: *Cyperus difformis* is the undisputed Rank 1 weed across almost 90% of the surveyed farms. This is followed closely by *Cyperus iria*, indicating that sedges are the primary biological constraint in Karaikal rice fields. Broad-leaved Weed (BLW) Complex: *Bergia capensis* and *Marsilea quadrifolia* are emerging as significant problems, frequently appearing in the Rank 2 and Rank 3 positions. The prevalence of *Marsilea quadrifolia* (an aquatic fern) suggests prolonged submerged conditions in the fields of Surakudi and Agalankannu. Grassy Weeds: While sedges dominate, grasses like *Echinochloa crusgalli*, *Leptochloa chinensis*, and *Echinochloa colonum* remain persistent threats, particularly in the Direct Seeded Rice (DSR) or early-season transplanted fields.

Documentation of Farmer Practices and Herbicide Use

Karaikal farmers demonstrate a sophisticated, chemistry-heavy approach to weed management, largely omitting pre-emergence steps in favor of complex post-emergence (POE) combinations. Post-emergence (POE) Reliance: There is a 100% absence of pre-emergence herbicide use among the 25 respondents. Instead, farmers rely heavily on Nominee Gold (Bispyribac-sodium) applied at 15 Days After Sowing (DAS). Herbicide Tank-Mixes & Sequences: To combat the diverse weed flora, farmers are adopting advanced combinations: Nominee Gold + Council Activ: A popular mix for broad-spectrum control of sedges and grasses. 2,4-D: Frequently used as a follow-up spray at 25 DAS to specifically target broad-leaved weeds and sedge escapes. Integrated Manual Weeding: Despite intensive chemical use, 100% of farmers still perform manual weeding, typically between 35 and 45 DAS/DAT. This suggests that current herbicide regimes are not providing "season-long" weed-free conditions.

Economics of Management and Resource Allocation

The economic data reveals a high investment in weed management relative to the typical cost structures seen in other districts. Weed Control Costs: The total weed control cost fluctuates significantly, from a low of Rs 3,750/ha to a high of Rs 8,630/ha. Cost Drivers: The use of

"Triple Protection" (e.g., Nominee Gold + Rice Star + Manual Weeding) drives the costs to the upper end of the spectrum. Manual weeding alone accounts for a significant portion of the budget, with costs ranging from Rs 2,500 to Rs 7,500 per hectare. Labor Dependency: Interestingly, farmers invest Rs 7,500/ha in manual weeding alone (two sessions), matching the cost of chemical-intensive farms, which highlights the high labor wages or scarcity in the Karaikal region.

Targeted Recommendations

The Karaikal survey demonstrates a "chemically-evolved" farming community that is still struggling with sedge-dominated weed pressure. Shift to Pre-emergence: The total absence of pre-emergence herbicides (like Pretilachlor + Safener) is a major gap. Introducing these could suppress the initial flush of *Cyperus difformis*, potentially eliminating the need for expensive secondary POE sprays like 2,4-D. Sedge-Specific Management: Given that *Cyperus* is the Rank 1 problem, demonstrating high-efficacy sedge-killers like *Halsulfuron-methyl* could provide more targeted and cost-effective relief than broad-spectrum mixes. Water Management: The presence of *Marsilea quadrifolia* and *Bergia capensis* indicates that improving field drainage could naturally reduce the population of these moisture-loving broad-leaved weeds.

Moncompu

The data from the diagnostic survey conducted across nine major rice-growing villages in the Alappuzha district of Kerala reveals a complex weed flora and a heavy reliance on post-emergence chemical interventions.

Dominant Weed Flora and Emerging Problems

The survey identified a diverse weed community dominated by sedges, grasses, and broad-leaved weeds. Sedges like *Fimbristylis miliaceae* and *Cyperus difformis* were ubiquitous across all surveyed locations. Among grasses, *Leptochloa chinensis* and *Echinochloa stagnina* were the most persistent threats. A significant finding is the widespread emergence of weedy rice (*Oryza sativa* f. sp. *spontanea*), recorded in 6 out of 9 villages (Pulincunno, Champakulam, Thalavady, Ramankary, Karuvatta, and Kainakary). The presence of weedy rice, alongside broad-leaved weeds like *Monochoria vaginalis* and *Lindernia* sp., indicates a shifting weed dynamics that complicates traditional management due to the physiological similarity between weedy rice and the cultivated crop.

Current Farmer Practices and Herbicide Use

The documentation of farmer practices reveals a total absence of pre-emergence herbicide use across all villages. Instead, farmers are exclusively dependent on post-emergence (POE) chemical control. The most popular POE combinations involve Loyant + Affinity and Dishum + Affinity. New-generation herbicides like Vivaya (at Pulincunno) and Penflor (at Champakulam) are being adopted, yielding some of the highest grain outputs (7500 kg/ha). While some farmers (e.g., in Nedumudy and Ramankary) rely solely on herbicides, most still integrate manual weeding, ranging from 3 to 25 women/ha, to tackle escapes or weedy rice patches.

Economics of Weed Management and Grain Yield

The economic analysis shows a wide variation in weed management costs, primarily driven by the intensity of manual labor. The highest weed control cost was recorded in Champakulam (Rs 23,750/ha), where a single post-emergence spray was supplemented by 25 manual laborers. In contrast, the lowest cost was in Ramankary (Rs 7,000/ha) using only Dishum. Despite the variation in costs, grain yields remained robust, ranging from 6750 to 7500 kg/ha. Interestingly, the use of Vivaya + Affinity in Pulincunno achieved a peak yield of 7500 kg/ha with a relatively moderate weed control cost (Rs 9,850/ha) and zero manual labor, suggesting high efficacy of this specific chemical combination.

Pattambi

Diagnostic Survey of Weed Flora and Emerging Problems

The weed spectrum in this region is distinct due to the dominance of species that thrive in high-moisture, lowland conditions. Dominant Species: *Isachne miliaceae* and *Echinochloa crusgalli* are the most frequently reported dominant weeds across Vilayur, Edappalam, and Chalisseri. Aquatic Specialists: A significant finding is the prevalence of *Monochoria vaginalis* and *Eichhornia crassipes* (Water hyacinth), alongside *Ludwigia perennis* and *Chara Sp.* (Green algae). These indicate high water levels and potentially poor drainage in certain clusters. Emerging Threats: *Sphagneticola trilobata* (Bayhops) was recorded in multiple plots in Edappalam and Vilayur. Its presence in rice ecosystems is a notable emerging problem as it is typically a creeping perennial that can be difficult to manage with standard rice herbicides.

Documentation of Farmer Practices and Herbicide Use

The Pattambi cluster shows a sophisticated adoption of Pre-emergence (PE) herbicides, representing a proactive management style. Standard PE Protocols: Most farmers utilize EROS (Pretilachlor 6% + Pyrazosulfuron ethyl 0.15%) at 4 kg/acre or Saathi (Pyrazosulfuron ethyl) at 80 g/acre within 2–3 Days After Transplanting (DAT). Tank Mixtures: In some instances, farmers in Vilayur and Edappalam use a combination of Saathi and Refit (Pretilachlor) to broaden the spectrum of control. Post-emergence (POE) Integration: High-yielding farms in Chalisseri and Vilayur supplement their PE application with Nominee Gold (Bispyribac sodium) at 25 DAT to tackle escapes, particularly *Echinochloa* and sedges. Manual Weeding: Manual weeding is employed selectively. While some farmers in Vilayur invest heavily in labor (up to 1 month after transplanting), those using a robust PE + POE program (like in Chalisseri) often omit manual weeding entirely while maintaining high yields.

Economics of Management and Productivity Trends

The data highlights a significant "cost-efficiency" gap depending on the management strategy chosen. Labor vs. Chemical Costs: The survey captured extreme variations in weed control costs. Farmers relying solely on manual weeding in Vilayur reported exorbitant costs (up to Rs 40,000/ha), whereas those utilizing a chemical-led program averaged between Rs 2,000 and Rs 4,500/ha. Total Cultivation Costs: Total investment ranged from Rs 35,000 to as high as Rs 1,20,000/ha. The high-cost outliers are directly linked to intensive manual labor requirements for managing heavy infestations of *Isachne* and *Monochoria*. Yield Performance: Despite the

cost variations, grain yields remained relatively stable at 3.0 to 5.0 t/ha. Notably, the highest yield of 5 t/ha was achieved both by high-cost manual weeding and by low-cost integrated chemical management (Saathi + Nominee Gold), proving that chemical efficiency can replace high labor expenditure without sacrificing productivity.

Strategic Decisions

The Pattambi survey underscores the economic necessity of transitioning from manual labor to integrated chemical management. Addressing *Isachne miliaceae*: Since *Isachne* is a dominant threat, the efficacy of the EROS and Saathi + Refit combinations should be further validated in multi-location trials. Managing Aquatic Flora: The presence of *Eichhornia* and Green algae suggests that weed management must be coupled with improved water level control and land leveling. Cost Rationalization: There is a clear opportunity to save farmers in the Palakkad/Thrissur belt up to Rs 30,000/ha by demonstrating the effectiveness of pre-emergence herbicides over traditional manual weeding.

Table 4.4.2: Weed survey in different zones, kharif 2025.

AICRPR Zones	Villages	District & State	Dominant weed species	Weed control methods			Total Weed Control Cost (Rs/ha)	Total cost of cultivation (Rs/ha)	Grain yield (t/ha)
				Pre emergence herbicide	Post emergence herbicide	Manual weeding			
Zone II									
Ludhiana	Nidhanwala, Gulelra, Chatha, Meerapur, Cholta, Bhadalwad, Kakra, Balad Kalan, Sanaur, Duggan, Sadhawala, Longowal, Ratal, Peerewal, Salempur, Lehra Mohabbat, Talwandi Chaudhrian	Moga, Ludhiana, Bathinda, kapurthala, Gurdaspur, Patiala, Firozepur, Tarn Taran, Sangrur, Amritsar	Grasses: <i>Echinochloa crusgalli</i> , <i>Leptochloa chinensis</i> Sedges: <i>Cyperus iria</i> , <i>Cyperus difformis</i> , <i>Cyperus rotundus</i> BLW: <i>Eclipta alba</i> , <i>Ammannia baccifera</i> , <i>Sphenoclea zeylanica</i>	Rift plus 600ml/acre, Butachlor 50 EC + Pyrazosulfuron ethyl 10 WP 1200 ml/acre + 81 g/acre, Pretlachlor 50 EC 650 ml/acre, Butachlor 50 EC 1200 ml/acre, Stomp 30 EC 1 L/acre, Stomp 30 EC + Saathi 10 WP 1 L/acre + 10 g/acre, Pendimethalin 30 EC + Pyrazosulfuron ethyl 1200 ml/acre + 10 g/acre, Anilofos 30 EC 500 ml/acre	Nominee gold 10 SC 100 ml/acre, Rice Star (Fenoxaprop-p-ethyl) 400 ml/acre	1 Hand weeding	4170	49600	7.3
Pantnagar	Gangapur, Bhagwada, Gadarpur, Ganeshpur, Phulsungha, Anandpur, Pratappur, Rameshwarpur, Saktipharan, Uttam nagar, Matafaram, Rekkhifaram, Kichha, Kanakpur, Dineshpur, Darau Kichha	Udham Singh Nagar, Haridwar, Nainital	Grasses: <i>Echinochloa colona</i> , <i>Echinochloa crus-galli</i> , <i>Echinochloa indica</i> Sedges: <i>Cyperus iria</i> , <i>Cyperus difformis</i> , <i>Cyperus rotundus</i>	Pretlachlor 37% EW @ 600ml/acre	Nomini-gold (80ml/acre) + MSM (8g/ acre) or Council active (90g/acre) After 30-35 DOT	Hand Weeding (one)	2150	41429	5.5

Table 4.4.2: Contd.

AICRPR Zones	Villages	District & State	Dominant weed species	Weed control methods			Total Weed Control Cost (Rs/ha)	Total cost of cultivation (Rs/ha)	Grain yield (t/ha)
				Pre emergence herbicide	Post emergence herbicide	Manual weeding			
Zone III									
Chinsurah	Uttar Simla, Damra, Khalsi, Rampur, Jamunaband	Hooghly, Purulia - West Bengal	Grasses: <i>Echinochloa colona</i> , <i>Echinochloa crusgalli</i> , <i>Cynodon Dactylon</i> Sedges: <i>Cyperus difformis</i> , <i>Cyperus iria</i> , <i>Cyperus rotundus</i> BLW: <i>Ludwigia parviflora</i> , <i>Monochoria vaginalis</i> , <i>Ammania baccifera</i> , <i>Marsilea quadrifolia</i> , <i>Chara zeylanica</i>	Pyrazosulfuron-ethyl 10 WP (Saathi) @ 200 g/ha at 2 DAT	Triafamone + Ethoxysulfuron 30 WG (Council Activ) @ 225 g at 15 DAT, Bispyribac-sodium 10 SC (Nominee Gold) @ 250 ml/ha at 20 DAS, Ethoxysulfuron 15 WDG (Sunrice) @ 125 g/ha at 15 DAT	Hand weeding twice at 3 & 6 weeks after transplanting, Hand weeding twice at 5 & 8 weeks after sowing	21517	76690	4.65
Zone IV									
Titabar	Deoghataria, Dihingia	Jorhat, Goalpara, Golaghat - Assam	Grasses: <i>Echinochloa</i> spp. Sedges: <i>Cyperus</i> spp., Scirpus BLW: <i>Ceratophyllum</i> , <i>Marsilea quadrifolia</i>	Pyrazosulfuron Ethyl 10% WP	Bispyribac Sodium 10 % w/v SC	4 MD, Time-4 days, 5 MD, Time-5 days, 6 MD, Time-5 days	2236	53360	3.99
Zone VI									
Navsari	Sindhai, Sarav, Ranveri Khurd, Abrama, Ponsara, Vyara, Panwadi, Bhnavadi, Dabhlai, Mahudi, Mandir, Upsal, Naranpore, Vandardevi, Vadapada, Godthal, Boriach, Kalakava, Nagdhara, Kalakava, Singod, Nandhai	Navsari, Tapi - Gujarat	Grasses: <i>Echinochloa colonum</i> , <i>Echinochloa crusgalli</i> , <i>Dactyloctenium aegyptium</i> , <i>Digitaria sanguinalis</i> Sedges: <i>Cyperus iridea</i> , <i>Cyperus difformis</i> , <i>Fimbristylis miliacea</i> BLW: <i>Eclipta alba</i> , <i>Rotala densiflora</i> , <i>Marsilea quadrifolia</i>			2 times; at maximum tillering and panicle initiation stage, 2 times: first at 30-40 days and other 50-60 days after transplanting	9063	76767	4.55

Table 4.4.2: Contd.

AICRPR Zones	Villages	District & State	Dominant weed species	Weed control methods			Total Weed Control Cost (Rs/ha)	Total cost of cultivation (Rs/ha)	Grain yield (t/ha)
				Pre emergence herbicide	Post emergence herbicide	Manual weeding			
Zone VII									
Karaikal	Ambagarthur, Thennangudi, Maadhur, Thirunallar, Pathakudi, Karukangudi, Surakudi, Thirunallar, Surakudi, Karukangudi, Nedungadu, Agalankannu, Pattinacherry, Keezhaiyur, Neravy, pattinam	Karaikal - Pdu ducherry	Grasses: <i>Echinochloa crusgalli</i> , <i>Leptochloa chinensis</i> , <i>Echinochloa colonum</i> Sedges: <i>Cyperus difformis</i> , <i>Cyperus iria</i> BLW: <i>Bergia capensis</i> , <i>Marsilea quadrifolia</i>		Nominee gold 200 ml/ha at 15 DAS, Council activ 200 g/ha at 15 DAS, Rice star 1000 ml/ha at 15 DAS, Almix 20 g/ha at 15 DAS, 2,4 D 625 g/ha at 25 DAS	20&45DAT, 35 DAS, 40 DAS, 45 DAS	5865		
	Pulincunno, Champakulam, Thalavady, Ramankary, Karuvatta, Nedumudy, Kainakary	Alappuzha - Kerala	Grasses: <i>Leptochloa chinensis</i> , <i>Echinochloa stagnina</i> , <i>Oryza sativa f. sp.</i> Spontanea, Sedges: <i>Fimbristylis miliaceae</i> , <i>Cyperus difformis</i> BLW: <i>Monochoria vaginalis</i> , <i>Lindernia sp.</i>	Not used	Loyant+ Affinity, Dishum+ Affinity, Vivaya + Affinity, Penflor	5 women / hectare, 6 women / hectare, 10 women / hectare, 25 women / hectare	12338	71583	7.16
Pattambi	Vilayur, Edappalam, Chalissey	Palakkad, Thrissur, Kollam - Kerala	Grasses: <i>Isachne miliaceae</i> , <i>Echinochloa crusgalli</i> BLW: <i>Monochoria vaginalis</i> , <i>Eichhornia crassipes</i> , <i>Ludwigia perennis</i> , <i>Chara sp.</i> , <i>Sphagneticola trilobata</i>	EROS (Pretlachlor 6%+ Pyrazosulfuron ethyl 0.15%) – 4kg/acre, Saathi, Pyrazosulfuron ethyl, 80g/ acre 2-3 DAT, Saathi, Pyrazosulfuron ethyl, 40g/ acre and Refit, Pretlachlor 400ml/acre 2-3 DAT	Nominee gold, Bispyribac sodium 25 DAT	1 month after transplanting	5607	53800	3.76

4.4.3. Weedy rice management in DSR

During *Kharif* 2025, the trials were conducted in four Zones at 5 locations viz., **Chatha, Gangavathi, Jagdalpur, Malan and Rawa**. The effect of weed management practices on crop performance and weed dynamics is presented in **Tables 4.4.3.**

Hilly Area Zone I

Malan

Growth attributes

At Malan, total dry matter production differed significantly among treatments at both stages. At the active tillering stage, the highest dry matter was recorded under weed-free treatment (T7: 0.30 kg m⁻²), followed by pretilachlor (T1: 0.24 kg m⁻²) and oxyfluorfen (T2: 0.23 kg m⁻²), while the lowest was under weedy check (T6: 0.20 kg m⁻²). At the panicle initiation stage, T7 (0.57 kg m⁻²) recorded significantly higher dry matter, followed by T1 (0.49 kg m⁻²) and T2 (0.46 kg m⁻²), whereas T6 (0.41 kg m⁻²) recorded the lowest. The results suggest that chemical weed management and weed-free conditions effectively promoted crop growth, leading to higher biomass accumulation at Malan.

Yield attributes

At Malan, panicle number differed significantly among treatments. The highest number of panicles was recorded under weed-free treatment (T7: 297 m⁻²), followed by pretilachlor (T1: 258 m⁻²) and oxyfluorfen (T2: 250 m⁻²), while the lowest was under weedy check (T6: 198 m⁻²). Panicle weight was also significantly higher under T7 (2.96 g) and T1 (2.80 g) compared to other treatments. Similarly, test weight was highest under T7 (27.27 g) and lowest under T6 (21.78 g), indicating significant differences. These findings suggest that chemical weed control and weed-free conditions were particularly effective in improving yield attributes at Malan.

Yields

At Malan, grain yield differences were significant. The highest yield was recorded under weed-free treatment (T7: 3.22 t ha⁻¹), followed by pretilachlor (T1: 2.83 t ha⁻¹) and oxyfluorfen (T2: 2.73 t ha⁻¹). Interestingly, hand weeding (T5: 2.58 t ha⁻¹) and pyrazosulfuron-ethyl (T3: 2.40 t ha⁻¹) showed relatively lower yields, indicating location-specific responses. The lowest yield was observed under weedy check (T6: 1.93 t ha⁻¹). Straw yield was highest under weed-free treatment (T7: 4.10 t ha⁻¹), followed by T1 (3.58 t ha⁻¹) and T2 (3.43 t ha⁻¹). The results suggest that chemical weed control was relatively more effective than manual methods under Malan conditions.

Weedy rice density and biomass

At Malan, weedy rice population and biomass were significantly influenced by different weed management practices at both growth stages. At the active tillering stage, the lowest population was recorded under weed-free treatment (T7: 0.00 m⁻²), followed by pretilachlor (T1: 3.33 m⁻²), whereas the highest was observed under weedy check (T6: 18.67 m⁻²). Other treatments such as T2 (6.67 m⁻²) and T4 (6.00 m⁻²) showed moderate control, while T3 and T5 recorded

relatively higher populations. At the panicle initiation stage, the trend remained similar, with T7 maintaining zero population, while T1 (4.67 m^{-2}) recorded lower values compared to T6 (22.00 m^{-2}).

Weedy rice biomass also followed a similar pattern. At active tillering, biomass ranged from 0.00 g m^{-2} (T7) to 22.03 g m^{-2} (T6). Among treatments, T1 (3.47 g m^{-2}) recorded the lowest biomass, indicating effective suppression. At panicle initiation, biomass increased but remained lowest under T7 (0.00 g m^{-2}) and relatively low under T1 (5.13 g m^{-2}), while the highest biomass was recorded under T6 (40.48 g m^{-2}). These results indicate that pretilachlor and weed-free conditions were highly effective in reducing both population and biomass, thereby minimizing weed competition.

Weed density based on morphology

At Malan, all three weed categories (grasses, sedges, and BLW) were prominent. At the active tillering stage, the lowest total weed population was observed under T7 (0.00 m^{-2}), followed by T1 (26.67 m^{-2}), whereas the highest was recorded under T6 (92.67 m^{-2}). At the panicle initiation stage, weed population increased across treatments. T7 maintained complete control, while T1 (31.33 m^{-2}) recorded lower infestation compared to T2 (45.33 m^{-2}), T4 (49.33 m^{-2}), and T6 (106.00 m^{-2}). Grasses and sedges were major contributors, while BLW also showed significant presence, particularly under T3 and T6. The results indicate that pretilachlor and weed-free conditions effectively suppressed mixed weed flora, whereas stale seed bed and oxyfluorfen were less effective.

Weed biomass based on morphology

At Malan, all weed groups contributed substantially to total biomass. At the active tillering stage, the lowest biomass was recorded under T7 (0.00 g m^{-2}), while among treatments, T1 (22.80 g m^{-2}) and T5 (28.13 g m^{-2}) recorded comparatively lower biomass than T6 (68.77 g m^{-2}). At the panicle initiation stage, biomass increased markedly. T7 maintained zero biomass, whereas T1 (35.08 g m^{-2}) recorded lower values compared to T2 (52.62 g m^{-2}), T4 (54.93 g m^{-2}), and T6 (138.44 g m^{-2}). Notably, T3 (99.49 g m^{-2}) showed higher biomass, indicating comparatively lower effectiveness at later stages. Grasses, sedges, and BLW all contributed significantly, suggesting mixed weed flora and higher weed pressure at this location.

Zone II Northern

Chatha

Growth attributes

At Chatha, total dry matter production was significantly influenced by weed management practices at both growth stages. At the active tillering stage, the highest dry matter accumulation was recorded under weed-free treatment (T7: 260 kg m^{-2}), followed by hand weeding (T5: 252 kg m^{-2}), while the lowest was observed under weedy check (T6: 206.67 kg m^{-2}). A similar trend was observed at the panicle initiation stage, where T5 (449.33 kg m^{-2}) and T7 (444 kg m^{-2}) recorded higher dry matter compared to other treatments, whereas T6 (298.33 kg m^{-2}) recorded the lowest value. These results indicate that effective weed control

significantly enhanced biomass accumulation, likely due to reduced competition for nutrients, water, and light.

Yield attributes

At Chatha, yield attributes were significantly influenced by different weed management practices. The number of panicles was highest under hand weeding (T5: 239 m⁻²), followed by stale seed bed (T4: 235 m⁻²) and pretilachlor (T1: 232 m⁻²), while the lowest was recorded under weedy check (T6: 137 m⁻²). Panicle weight also followed a similar trend, with the highest values under T5 (2.21 g) and weed-free treatment (T7: 2.19 g), whereas the lowest was under T6 (0.84 g). Test weight (1000-grain weight) was significantly higher under T7 (21.73 g) and T5 (21.20 g) compared to other treatments. These results indicate that effective weed control enhanced both reproductive growth and grain filling, leading to improved yield attributes.

Yields

At Chatha, grain yield was significantly influenced by different weed management practices. The highest grain yield was recorded under hand weeding (T5: 3.22 t ha⁻¹), followed closely by stale seed bed technique (T4: 3.16 t ha⁻¹) and weed-free condition (T7: 3.08 t ha⁻¹). Among herbicidal treatments, pretilachlor (T1: 2.99 t ha⁻¹) and pyrazosulfuron-ethyl (T3: 2.83 t ha⁻¹) performed better than oxyfluorfen (T2: 2.70 t ha⁻¹). The lowest yield was observed under weedy check (T6: 1.15 t ha⁻¹). A similar trend was observed for straw yield, with the highest values under T5 (6.44 t ha⁻¹) and T4 (6.31 t ha⁻¹), indicating better crop growth under effective weed control. The poor performance of weedy check highlights the severe impact of uncontrolled weeds on crop productivity.

Weedy rice density and biomass

At Chatha, weedy rice population was relatively lower compared to other locations. At the active tillering stage, the lowest population was recorded under T7 (0.00 m⁻²), followed by T1 (1.67 m⁻²) and T3 (2.67 m⁻²). The highest population was observed under T6 (8.00 m⁻²). At the panicle initiation stage, similar trends were observed, with T7 maintaining zero population, while T1 (1.67 m⁻²) continued to show effective control compared to T6 (8.00 m⁻²).

Weedy rice biomass at active tillering ranged from 0.00 g m⁻² (T7) to 65.23 g m⁻² (T6), indicating severe biomass accumulation under uncontrolled conditions. Among treatments, T1 (14.30 g m⁻²) recorded lower biomass compared to T2 and T4 (~33 g m⁻²). At panicle initiation, biomass remained lowest under T7, while T6 (65.23 g m⁻²) continued to record the highest values. Other treatments showed moderate reduction in biomass. These results suggest that early-stage herbicide application, particularly pretilachlor, effectively reduced weedy rice infestation, while lack of control resulted in substantial biomass accumulation.

Weed density based on morphology

At Chatha, weed population was comparatively lower and more evenly distributed among grasses, sedges, and BLW. At the panicle initiation stage, the lowest total weed population was recorded under T7 (0.00 m⁻²), followed by T5 (14.33 m⁻²) and T4 (17.33 m⁻²). Among herbicides, pretilachlor (T1: 18.67 m⁻²) and pyrazosulfuron-ethyl (T3: 24.00 m⁻²) showed better

control compared to oxyfluorfen (T2: 27.67 m⁻²). The highest weed population was recorded under T6 (81.00 m⁻²). Sedges were relatively dominant, followed by grasses and BLW.

Central Zone V

Jagdapur

Yield attributes

At Jagdalpur, only 1000-grain weight data were available, which showed significant variation among treatments. The highest test weight was recorded under pretilachlor (T1: 24.00 g) and weed-free treatment (T7: 23.67 g), while the lowest was observed under weedy check (T6: 21.00 g). This suggests that effective weed management improved grain filling and seed quality at this location.

Yields

Jagdapur recorded the highest yields among all locations, indicating favorable growing conditions. Grain yield was maximum under weed-free treatment (T7: 7.38 t ha⁻¹), followed by hand weeding (T5: 6.55 t ha⁻¹) and pyrazosulfuron-ethyl (T3: 6.20 t ha⁻¹). Herbicide treatments such as pretilachlor (T1: 4.26 t ha⁻¹) were moderately effective, while oxyfluorfen (T2: 2.48 t ha⁻¹) performed poorly. The lowest yield was under weedy check (T6: 1.67 t ha⁻¹), confirming the strong negative impact of weeds. Straw yield followed a similar trend, with T7 (8.43 t ha⁻¹) and T5 (7.19 t ha⁻¹) producing the highest biomass. The significant differences indicate that effective weed management substantially improved productivity at this location.

Benefit-cost ratio

At Jagdalpur, the B:C ratio differed significantly among treatments. The highest value was recorded under pyrazosulfuron-ethyl (T3: 2.92), followed by weed-free (T7: 2.45) and hand weeding (T5: 2.44). Pretilachlor (T1: 1.86) provided moderate returns, whereas oxyfluorfen (T2: 1.10) and weedy check (T6: 0.94) were least economical. The higher profitability of T3 suggests that effective weed control combined with relatively lower input cost enhanced economic returns.

Cost of Cultivation

At Jagdalpur, where weedy check (T6: ₹48,000 ha⁻¹) recorded the lowest cost, followed by herbicide-based treatments such as T1, T2, and T3 (~₹48,500–48,560 ha⁻¹). In contrast, stale seed bed (T4: ₹55,300 ha⁻¹), hand weeding (T5: ₹58,500 ha⁻¹), and weed-free treatment (T7: ₹63,500 ha⁻¹) incurred substantially higher costs due to intensive operations.

Weed density based on morphology

At Jagdalpur, weed flora was dominated by sedges and BLW, with moderate presence of grasses. At the panicle initiation stage, T7 maintained complete weed control, while T5 (6.08 m⁻²) recorded the lowest weed population among treatments. Among herbicides, T3 (12.67 m⁻²) showed better performance compared to T1 (24.80 m⁻²) and T2 (21.17 m⁻²). The highest weed population was observed under T6 (106.38 m⁻²). Sedges were the dominant weed group, particularly under T6 and T4, while BLW contribution was also notable. The results highlight

that pyrazosulfuron-ethyl and manual weeding were more effective in controlling mixed weed flora.

Weed biomass based on morphology

At Jagdalpur (panicle initiation stage), weed biomass was mainly dominated by sedges and BLW. The lowest biomass was recorded under T7 (0.00 g m^{-2}), followed by hand weeding (T5: 9.12 g m^{-2}) and pyrazosulfuron-ethyl (T3: 19.01 g m^{-2}). Among herbicides, T1 (37.95 g m^{-2}) and T2 (31.75 g m^{-2}) recorded moderate biomass, while T6 (159.56 g m^{-2}) recorded extremely high biomass, indicating severe weed infestation under uncontrolled conditions. The results highlight that manual weeding and T3 were more effective in reducing biomass of mixed weed flora, especially sedges and BLW.

Rewa (Central Zone V)

Growth attributes

At Rewa, total dry matter production at both active tillering and panicle initiation stages was non-significant, indicating minimal treatment effect on biomass accumulation. At the active tillering stage, dry matter ranged narrowly from 1.81 to 1.89 kg m^{-2} , with slightly higher values under T3 (1.89 kg m^{-2}) and T7 (1.88 kg m^{-2}). At the panicle initiation stage, dry matter values varied between 3.96 and 4.12 kg m^{-2} , with the highest under T3 (4.12 kg m^{-2}) and relatively similar values across other treatments. The lack of significant differences suggests that environmental factors and inherent variability overshadowed treatment effects, resulting in uniform biomass accumulation across treatments.

Yield attributes

At Rewa, panicle number and test weight differences among treatments were non-significant, indicating minimal treatment effect on these parameters. However, panicle number was numerically higher under T1 (307 m^{-2}) and T5 (306 m^{-2}) compared to other treatments. Panicle weight showed significant variation, with the highest values under pretilachlor (T1: 2.84 g) and weed-free treatment (T7: 2.57 g), while lower values were observed under T3 (1.97 g) and T4 (1.90 g). Test weight differences were non-significant, with values ranging narrowly across treatments. These results indicate that yield attributes were less responsive to weed management practices, possibly due to environmental variability.

Yields

At Rewa, grain yield differences among treatments were non-significant, indicating high variability. However, numerically higher yields were observed under pretilachlor (T1: 1.83 t ha^{-1}) and pyrazosulfuron-ethyl (T3: 1.60 t ha^{-1}) compared to other treatments. Stale seed bed (T4: 0.96 t ha^{-1}) recorded the lowest yield. Straw yield differences were also non-significant. However, relatively higher values were observed under T1 (2.86 t ha^{-1}) and T2 (2.48 t ha^{-1}). The lack of statistical significance suggests that environmental factors and high variability masked treatment effects at this location.

Weedy rice density and biomass

At Rewa, weedy rice infestation was comparatively higher than other locations. At the active tillering stage, T7 completely controlled weedy rice, whereas T3 (14.33 m^{-2}) and T2 (16.67 m^{-2}) recorded relatively lower populations among treatments. The highest population was observed under T6 (38.33 m^{-2}). At the panicle initiation stage, population increased further, with T6 (49.33 m^{-2}) recording the maximum, while T1 (29.00 m^{-2}) and T3 (23.00 m^{-2}) showed comparatively better control.

Weedy rice biomass followed similar trends. At active tillering, biomass ranged from 0.00 g m^{-2} (T7) to 10.56 g m^{-2} (T6). Among treatments, T3 (4.92 g m^{-2}) recorded relatively lower biomass. At panicle initiation, biomass was highest under T6 (25.77 g m^{-2}), while T5 (3.82 g m^{-2}) recorded the lowest among treatments. Overall, weedy rice pressure was high at Rewa, and although all treatments reduced infestation compared to weedy check, their effectiveness varied considerably.

Weed density based on morphology

At Rewa, weed flora was dominated by grasses, followed by sedges and BLW. At the active tillering stage, total weed population ranged from 0.00 m^{-2} (T7) to 104.67 m^{-2} (T6). Among treatments, pyrazosulfuron-ethyl (T3: 27.33 m^{-2}) recorded relatively lower population, while T1 and T2 showed moderate effectiveness. At the panicle initiation stage, weed population increased further, with T6 recording the highest (144.33 m^{-2}). Among treatments, T5 (38.33 m^{-2}) and T3 (51.33 m^{-2}) performed relatively better in reducing weed density. Grasses were the dominant group, particularly under uncontrolled conditions, while sedges and BLW also contributed significantly.

Weed biomass based on morphology

At Rewa, weed biomass was predominantly contributed by grasses, especially at the active tillering stage. The lowest biomass was recorded under T7 (0.00 g m^{-2}), while among treatments, T3 (16.41 g m^{-2}) showed relatively better control compared to T1 (23.61 g m^{-2}) and T5 (25.12 g m^{-2}). The highest biomass was recorded under T6 (39.60 g m^{-2}). At the panicle initiation stage, biomass further increased, with T6 (59.19 g m^{-2}) recording the highest. Among treatments, T3 (26.93 g m^{-2}) and T5 (29.59 g m^{-2}) performed better in reducing biomass compared to T1 (39.40 g m^{-2}) and T4 (46.66 g m^{-2}). These results indicate that grass-dominated weed flora required effective control measures, with pyrazosulfuron-ethyl and manual weeding showing better performance.

Southern Zone VII

Gangavathi

Yield attributes

At Gangavathi, variations in panicle number and panicle weight were non-significant, indicating high variability. However, numerically higher panicle numbers were observed under weed-free (T7: 162 m^{-2}) and hand weeding (T5: 152 m^{-2}) treatments. Panicle weight was also numerically higher under T7 (14.60 g) and T5 (13.77 g), while the lowest was recorded under weedy check (T6: 9.37 g). Test weight showed non-significant differences, though higher

values were observed under T7 (18.73 g) and T5 (18.07 g). Overall, although trends favoured better weed control, high variability masked statistical significance at this location.

Yields

At Gangavathi, grain yield varied widely among treatments, although variability was high. The highest yield was recorded under weed-free treatment (T7: 4.36 t ha⁻¹), closely followed by hand weeding (T5: 4.24 t ha⁻¹) and pyrazosulfuron-ethyl (T3: 3.78 t ha⁻¹). Pretilachlor (T1: 3.63 t ha⁻¹) also performed reasonably well, while stale seed bed (T4: 2.55 t ha⁻¹) and oxyfluorfen (T2: 2.90 t ha⁻¹) recorded comparatively lower yields. The lowest yield was under weedy check (T6: 1.75 t ha⁻¹). Straw yield followed a similar pattern, with the highest values under T5 (6.65 t ha⁻¹) and T7 (6.13 t ha⁻¹). However, statistical significance for straw yield was non-significant, suggesting variability in biomass response. Overall, better weed control translated into higher yield, though environmental variability influenced treatment performance.

Weed density based on morphology

At Gangavathi, weed flora was dominated by sedges followed by grasses, while BLW were negligible across treatments. At the active tillering stage, the lowest total weed population was recorded under weed-free treatment (T7: 0.00 m⁻²), followed by hand weeding (T5: 8.00 m⁻²) and pyrazosulfuron-ethyl (T3: 16.74 m⁻²). In contrast, weedy check (T6: 37.86 m⁻²) recorded the highest infestation. Among herbicides, pretilachlor (T1: 17.57 m⁻²) was more effective than oxyfluorfen (T2: 31.47 m⁻²) and stale seed bed (T4: 32.89 m⁻²). Sedges constituted the major share of weed flora, particularly under T2 and T4. Overall, T7 and T5 effectively reduced all weed categories, while T1 provided better control among herbicides, particularly against grasses and sedges.

Weed biomass based on morphology

At Gangavathi, weed biomass at the active tillering stage was dominated by sedges followed by grasses, while BLW contribution was minimal. The lowest total biomass was recorded under weed-free treatment (T7: 0.00 g m⁻²), followed by hand weeding (T5: 2.23 g m⁻²) and pretilachlor (T1: 5.18 g m⁻²). In contrast, weedy check (T6: 14.97 g m⁻²) recorded the highest biomass. At the panicle initiation stage, biomass increased across treatments, but T7 maintained complete control, while T5 (1.13 g m⁻²) and T3 (8.44 g m⁻²) recorded lower biomass compared to T6 (18.75 g m⁻²). Sedges remained the dominant weed group at both stages. These results indicate that manual weeding and pretilachlor effectively reduced early weed biomass, particularly of sedges.

Benefit–Cost Ratio

The benefit–cost (B:C) ratio varied across treatments and locations, reflecting differences in both yield performance and input costs. At Gangavathi, the highest B:C ratio was recorded under weed-free treatment (T7: 2.03), closely followed by hand weeding (T5: 2.01) and pyrazosulfuron-ethyl (T3: 1.95). Pretilachlor (T1: 1.86) also showed favourable returns, whereas oxyfluorfen (T2: 1.52) and stale seed bed (T4: 1.31) were comparatively less economical. The lowest B:C ratio was observed under weedy check (T6: 0.92). However, differences were statistically non-significant, indicating variability in economic returns.

Cost of Cultivation

The cost of cultivation varied considerably among treatments due to differences in input and labour requirements. At Gangavathi, the lowest cost was observed under weedy check (T6: ₹47,580 ha⁻¹), followed closely by oxyfluorfen (T2: ₹47,780 ha⁻¹) and pretilachlor (T1: ₹48,780 ha⁻¹). Higher costs were associated with hand weeding (T5: ₹52,580 ha⁻¹) and weed-free treatment (T7: ₹53,780 ha⁻¹) due to increased labour inputs.

Table 4.4.3: Yield parameters and grain yield of Weedy Rice Management in DSR areas Kharif-2025.

Treatment details	Grain yield (t/ha)					Straw yield (t/ha)				
	ZONE-II Chatha	ZONE-VII Gangavathi	ZONE-V Jagdalpur	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha	ZONE-VII Gangavathi	ZONE-V Jagdalpur	ZONE-I Malan	ZONE-V Rewa
T1 - Pre-emergence application of Pretilachlor @ 1.5 kg ha ⁻¹ at 2-3 DBS	2.99	3.63	4.26	2.83	1.83	5.99	4.88	4.4	3.58	2.86
T2 - Pre-emergence application of Oxyfluorfen @ 0.20 kg ha ⁻¹ at 2-3 DBS	2.7	2.9	2.48	2.73	1.56	5.4	4.14	2.82	3.43	2.48
T3 - Pre-emergence application of Pyrazosulfuron-ethyl@25 g ha ⁻¹ at 2-3 DBS	2.83	3.78	6.2	2.4	1.6	5.67	5.29	7.08	2.95	2.43
T4 - Stale Seed Bed Technique (in Wet DSR)	3.16	2.55	3.33	2.7	0.96	6.31	4.13	3.86	3.38	1.49
T5 - Hand Weeding at 25-30, 45-50 DAS	3.22	4.24	6.55	2.58	1.21	6.44	6.65	7.19	3.18	1.92
T6 - Weedy check	1.15	1.75	1.67	1.93	1.25	2.31	4.02	2.58	2.34	1.93
T7 - Weed Free	3.08	4.36	7.38	3.22	1.31	6.15	6.13	8.43	4.1	2.03
Exp. mean	2.73	3.31	4.55	2.63	1.39	5.47	5.03	5.19	3.28	2.16
CD(0.05)	0.04	1.58	0.9	0.41	0.76	0.08	2.6	0.81	0.53	1.21
CV	0.8	26.86	11.09	8.82	30.9	0.8	28.98	8.77	9.05	31.58
Applied N:P:K:Zn Kg/ha	30:20:10 kg /ha			90:40:40 kg/ha						
Avail N:P:K (kg/ha)	245:15:14:34:146.31 kg /ha									
Soil type	Sandy clay loam	Black soil		Silty clay loam						
pH	8.03			5.6						
EC (dsm-1)	0.21									
Organic carbon	0.57			0.92						

Table 4.4.3: Contd.

Treatment details	Panicles/m ² at harvesting				Panicle weight (g)				1000 grain weight (g)				
	ZONE-II Chatha	ZONE-VII Gangavathi	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha	ZONE-VII Gangavathi	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha	ZONE-VII Gangavathi	ZONE-V Jagdarpur	ZONE-I Malan	ZONE-V Rewa
T1	232	132	258	307	2.11	12.93	2.80	2.84	20.73	16.70	24.00	26.22	19.20
T2	214	115	250	294	2.02	10.37	2.60	2.05	20.20	13.57	22.33	24.93	18.67
T3	225	123	212	301	2.07	13.20	2.34	1.97	20.57	16.33	22.33	22.76	19.13
T4	235	119	244	287	2.16	10.03	2.56	1.90	20.77	13.00	22.00	23.07	19.13
T5	239	152	218	306	2.21	13.77	2.44	1.91	21.20	18.07	22.67	22.88	19.13
T6	137	98	198	286	0.84	9.37	2.10	2.04	18.83	12.87	21.00	21.78	18.73
T7	230	162	297	300	2.19	14.60	2.96	2.57	21.73	18.73	23.67	27.27	18.53
Exp. mean	216	129	240	297	1.94	12.04	2.54	2.18	20.58	15.61	22.57	24.13	18.93
CD(0.05)	5	44	31	19	0.05	4.57	0.34	0.63	0.24	4.70	1.51	2.51	1.71
CV	1	19	7	4	1.40	21.36	7.42	16.15	0.65	16.93	3.77	5.84	5.08

Treatment details	Total dry matter kg/m ² at the active tillering stage			Total dry matter kg/m ² at the panicle initiation stage			Benefit-Cost ratio		Cost of cultivation (Rs/ha)		
	ZONE-II Chatha	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha	ZONE-I Malan	ZONE-V Rewa	ZONE-VII Gangavathi	ZONE-V Jagdarpur	ZONE-VII Gangavathi	ZONE-V Jagdarpur	ZONE-V Jagdarpur
T1	231.67	0.24	1.84	436.00	0.49	3.97	1.86	1.86	48780	48500	48500
T2	220.67	0.23	1.83	421.67	0.46	4.01	1.52	1.1	47780	48550	48550
T3	227.67	0.21	1.89	429.67	0.43	4.12	1.95	2.92	48330	48560	48560
T4	231	0.22	1.81	435.33	0.43	3.98	1.31	1.34	48680	55300	55300
T5	252	0.22	1.85	449.33	0.43	3.97	2.01	2.44	52580	58500	58500
T6	206.67	0.2	1.82	298.33	0.41	3.96	0.92	0.94	47580	48000	48000
T7	260	0.3	1.88	444.00	0.57	4.07	2.03	2.45	53780	63500	63500
Exp. mean	232.81	0.23	1.84	416.33	0.46	4.01	1.66	1.86			
CD(0.05)	7.29	0.01	0.06	7.19	0.03	0.24	0.8	0.43			
CV	1.76	2.84	1.96	0.97	3.63	3.31	27.18	12.89			

T1 - Pre-emergence application of Pretilachlor @ 1.5 kg ha⁻¹ at 2-3 DBS
T2 - Pre-emergence application of Oxyfluorfen @ 0.20 kg ha⁻¹ at 2-3 DBS
T3 - Pre-emergence application of Pyrazosulfuron-ethyl@25 g ha⁻¹ at 2-3 DBS
T4 - Stale Seed Bed Technique (in Wet DSR)
T5 - Hand Weeding at 25-30, 45-50 DAS
T6 - Weedy check
T7 - Weed Free

Table 4.4.3: Weedy rice population no/m2 & Weedy rice biomass gm/m2 at active tillering and panicle initiation stages of Weedy Rice Management in DSR areas Kharif-2025.

Treatment details	Weedy rice population no/m ² at Active Tillering stage			Weedy rice population no/m ² at Panicle Initiation stage			Weedy rice biomass gm/m ² at Active Tillering stage			Weedy rice biomass gm/m ² at Panicle Initiation stage		
	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha	ZONE-I Malan	ZONE-V Rewa	ZONE-II Chatha
T1 - Pre-emergence application of Pretilachlor @ 1.5 kg ha -1 at 2-3 DBS	3.33(1.94)	19.67(4.49)	1.67(1.46)	4.67(2.26)	29.00(5.43)		3.47	7.00	14.30	5.13	15.30	
T2 - Pre-emergence application of Oxyfluorfen @ 0.20 kg ha -1 at 2-3 DBS	6.67(2.67)	16.67(4.14)	3.67(2.04)	8.00(2.92)	26.00(5.15)		7.13	6.12	33.67	8.96	12.80	
T3 - Pre-emergence application of Pyrazosulfuron-ethyl@25 g ha -1 at 2-3 DBS	10.00(3.23)	14.33(3.85)	2.67(1.77)	13.33(3.70)	23.00(4.85)		11.50	4.92	24.60	24.67	9.30	
T4 - Stale Seed Bed Technique (in Wet DSR)	6.00(2.53)	32.33(5.73)	3.67(2.04)	8.67(3.00)	36.33(6.07)		6.54	8.34	33.00	15.95	14.95	
T5 - Hand Weeding at 25-30, 45-50 DAS	8.67(3.02)	26.67(5.21)	4.67(2.27)	12.00(3.54)	8.67(3.02)		10.14	7.96	41.80	21.60	3.82	
T6 - Weedy check	18.67(4.36)	38.33(6.23)	8.00(2.91)	22.00(4.73)	49.33(7.06)		22.03	10.56	65.23	40.48	25.77	
T7 - Weed Free	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)		0.00	0.00	0.00	0.00	0.00	
Exp. mean	2.64	4.34	1.89	2.98	4.61		8.69	6.41	30.37	16.68	11.70	
CD(0.05)	0.5	0.26	0.27	0.47	0.33		3.85	0.87	8.79	6.32	2.21	
CV	10.68	3.4	8.07	8.78	4		24.91	7.60	16.26	21.29	10.60	

(Values in parentheses are transformed values)

Table 4.4.3: Group wise weed population no/m² at active tillering and panicle initiation stages of Weedy Rice Management in DSR areas Kharif-2025.

Treatment details	Active tillering stage											
	ZONE-VII Gangavathi				ZONE-I Malan				ZONE-V Rewa			
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	4.27(2.09)	13.31(3.72)	0.00(0.71)	17.57(4.24)	8.67(3.02)	10.00(3.24)	8.00(2.90)	26.67(5.21)	27.67(5.30)	12.67(3.63)	8.67(3.02)	49.00(7.03)
T2	7.11(2.68)	23.29(4.87)	1.07(1.11)	31.47(5.65)	10.00(3.24)	20.67(4.56)	10.00(3.23)	40.67(6.39)	24.33(4.98)	10.33(3.29)	4.67(2.27)	39.33(6.31)
T3	3.94(2.02)	12.45(3.55)	0.35(0.91)	16.74(4.06)	22.67(4.81)	13.33(3.71)	18.67(4.36)	54.67(7.41)	18.67(4.38)	5.67(2.48)	3.00(1.86)	27.33(5.28)
T4	7.64(2.85)	24.18(4.94)	1.07(1.20)	32.89(5.76)	12.67(3.63)	17.33(4.22)	12.00(3.54)	42.00(6.52)	46.33(6.84)	15.33(3.98)	8.67(3.02)	70.33(8.42)
T5	2.67(1.76)	4.27(2.15)	1.07(1.19)	8.00(2.90)	13.33(3.72)	14.67(3.88)	15.33(3.97)	43.33(6.62)	36.67(6.10)	13.67(3.75)	6.67(2.67)	57.00(7.58)
T6	9.96(3.21)	25.78(5.09)	2.13(1.57)	37.86(6.17)	32.67(5.73)	26.67(5.20)	33.33(5.80)	92.67(9.62)	60.67(7.82)	29.67(5.49)	14.33(3.85)	104.67(10.25)
T7	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Exp. mean	2.19	3.57	1.06	4.21	3.55	3.65	3.5	6.07	5.16	3.33	2.49	6.51
CD(0.05)	0.96	0.78	0.76	0.94	0.49	0.66	0.65	0.82	0.26	0.39	0.34	0.28
CV	24.66	12.25	40.38	12.52	7.82	10.1	10.47	7.59	2.84	6.63	7.67	2.41

*(Values in parentheses are transformed values)

- T1 - Pre-emergence application of Pretilachlor @ 1.5 kg ha⁻¹ at 2-3 DBS
- T2 - Pre-emergence application of Oxyfluorfen @ 0.20 kg ha⁻¹ at 2-3 DBS
- T3 - Pre-emergence application of Pyrazosulfuron-ethy(@25 g ha⁻¹ at 2-3 DBS
- T4 - Stale Seed Bed Technique (in Wet DSR)
- T5 - Hand Weeding at 25-30, 45-50 DAS
- T6 - Weedy check
- T7 - Weed Free

Table 4.4.3: Contd.

Treatment details	Panicle initiation stage											
	ZONE-II Chatha				ZONE-VII Gangavathi				ZONE-V Jagdalpur			
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	6.33(2.61)	10.00(3.24)	2.33(1.68)	18.67(4.38)	5.35(2.35)	14.28(3.84)	0.36(0.89)	19.99(4.51)	3.30(1.94)	6.10(2.45)	15.39(3.97)	24.80(5.00)
T2	9.67(3.19)	15.00(3.94)	3.00(1.87)	27.67(5.31)	7.48(2.75)	24.75(5.02)	1.07(1.11)	33.29(5.81)	4.20(2.10)	11.40(3.45)	5.57(2.44)	21.17(4.65)
T3	8.33(2.97)	12.67(3.63)	3.00(1.87)	24.00(4.95)	4.33(2.07)	14.40(3.74)	2.67(1.76)	21.40(4.57)	3.16(1.91)	5.23(2.38)	4.28(2.14)	12.67(3.61)
T4	6.33(2.61)	9.33(3.13)	1.67(1.46)	17.33(4.22)	8.12(2.93)	16.18(4.06)	2.84(1.47)	27.14(5.21)	4.08(2.11)	21.87(4.71)	7.82(2.88)	33.77(5.85)
T5	5.67(2.48)	7.67(2.86)	1.00(1.22)	14.33(3.85)	0.87(1.13)	2.49(1.73)	0.89(1.17)	4.24(2.16)	2.56(1.69)	0.00(0.71)	3.52(1.99)	6.08(2.51)
T6	31.67(5.67)	46.00(6.82)	3.33(1.95)	81.00(9.02)	12.04(3.50)	26.47(5.17)	4.44(1.99)	42.95(6.59)	24.25(4.96)	51.43(7.20)	30.70(5.57)	106.38(10.33)
T7	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Exp. mean	2.89	3.47	1.54	4.63	2.21	3.47	1.3	4.22	2.2	3.09	2.81	4.66
CD(0.05)	0.28	0.26	0.18	0.32	1.08	0.96	1.29	1.15	0.82	0.83	0.67	0.9
CV	5.43	4.25	6.61	3.84	27.52	15.59	55.82	15.36	20.89	15.06	13.39	10.84

*(Values in parentheses are transformed values)

- T1 - Pre-emergence application of Pretilachlor @ 1.5 kg ha⁻¹ at 2-3 DBS
- T2 - Pre-emergence application of Oxyfluorfen @ 0.20 kg ha⁻¹ at 2-3 DBS
- T3 - Pre-emergence application of Pyrazosulfuron-ethyl@25 g ha⁻¹ at 2-3 DBS
- T4 - Stale Seed Bed Technique (in Wet DSR)
- T5 - Hand Weeding at 25-30, 45-50 DAS
- T6 - Weedy check
- T7 - Weed Free

Table 4.4.3: Contd.

Treatment details	Panicle initiation stage							
	ZONE-I Malan			ZONE-V Rewa				
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	10.67(3.32)	11.33(3.44)	9.33(3.13)	31.33(5.64)	41.33(6.47)	19.00(4.42)	15.00(3.93)	75.33(8.71)
T2	12.00(3.50)	22.67(4.81)	10.67(3.32)	45.33(6.76)	39.67(6.34)	16.67(4.14)	14.00(3.81)	70.33(8.42)
T3	24.00(4.95)	16.00(4.04)	21.33(4.66)	61.33(7.86)	25.00(5.05)	16.00(4.05)	10.33(3.29)	51.33(7.20)
T4	13.33(3.70)	21.33(4.67)	14.67(3.89)	49.33(7.06)	46.00(6.82)	25.33(5.08)	21.00(4.64)	92.33(9.63)
T5	14.00(3.80)	16.00(4.06)	16.00(4.05)	46.00(6.82)	19.33(4.44)	9.00(3.08)	10.00(3.24)	38.33(6.22)
T6	35.33(5.98)	30.67(5.58)	40.00(6.35)	106.00(10.32)	80.00(8.97)	38.67(6.26)	25.67(5.11)	144.33(12.03)
T7	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Exp. mean	3.71	3.9	3.73	6.45	5.54	3.96	3.53	7.56
CD(0.05)	0.67	0.42	0.7	0.44	0.36	0.29	0.3	0.31
CV	10.13	6.01	10.61	3.87	3.62	4.06	4.83	2.33

*(Values in parentheses are transformed values)

- T1 - Pre-emergence application of Pretilachlor @ 1.5 kg ha -1 at 2-3 DBS
- T2 - Pre-emergence application of Oxyfluorfen @ 0.20 kg ha -1 at 2-3 DBS
- T3 - Pre-emergence application of Pyrazosulfuron-ethyl@25 g ha -1 at 2-3 DBS
- T4 - Stale Seed Bed Technique (in Wet DSR)
- T5 - Hand Weeding at 25-30, 45-50 DAS
- T6 - Weedy check
- T7 - Weed Free

Table 4.4.3: Group wise weed biomass gm/m² at active tillering and panicle initiation stages of Weedy Rice Management in DSR areas Kharif-2025.

Treatment details	Active Tillering Stage											
	ZONE-VII Gangavathi						ZONE-I Malan					
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	1.52	3.66	0.00	5.18	6.48	12.73	3.59	22.80	12.59	5.92	5.10	23.61
T2	2.40	8.33	0.38	11.11	6.23	30.94	6.64	43.80	118.15	5.55	4.65	128.35
T3	1.84	5.21	0.10	7.15	27.92	12.34	8.32	48.57	8.55	3.94	3.92	16.41
T4	4.20	8.82	1.16	14.18	10.86	17.53	5.18	33.57	16.33	8.03	6.47	30.83
T5	0.45	1.40	0.37	2.23	11.59	12.43	4.11	28.13	13.28	7.07	4.77	25.12
T6	4.54	8.41	2.02	14.97	31.26	21.33	16.18	68.77	21.54	10.23	7.83	39.60
T7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exp. mean	2.14	5.12	0.58	7.83	13.48	15.33	6.29	35.09	27.21	5.82	4.68	37.70
CD(0.05)	2.00	1.95	1.84	4.11	5.93	10.78	7.78	15.27	123.85	0.73	1.28	124.40
CV	52.65	21.36	179.21	29.48	24.72	39.54	69.56	24.46	255.87	7.00	15.33	185.45

Treatment details	Panicle Initiation Stage											
	ZONE-VII Gangavathi						ZONE-V Jagdalpur					
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	4.30	4.85	0.22	9.38	4.95	9.16	23.84	37.95	15.27	12.78	7.02	35.08
T2	2.86	10.12	0.39	13.37	6.30	17.10	8.35	31.75	16.49	27.93	8.21	52.62
T3	1.82	5.56	1.05	8.44	4.74	7.84	6.43	19.01	59.98	23.22	16.29	99.49
T4	3.16	8.99	1.16	13.31	6.13	32.80	10.98	49.90	22.63	21.17	11.13	54.93
T5	0.19	0.57	0.37	1.13	3.84	0.00	5.28	9.12	19.31	18.87	12.49	50.67
T6	5.50	11.23	2.02	18.75	36.38	77.14	46.05	159.56	64.23	43.93	30.28	138.44
T7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exp. mean	2.55	5.90	0.75	9.20	8.90	20.58	14.42	43.90	28.27	21.13	12.20	61.60
CD(0.05)	2.78	2.87	1.89	4.76	7.48	8.72	7.36	15.84	7.86	6.11	4.68	10.35
CV	61.41	27.34	142.68	29.11	47.23	23.83	28.70	20.28	15.63	16.26	21.55	9.44

T1 - Pre-emergence application of Pretilachlor @ 1.5 kg ha -1 at 2-3 DBS
T2 - Pre-emergence application of Oxyfluorfen @ 0.20 kg ha -1 at 2-3 DBS
T3 - Pre-emergence application of Pyrazosulfuron-ethyl@25 g ha -1 at 2-3 DBS
T4 - Stale Seed Bed Technique (in Wet DSR)
T5 - Hand Weeding at 25-30, 45-50 DAS
T6 - Weedy check
T7 - Weed Free

4.4.4. Integrated Pest Management – on farm management of insects, diseases and weeds in DSR. Special interdisciplinary trial (Entomology, Pathology and Agronomy), Kharif 2025

During *Kharif* 2025, the trial was conducted in five Zones at 9 locations viz., **Ludhiana, Chinsurah, Titabar, Navasari, Aduthurai, Coimbatore, Gangavathi, Mandya and Puducherry**. The effect of integrated pest management (IPM) over farmers practice on crop performance and weed dynamics is presented in **Tables 4 (4.4)**.

Zone II – Northern (Punjab-Ludhiana)

Crop Growth and Yield Attributes

The number of panicles per m² did not differ between treatments, remaining constant at 262 panicles m⁻², indicating that IPM practices had no significant influence on panicle density. Similarly, panicle weight showed negligible variation between treatments (2.96 g under IPM and 2.95 g under farmers practice).

Grain and Straw Yield

Despite similar yield attributes, grain yield was significantly influenced by IPM practices. The IPM treatment recorded a higher grain yield (6.09 t ha⁻¹) compared to farmers practice (5.99 t ha⁻¹), resulting in a yield advantage of 1.64%.

A similar trend was observed for straw yield, where IPM produced 7.87 t ha⁻¹, which was significantly higher than farmers practice (7.74 t ha⁻¹). The increase in yield under IPM, despite comparable panicle number and weight, suggests improved resource use efficiency and reduced crop–weed competition.

Weed Population Dynamics

Weed population was significantly reduced under IPM compared to farmers practice. At the panicle initiation stage, IPM recorded 4.00 weeds m⁻² (2.05 after transformation), which was significantly lower than farmers practice (5.50 weeds m⁻², 2.39 transformed). This demonstrates the effectiveness of IPM in early-stage weed suppression.

Weed Biomass

Weed dry biomass was markedly reduced under IPM. At the panicle initiation stage, IPM recorded 27.64 g m⁻², significantly lower than farmers practice (39.02 g m⁻²). This indicates that IPM not only reduced weed numbers but also suppressed weed growth and vigour.

Zone III – Eastern (Chinsurah)

Crop Growth and Yield Attributes

Unlike Ludhiana, yield attributes at Chinsurah showed clear variation between treatments. The IPM treatment recorded a significantly higher number of panicles (332 m⁻²) compared to farmers practice (300 m⁻²). Similarly, panicle weight was significantly higher under IPM (3.27 g) than farmers practice (2.95 g). These results indicate that improved weed management under

IPM positively influenced crop growth and reproductive development, leading to better yield attributes.

Grain Yield

Grain yield was significantly higher under IPM (5.50 t ha⁻¹) compared to farmers practice (4.96 t ha⁻¹), with a yield advantage of 9.82%. The higher yield under IPM can be attributed to improvements in both panicle number and panicle weight, unlike in Ludhiana where yield gains occurred without changes in these attributes.

Weed Population Dynamics

IPM significantly reduced weed population at both growth stages. At the active tillering stage, weed density under IPM was 3.83 m⁻² (2.08 transformed) compared to 11.47 m⁻² (3.46 transformed) under farmers practice. A similar trend was observed at the panicle initiation stage, where IPM recorded 1.02 m⁻² (1.23 transformed) compared to 2.81 m⁻² (1.82 transformed) under farmers practice. This indicates that IPM provided effective and sustained weed suppression throughout the crop growth period.

Weed Biomass

Weed dry biomass was drastically reduced under IPM at both stages. At active tillering, biomass was 0.49 g m⁻² under IPM compared to 3.93 g m⁻² under farmers practice. Similarly, at panicle initiation, IPM recorded 0.14 g m⁻², significantly lower than 0.44 g m⁻² under farmers practice. The substantial reduction in biomass suggests that IPM not only reduced weed numbers but also suppressed weed growth and competitiveness more effectively.

Zone – IV North Eastern (Titabar)

Grain yield at Titabar was significantly influenced by weed management practices. The IPM treatment recorded a higher grain yield (4.56 t ha⁻¹) compared to farmers practice (3.27 t ha⁻¹), resulting in a substantial yield advantage of 28.28%. The marked increase in yield under IPM suggests that weed competition was a major limiting factor under farmers practice, and its effective management led to significant productivity gains.

Weed population was significantly lower under IPM at both growth stages. At the active tillering stage, IPM recorded 14.60 weeds m⁻² (3.88 transformed) compared to 20.00 weeds m⁻² (4.52 transformed) under farmers practice.

At the panicle initiation stage, a similar trend was observed, with IPM recording 16.00 weeds m⁻² (4.06 transformed) compared to 19.80 weeds m⁻² (4.50 transformed) under farmers practice. These results indicate that IPM ensured effective weed suppression throughout the crop growth period.

Weed dry biomass was also reduced under IPM, although the magnitude of reduction was relatively moderate. At the active tillering stage, biomass under IPM was 4.16 g m⁻², compared to 4.96 g m⁻² under farmers practice. At panicle initiation, IPM recorded 4.00 g m⁻², significantly lower than 4.64 g m⁻² under farmers practice. This reduction indicates that IPM not only reduced weed numbers but also restricted weed growth and vigour.

Zone – VI Western (Navasari)**Crop Growth and Yield Attributes**

At Navsari, yield attributes showed moderate improvement under IPM compared to farmers practice. The number of panicles was slightly higher under IPM (339 m⁻²) than farmers practice (331 m⁻²), but the difference was not statistically significant. Similarly, panicle weight was higher under IPM (4.89 g) compared to farmers practice (4.60 g). However, this difference was also non-significant. These results suggest that IPM had a limited effect on yield attributes under Navsari conditions.

Grain and Straw Yield

Grain yield was significantly influenced by weed management practices. The IPM treatment recorded a higher grain yield (5.14 t ha⁻¹) compared to farmers practice (4.70 t ha⁻¹), resulting in a yield advantage of 8.56%. Similarly, straw yield was significantly higher under IPM (7.04 t ha⁻¹) compared to farmers practice (6.86 t ha⁻¹). The increase in yield despite non-significant differences in yield attributes suggests improved crop performance due to reduced weed interference.

Weed Population Dynamics

Weed population was significantly lower under IPM at both crop stages. At the active tillering stage, IPM recorded 6.80 weeds m⁻² (2.68 transformed) compared to 10.60 weeds m⁻² (3.31 transformed) under farmers practice. At the panicle initiation stage, a similar trend was observed, with IPM recording 6.40 weeds m⁻² (2.54 transformed) compared to 11.80 weeds m⁻² (3.48 transformed) under farmers practice. This indicates effective and sustained weed suppression under IPM.

Weed Biomass

Weed dry biomass was also significantly reduced under IPM. At active tillering, biomass under IPM was 8.64 g m⁻², compared to 13.01 g m⁻² under farmers practice. At panicle initiation, IPM recorded 8.59 g m⁻², which was significantly lower than 15.18 g m⁻² under farmers practice. This substantial reduction highlights the ability of IPM to limit weed growth and competitiveness throughout the crop cycle.

Zone – VII Sothorn (Aduthurai)

Grain yield at Aduthurai was significantly higher under IPM (3.88 t ha⁻¹) compared to farmers practice (3.42 t ha⁻¹), resulting in a yield advantage of 11.85%. The yield improvement under IPM can be attributed to effective early-stage weed suppression, which reduced crop–weed competition.

Weed population at the active tillering stage was significantly lower under IPM (20.73 m⁻²; 4.26 transformed) compared to farmers practice (32.67 m⁻²; 5.40 transformed). Similarly, weed biomass was reduced under IPM (19.93 g m⁻²) compared to farmers practice (22.20 g m⁻²), though the difference was statistically non-significant.

Zone – VII Sothern (Coimbatore)

Although yield data are not provided, weed dynamics clearly indicate the superiority of IPM. Weed population at active tillering was significantly reduced under IPM (26.20 m^{-2} ; 5.13 transformed) compared to farmers practice (32.13 m^{-2} ; 5.70 transformed). At panicle initiation, weed density under IPM (9.20 m^{-2} ; 3.11 transformed) remained significantly lower than farmers practice (11.60 m^{-2} ; 3.47 transformed). Weed biomass was drastically reduced under IPM at both stages (3.90 and 4.50 g m^{-2}) compared to farmers practice (16.48 and 5.28 g m^{-2}), indicating strong suppression of weed growth. These results demonstrate that IPM provides consistent and effective weed control throughout crop growth, which is expected to translate into yield benefits.

Zone – VII Sothern (Gangavathi)

IPM significantly improved yield attributes and yield at Gangavathi. The number of panicles was higher under IPM (267 m^{-2}) compared to farmers practice (213 m^{-2}). Panicle weight was also higher under IPM (2.58 g) compared to farmers practice (2.29 g). Grain yield under IPM (4.54 t ha^{-1}) was significantly higher than farmers practice (4.13 t ha^{-1}), resulting in a yield advantage of 9.03%. Straw yield followed a similar trend (5.79 vs. 5.35 t ha^{-1}).

Weed population and biomass were consistently lower under IPM at both stages, though differences were not statistically significant. This indicates that IPM improved productivity through a combination of better yield attributes and reduced weed competition.

Zone – VII Sothern (Mandya)

At Mandya, IPM resulted in substantial improvements in both yield attributes and yield. Panicle number was higher under IPM (362 m^{-2}) compared to farmers practice (344 m^{-2}). However, panicle weight differences were non-significant.

Grain yield was significantly higher under IPM (6.17 t ha^{-1}) compared to farmers practice (5.34 t ha^{-1}), with a yield advantage of 13.45%. Straw yield also increased significantly (8.92 vs. 7.71 t ha^{-1}).

Weed population and biomass were markedly lower under IPM at both stages. Weed biomass at active tillering was 0.68 g m^{-2} under IPM compared to 1.82 g m^{-2} under farmers practice. This strong reduction in weed pressure contributed to improved crop performance.

Zone – VII Sothern (Puducherry)

Puducherry showed the most pronounced response to IPM. Panicle number (211 vs. 192 m^{-2}) and panicle weight (2.68 vs. 2.55 g) were significantly higher under IPM.

Grain yield under IPM (3.36 t ha^{-1}) was significantly higher than farmers practice (2.85 t ha^{-1}), resulting in a yield advantage of 15.17%. Straw yield also improved significantly (5.69 vs. 4.96 t ha^{-1}). The large yield advantage reflects severe weed pressure under farmers practice, which was effectively controlled by IPM.

Weed population and biomass were drastically reduced under IPM. At active tillering, weed density decreased from 85.51 to 49.36 m⁻², and biomass from 60.75 to 30.42 g m⁻². Similar reductions were observed at panicle initiation.

Species wise weed data

Species wise weed data reported by 4 locations viz., **Gangavathi, Ludhiana, Mandya, Navasari**. The weed flora reported in the test locations included

Grasses: *Dactylactenium aegyptium*, *Echinochloa colona*, *Echinochloa crusgalli*, *Echinochloa spp*, *Leptochloa chinensis*, *Leptochloa spp*, *Panicum repens*, *Panicum tripheron*.

Sedges: *Cyperus spp*, *Cyperus difformis*, *Cyperus iria*, *Cyperus procerus*, *Fimbristylis miliacea*, *Scirpus spp*.

BLW: *Ammania baccifera*, *Bergia capensis*, *Cynotis spp*, *Eclipta alba*, *Glinus oppositifolia*, *Ludwigia parviflora*, *Marsilea quadrifolia* and *Spilanthus acmella*.

Table 4.4.4: Yield parameters and Grain yield & weed population no/m², weed biomass g/m² of Integrated Pest Management - on farm management of insects, diseases and weeds IPMs (Entomology, Pathology and Agronomy) - Special Interdisciplinary trial, Kharif 2025.

Location	Treatments	Panicle No/m ²	Panicle wt (g)	Grain Yield t/ha	Yield advantage	Straw Yield t/ha	Weed population no/m ²		Weed dry biomass g/m ²		
							Active Tillering Stage	AT Panicle Initiation Stage	Active Tillering Stage	AT Panicle Initiation Stage	
ZONE-II											
LUDHIANA	IPM	262	2.96	6.09	1.642	7.87	4.00(2.05)		27.64		
	Farmers Practice	262	2.95	5.99		7.74	5.50(2.39)		39.02		
	Exp. mean	262	2.95	6.04		7.80	2.22		33.33		
	CD(0.05)	11	0.04	0.02		0.14	0.66		14.49		
ZONE-III											
CHINSURAH	IPM	332	3.27	5.50	9.818		3.83(2.08)		0.14		
	Farmers Practice	300	2.95	4.96			11.47(3.46)		3.93		
	Exp. mean	316	3.11	5.23			2.77		2.21		
	CD(0.05)	15	0.15	0.25			0.18		0.3		
ZONE-IV											
TITABAR	IPM			4.56	28.28		14.60(3.88)		4.16		
	Farmers Practice			3.27			20.00(4.52)		4.96		
	Exp. mean			3.91			4.2		4.56		
	CD(0.05)			0.05			0.14		0.41		
ZONE-VI											
NAVSARI	IPM	339	4.89	5.14	8.56	7.04	6.40(2.54)		8.59		
	Farmers Practice	331	4.6	4.70		6.86	11.80(3.48)		15.18		
	Exp. mean	335	4.74	4.92		6.95	3.01		11.89		
	CD(0.05)	10	0.46	0.25		0.37	0.4		2.33		

Table 4.4.4: Contd.

Location	Treatments	Panicle No/m ²	Panicle wt (g)	Grain Yield t/ha	Yield advantage	Straw Yield t/ha	Weed population no/m ²		Weed dry biomass g/m ²		
							Active Tillering Stage	AT Panicle Initiation Stage	Active Tillering Stage	AT Panicle Initiation Stage	
ZONE-VII											
ADUTHURAI	IPM			3.88	11.85		20.73(4.26) 32.67(5.40)		19.93 22.2		
	Farmers Practice		3.42	4.83 1.6			21.07 9.81				
	Exp. mean CD(0.05)		3.65 0.64								
COIMBATORE	IPM						26.20(5.13) 32.13(5.70)		3.90 16.48		
	Farmers Practice			9.20(3.11) 11.60(3.47)			10.19 2.65				
	Exp. mean CD(0.05)			5.42 0.34			3.29 0.16				
GANGAVATHI	IPM	267	2.58	4.54	9.03	5.79 5.35	9.08(3.01) 9.75(3.19)		4.19 4.90		
	Farmers Practice	213	2.29	4.13			3.1 0.87		2.14 0.34		
	Exp. mean CD(0.05)	240 16	2.44 0.33	4.34 0.17			5.57 0.22		4.54 2.61		
MANDYA	IPM	362	4.26	6.17	13.45	8.92 7.71	7.00(2.60) 10.80(3.31)		0.68 1.82		
	Farmers Practice	344	4.11	5.34			2.96 0.94		2.23 0.58		
	Exp. mean CD(0.05)	353 16	4.19 0.58	5.75 1.38			8.32 1.7		1.25 0.45		
PUDUCHERRY	IPM	211	2.68	3.36	15.17	5.69 4.96	49.36(7.06) 85.51(9.27)		30.42 60.75		
	Farmers Practice	192	2.55	2.85			33.00(5.79) 62.01(7.90)		45.58 1.64		
	Exp. mean CD(0.05)	201 3	2.61 0.03	3.1 0.03			8.17 0.14		6.85 0.12		

Table 4.4.4: Reduction in weed parameters in Integrated Pest Management - on farm management of insects, diseases and weeds IPMs (Entomology, Pathology and Agronomy) - Special Interdisciplinary trial, Kharif 2025.

Zones	Centers	Weed Population (% reduction in IPM)		Weed dry biomass (% reduction in IPM)	
		Active Tillering Stage	AT Panicle Initiation Stage	Active Tillering Stage	AT Panicle Initiation Stage
ZONE-II	Ludhiana	-	27.27	-	29.16
ZONE-III	Chinsurah	66.60	63.70	87.53	68.18
ZONE-IV	Titabar	27.00	19.19	16.12	13.79
ZONE-VI	Navasari	35.84	45.76	33.58	43.41
ZONE-VII	Adluthurai	36.54	-	10.22	-
	Coimbatore	18.45	20.68	76.33	14.77
	Gangavathi	6.87	6.79	14.48	13.59
	Mandya	35.18	34.48	62.63	36.29
	Puducherry	42.27	46.78	49.92	35.75

INTER DISCIPLINARY TRIALS



4.5. INTER DISCIPLINARY TRIALS (IDT's)

4.5.1. Yield maximization of rice in different zones specific to DSR system (Wet or Dry)

Rice (*Oryza sativa* L.) is the principal staple food crop of India, occupying about 44 million hectares with a production of around 107 million tonnes. With the continuous increase in population, the demand for rice is projected to reach nearly 200 million tonnes by 2050, necessitating an increase in production by about 70-75%. Therefore, enhancing rice productivity in a sustainable manner remains a major challenge for ensuring national food security. The variability in rice productivity across different agro-climatic zones is largely attributed to imbalanced and inadequate nutrient management practices, along with poor adoption of integrated nutrient strategies. Continuous reliance on chemical fertilizers alone has led to stagnation or decline in yields in several regions, highlighting the need for combining organic and inorganic nutrient sources along with location-specific interventions. In this context, a multi-location trial was conducted during *kharif* 2025 across diverse agro-ecological regions to evaluate the suitable, promising and best management practices in rice crop with the following objectives 1. To maximize the yield in different zones 2. To compare yield and economics of the best management practices. The experiment was laid out in a randomized block design with three replications comprising seven treatments. Treatments are **T₁: Location Specific Recommended Dose of Fertilizer (LSRDF)**, **T₂: LSRDF + FYM@ 5t/ha**, **T₃: 125% LSRDF**, **T₄: 125% LSRDF + FYM@5 t/ha**, **T₅: LSRDF + Application of micro nutrient (deficient to that location)**, **T₆: LSRDF + Application of Biochar @ 500 kh/ha**, **T₇: Optional (According to location)**. The trial was conducted at 15 locations (**Khudwani, Malan, Pantnagar, Ranchi, Bankura, Chinsurah, Chinsurah (rabi), Ghaghraghat, Titabar, Raipur, Maruteru, Warangal, Pattambi, Pattambi (rabi), Mandya, Gangavathi, and Karaikal**). The results are summarized and presented in **Table 4.5.1** and the salient findings are given below.

In Zone I in silty clay loam soil of **Khudwani**, Optional (According to location) recorded the highest grain yield due to enhanced tiller and panicle count along with better grain filling improved sink size which was on par with LSRDF + Application of micro nutrient (deficient to that location). Cost of cultivation and gross returns were not influenced by any treatments, although higher gross returns were recorded in LSRDF + Application of micro nutrient (deficient to that location). In silty clay loam soil of **Malan**, 125% LSRDF + FYM@5 t/ha produced higher grain yield due to better panicle development, test weight and nutrient uptake which was on par with 125% LSRDF. **In Zone II** in silt loam soil of **Pantnagar**, 125% LSRDF + FYM@5 t/ha gave the highest grain yield, which was attributed to larger panicles, higher filled grains and better nutrient uptake followed by LSRDF + Application of micro nutrient (deficient to that location). **In Zone III** in clay loam soil of **Ranchi**, higher grain yield recorded in 125% LSRDF + FYM@5 t/ha due to higher panicle density, filled grains per panicle and total nutrient uptake (N, P, and K) which was on par with 125% LSRDF and LSRDF + FYM@ 5t/ha. In sandy loam soils of **Bankura**, rice performed best under 125% LSRDF + FYM@5 t/ha, recorded higher grain yield which was attributed to better tiller and panicle development and a higher number of filled grains per panicle, which enhanced sink

capacity. In clay loam soil of **Chinsurah**, grain yield and yield attributes such as tiller number, panicle number and panicle weight were statistically non-significant, indicating that all treatments performed similarly. However, 125% LSRDF + FYM@5 t/ha produced the highest grain yield. In *rabi* season at **Chinsurah**, grain yield and yield attributes were non-significant, though higher grain yield was observed in 125% LSRDF + FYM@5 t/ha due to higher tiller and panicle numbers. In sandy loam soil of **Ghaghrahat**, 125% LSRDF + FYM@5 t/ha recorded higher grain yield and was comparable with LSRDF + FYM@ 5t/ha. Well-developed tillers and panicles along with improved grain filling led to higher productivity. In **Zone IV** in clay loam soil of **Titabar**, grain yield was statistically non-significant, indicating similar treatment performance. However, higher grain yield was recorded in 125% LSRDF + FYM@5 t/ha due to efficient panicle formation and better filled grains per panicle. In **Zone V** in vertisols of **Raipur**, 125% LSRDF + FYM@5 t/ha resulted in higher grain yield due to increased panicle, tiller numbers and filled grains which was on par with 125% LSRDF. In **Zone VII** in alluvial soils of **Maruteru**, 125% LSRDF recording the highest grain yield due to efficient tiller and panicle formation and better grain filling led to superior performance followed by LSRDF + FYM@ 5t/ha. At **Warangal**, grain yield and nutrient uptake were significantly affected by treatments, whereas straw yield and all yield attributes remained non-significant. However, 125% LSRDF + FYM@5 t/ha produced higher grain yield due to increased panicle numbers, higher filled grains and nutrient uptake. At **Pattambi**, no significant differences were observed among treatments for grain yield and yield attributes, suggesting uniform treatment performance. In contrast, tiller density and panicle density exhibited significant variation. However, LSRDF + FYM@ 5t/ha recorded higher grain yield and straw yield. In *rabi* season at **Pattambi**, grain yield and yield attributes were significantly affected by treatments, with higher values recorded in LSRDF + Sampoorana (KAU) @10 g per litre of water due to higher tillers, panicles and filled grains per panicle. In red sandy loam soil of **Mandya**, treatments exhibited statistically non-significant differences with respect to grain yield, yield attributes and economic returns, suggesting that treatment effects were similar across all parameters. However, 125% LSRDF + FYM@5 t/ha recorded best performance among the treatments. In black soil of **Gangavathi**, grain yield, yield attributes such as tiller number, panicle number and panicle weight, as well as cost of cultivation and gross returns, were statistically non-significant, indicating that all treatments performed similarly. However, 125% LSRDF + FYM @ 5 t/ha recorded the highest grain yield. In *kharif* season, at **Karaikal**, grain yield and yield attributes were non-significant, though higher grain yield was observed in 125% LSRDF + FYM@5 t/ha.

Across the 15 locations in six zones, 125% LSRDF + FYM @ 5 t/ha consistently recorded higher or comparable grain yield, mainly due to improved tillering, panicle formation, and grain filling, though many parameters were statistically non-significant, indicating similar treatment performance under different agro-climatic zones.

Table 4.5.1: Yield maximization of rice in different Zones, kharif 2025

Treatment	BANKURA									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt. (g)	Filled grains/panicle	Un-Filled grains/panicle
T1	3.41	7	4.68	6.61	9.36	236	188	21.39	141	46
T2	3.80	4	5.16	7.60	10.32	274	216	22.15	162	36
T3	3.97	2	5.54	7.94	11.08	284	242	22.68	179	28
T4	4.22	1	5.70	8.44	11.40	292	250	22.77	182	27
T5	3.74	5	5.00	7.48	9.99	256	208	21.92	155	38
T6	3.69	6	4.90	7.37	9.79	245	200	21.82	145	42
T7	3.85	3	5.33	7.71	10.65	280	227	22.38	169	33
Exp. mean	3.81		5.19	7.59	10.37	267	219	22.16	162	36
CD(0.05)	0.06		0.09	0.28	0.19	8.84	9.23	0.07	6.36	3.42
CV	0.91		1.03	2.09	1.02	1.86	2.37	0.17	2.21	5.39
res	**		**	**	**	**	**	**	**	**
Soil type	Red & Lateritic (Sandy Loam)									
pH	-									
EC	-									
Variety	-									
Applied NPK kg/ha	70:35:35									
Available NPK kg/ha	-									

T₁: Location specific recommended dose of fertilizer (RDF)T₂: T₁ + FYM@ 5t/haT₃: 125% RDF of T₁T₄: 125% RDF of T₁ + FYM@5 t/haT₅: T₁+ Application of micro nutrient (deficient to that location)T₆: T₁+ Application of Biochar @ 500 kh/ha*T₇: Optional (According to location)

Table 4.5.1: Contd.

Treatment	CHINSURAH											
	Grain yield (t/ha)	Rank	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Soil available kg/ha				Soil pH	Soil EC	Soil OC
						N	P	K	Zn			
T1	5.22	6	355	307	3.18	476.33	87.89	283.52	17.51	7.03	0.22	1.21
T2	5.34	4	361	313	3.26	494.33	92.06	296.29	17.15	7.04	0.19	1.13
T3	5.30	5	359	312	3.23	495.33	96.23	291.43	17.58	7.04	0.21	1.17
T4	5.56	1	376	326	3.39	459.67	97.90	295.03	17.71	7.06	0.22	1.10
T5	5.36	3	363	315	3.27	500.33	96.23	285.93	17.28	6.99	0.23	1.21
T6	5.43	2	367	318	3.31	460.33	97.57	295.66	17.58	7.08	0.20	1.23
T7	5.15	7	348	301	3.14	451.67	92.89	279.89	17.75	7.06	0.21	1.08
Exp. mean	5.34		361	313	3.25	476.86	94.40	289.68	17.51	7.04	0.21	1.16
CD(0.05)	0.49		32.61	28.42	0.29	25.92	9.21	19.54	0.49	0.12	0.03	0.1
CV	5.12		5.07	5.1	5.08	3.06	5.48	3.79	1.57	0.92	8.5	4.84
res	NS		NS	NS	NS	**	NS	NS	NS	NS	NS	*
Soil type	Clay loam											
pH	-											
EC	-											
Variety	Muktashree											
Applied NPK kg/ha	80:40:40											
Available NPK kg/ha	-											

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: 125% RDF of T₁

T₄: 125% RDF of T₁ + FYM@5 t/ha

T₅: T₁+ Application of micro nutrient (Two rounds of foliar spray with 2.0 g ZnSO₄.7H₂O in 1.0 L of water, adding 10.0-15.0 g urea/L at AT & just before PI)

T₆: T₁+ Application of Biochar @ 500 kh/ha*

T₇ : Optional - Farmers' Practice

Table 4.5.1: Contd.

Treatment	GANGAVATHI											
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-Filled grains/panicle	Cost of cultivation/ha	Gross returns/ha
T1	4.47	6	4.25	8.94	8.50	196	183	16.00	172	6	67817	102829
T2	4.70	3	4.40	9.39	8.80	217	204	16.50	185	5	75317	108004
T3	4.55	5	4.67	9.08	9.34	221	215	17.00	180	5	69917	104458
T4	5.05	1	4.98	10.08	9.97	237	231	18.00	200	5	77417	115958
T5	4.61	4	4.16	9.22	8.33	199	180	16.33	175	5	70937	105992
T6	4.84	2	4.33	9.67	8.67	221	212	16.67	190	5	75317	111167
T7	2.90	7	2.99	5.81	5.99	189	180	14.67	150	7	59415	66796
Exp. mean	4.45		4.25	8.88	8.51	211	201	16.45	179	5	70877	102172
CD(0.05)	1.59		1.16	3.17	2.32	25.39	30.66	3.94	48.07	2.21	0	36473.69
CV	20.07		15.27	20.06	15.29	6.75	8.58	13.45	15.12	22.72	0	20.07
res	NS		NS	NS	NS	*	*	NS	NS	NS	NS	NS
Soil type	Black soil											
pH	-											
EC	-											
Variety	Gangavathi sona, 135 days											
Applied NPK kg/ha	150:75:75											
Available NPK kg/ha	-											

T₁: Location specific recommended dose of fertilizer (RDF)T₂: T₁ + FYM@ 5t/haT₃: 125% RDF of T₁T₄: 125% RDF of T₁ + FYM@5 t/haT₅: T₁+ Application of micro nutrient (deficient to that location)T₆: T₁+ Application of Biochar @ 500 kh/ha*T₇ : Optional - No NPK

Table 4.5.1: Contd.

Treatment	GHAGHRAGHAT							
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-Filled grains/panicle
T1	2.91	6	3.84	148	105	21.98	125	28
T2	3.43	2	4.91	199	134	23.61	184	18
T3	3.33	4	4.05	177	121	23.07	151	23
T4	3.59	1	5.30	213	139	23.65	191	17
T5	3.22	5	3.92	164	113	22.66	137	27
T6	3.35	3	4.80	185	123	23.47	171	21
T7								
Exp. mean	3.31		4.47	181	123	23.07	160	22
CD(0.05)	0.17		0.46	19.5	9.1	1.09	28.05	3.54
CV	2.9		5.68	5.92	4.08	2.59	9.66	8.76
res	**		**	**	**	*	**	**
Soil type	Sandy loam							
pH	-							
EC	-							
Variety	NDR 2065							
Applied NPK kg/ha	120:60:60							
Available NPK kg/ha	-							

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: 125% RDF of T₁

T₄: 125% RDF of T₁ + FYM@5 t/ha

T₅: T₁+ Application of micro nutrient (deficient to that location)

T₆: T₁+ Application of Biochar @ 500 kh/ha*

T₇ :-

Table 4.5.1: Contd.

KHUDWANI																		
Treatment	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/ panicle	Un-Filled grains/ panicle	Total uptake (kg/ha) in plant			Soil available kg/ha			Cost of cultivation/ha	Gross returns/ha
											N	P	K	N	P	K		
T1	6.90	6	8.07	14.00	16.03	410	364	28.93	105	12	116.58	21.93	101.10	370.00	18.23	231.00	80400	257761
T2	7.00	4	8.27	13.67	16.53	417	370	28.83	107	12	121.16	23.67	104.77	388.00	18.67	243.33	90400	262320
T3	6.87	7	8.03	13.67	16.03	411	353	28.40	102	15	117.60	22.87	99.90	346.00	19.47	237.67	85966	255766
T4	6.93	5	8.23	14.00	16.47	424	358	28.50	107	10	120.88	22.73	103.30	394.67	20.03	244.00	95966	259311
T5	7.50	2	8.97	15.00	17.87	439	394	29.40	118	12	135.36	25.60	114.87	363.67	18.37	250.67	81600	281139
T6	7.10	3	8.33	14.00	16.70	420	369	29.03	110	11	121.56	22.67	104.77	342.33	19.00	255.00	95400	264935
T7	7.67	1	9.13	15.33	18.30	447	399	29.57	122	11	137.26	26.63	117.20	403.00	19.23	249.00	91600	262561
Exp. mean	7.14		8.43	14.24	16.85	424	372	28.95	110	12	124.34	23.73	106.56	372.52	19.00	244.38	88762	263399
CD(0.05)	0.54		0.58	1.39	1.23	22.89	28.26	1.27	11.91	2.98	8.36	4.03	8.78	37.19	0.89	21.95	0	17357.91
CV	4.27		3.87	5.49	4.1	3.04	4.26	2.47	6.08	13.92	3.78	9.54	4.63	5.61	2.62	5.05	0	3.7
res	*		**	NS	**	*	*	NS	*	NS	**	NS	**	*	**	NS	NS	NS
Soil type	Silty clay loam																	
pH	-																	
EC	-																	
Variety	-																	
Applied NPK kg/ha	120:60:30																	
Available NPK kg/ha	378:18.7:248.5																	

T₁: Location specific recommended dose of fertilizer (RDF)
T₂: T₁ + FYM@ 5t/ha
T₃: 125% RDF of T₁
T₄: 125% RDF of T₁ + FYM@5 t/ha
T₅: T₁+ Application of micro nutrient (deficient to that location)
T₆: T₁+ Application of Biochar @ 500 kh/ha*
T₇ : Optional (According to location)

Table 4.5.1: Contd.

Treatment	MALAN									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-Filled grains/panicle
T1	1.89	7	4.52	3.79	9.03	210	181	16.97	79	16
T2	2.31	4	6.06	4.63	12.13	230	214	17.93	75	9
T3	2.79	2	7.75	5.58	15.50	234	221	18.80	85	8
T4	3.03	1	9.37	6.05	18.75	251	235	19.87	94	6
T5	2.12	5	5.28	4.24	10.56	210	195	17.37	73	12
T6	2.03	6	4.77	4.06	10.24	191	186	17.13	69	13
T7	2.39	3	6.80	4.79	13.59	236	215	17.97	77	9
Exp. mean	2.37		6.36	4.73	12.83	223	207	18.01	79	10
CD(0.05)	0.41		1.21	0.82	1.99	32.59	29.11	1.56	9.82	1.88
CV	9.77		10.72	9.74	8.72	8.21	7.92	4.88	6.99	10.25
res	**		**	**	**	*	*	*	**	**
Soil type	Silty clay loam									
pH	-									
EC	-									
Variety	Kasturi									
Applied NPK kg/ha	90:40:40									
Available NPK kg/ha	320;16.2:224									

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: 125% RDF of T₁

T₄: 125% RDF of T₁ + FYM@5 t/ha

T₅: T₁+ Application of micro nutrient (deficient to that location)

T₆: T₁+ Application of Biochar @ 500 kh/ha*

T₇ : Optional - Sampoorna (KAU) @10 g per litre of water twice in the cropping season (250 litre/hectare/application), ie., one week prior to maximum tillering stage and one week prior to panicle initiation (1% foliar application of 'Sampoorna KAU Multimix' @ 2.5 kg/ha each at the above two stages)

Table 4.5.1: Contd.

Treatment	MANDYA											
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains / panicle	Un-Filled grains / panicle	Cost of cultivation/ha	Gross returns/ha
T1	5.4	7	7.6	10.7	15.3	355	325	270	21	12.3	65324	157280
T2	5.8	4	8.1	11.5	16.3	377	347	275	18	12.8	71367	168693
T3	5.9	2	8.2	11.8	16.3	383	353	271	27	12.9	68741	172825
T4	6.1	1	9.1	12.2	18.2	382	352	286	22	12.6	74914	181074
T5	5.5	6	8.0	10.9	16.1	364	334	282	24	12.8	67037	161637
T6	5.5	5	7.7	11.0	15.5	368	338	275	23	12.6	74384	161371
T7	5.9	3	9.0	11.8	18.0	363	333	281	32	12.4	65553	175762
Exp. mean	5.7		8.3	11.4	16.5	370	340	277	24	12.6	69617	168377
CD(0.05)	1.01		0.92	2.02	1.83	37.06	37.06	50.02	13.91	0.45	1022.51	26192.37
CV	9.92		6.26	9.94	6.24	5.63	6.12	10.15	32.7	2.01	0.83	8.74
res	NS		*	NS	*	NS	NS	NS	NS	NS	**	NS
Soil type	Red sandy loam											
pH	7.85											
EC	0.37											
Variety	RNR 15048, 125-130 days											
Applied NPK kg/ha	125:62:6											
Available NPK kg/ha	296:77.5:287.5											

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: 125% RDF of T₁

T₄: 125% RDF of T₁ + FYM@5 t/ha

T₅: T₁+ Application of micro nutrient (deficient to that location)

T₆: T₁+ Application of Biochar @ 500 kg/ha*

T₇: Optional - Farmers application dose 150N: 30 P₂O₅:75 K₂O kg/ha

Table 4.5.1: Contd.

Treatment	MARUTERU							
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Total uptake (kg/ha) in plant		
						N	P	K
T1	5.82	7	9.00	376	357	0.87	0.32	0.29
T2	6.62	2	9.10	376	364	0.74	0.32	0.37
T3	6.80	1	9.36	423	368	0.80	0.30	0.28
T4	6.46	4	9.83	407	352	0.83	0.28	0.35
T5	6.06	5	9.17	368	355	0.92	0.33	0.31
T6	5.97	6	9.42	391	367	0.83	0.33	0.31
T7	6.50	3	9.46	351	341	0.89	0.31	0.31
Exp. mean	6.32		9.34	384	358	0.84	0.31	0.32
CD(0.05)	634.89		783.48	75.04	68.2	0.11	0.06	0.05
CV	5.77		4.7	10.97	10.72	7.3	9.97	9.17
res	**		NS	NS	NS	NS	NS	*
Soil type	Alluvium soils							
pH	-							
EC	-							
Variety	-							
Applied NPK kg/ha	90:60:60							
Available NPK kg/ha	-							

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: 125% RDF of T₁

T₄: 125% RDF of T₁ + FYM@5 t/ha

T₅: T₁+ Application of micro nutrient (deficient to that location)

T₆: T₁+ Application of Biochar @ 500 kh/ha*

T₇ : Optional (According to location)- Fertiliser as per nutriexpert (118-27-52)

Table 4.5.1: Contd.

Treatment	PANTNAGAR															
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-Filled grains/panicle	Total uptake (kg/ha) in plant					
											N	P	K			
T1	5.35	7	6.54	10.70	13.08	263	268	27.37	80	18	43.58	9.60	62.24	213.60	22.63	190.73
T2	5.63	5	6.53	11.27	13.05	283	278	27.80	79	21	38.93	8.91	68.91	232.43	26.97	212.47
T3	5.77	4	6.78	11.53	13.55	300	296	28.30	76	21	40.06	11.13	69.00	228.73	25.40	208.37
T4	6.25	1	6.77	12.50	13.54	318	314	28.00	78	18	38.35	11.21	73.74	228.83	25.83	198.23
T5	5.93	2	6.25	11.87	12.52	308	298	27.60	80	21	36.29	9.95	69.43	225.77	23.77	196.93
T6	5.37	6	5.89	10.73	11.78	285	279	27.40	76	20	33.56	8.37	64.43	221.30	25.60	194.63
T7	5.90	3	6.15	11.80	12.30	316	311	27.30	76	18	33.87	9.83	68.98	219.57	23.23	193.43
Exp. mean	5.74		6.42	11.49	12.83	296	292	27.68	78	19	37.81	9.86	68.10	224.32	24.78	199.26
CD(0.05)	0.24		0.52	0.49	1.04	11.65	8.64	0.3	2.89	5.48	5.71	1.02	4.35	2.48	1.62	3.97
CV	2.39		4.57	2.39	4.55	2.21	1.66	0.62	2.09	15.82	8.49	5.81	3.59	0.62	3.68	1.12
res	**		*	**	*	**	**	**	*	NS	*	**	**	**	**	**
Soil type	Silt loam															
pH	-															
EC	-															
Variety	-															
Applied NPK kg/ha	150:60:40															
Available NPK kg/ha	230.22:25.1:212.0															

T₁: Location specific recommended dose of fertilizer (RDF) - (150:60:40 kg/ha NPK + ZnSO₄ & FeSO₄ 0.50% foliar application)T₂: T₁ + FYM@ 5t/haT₃: 125% RDF of T₁T₄: 125% RDF of T₁ + FYM@5 t/haT₅: T₁+ Application of micro nutrient - (Multiplex consortia of Ca, Mg, S, B, Cu, Mn & Mg)T₆: T₁+ Application of Biochar @ 500 kh/ha*T₇: Optional --(Farmers Practice 220:40:20 Kg/ha NPK+ ZnSo4 & FeSO4 0.50% folior spray)

Table 4.5.1: Contd.

Treatment	PATTAMBI									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-Filled grains/panicle
T1	4.43	4	8.83	8.87	17.70	374	352	26.27	105	28
T2	5.03	1	10.97	10.00	21.93	418	396	27.13	106	33
T3	4.47	3	9.43	8.87	18.80	429	418	27.77	122	37
T4	4.17	5	7.40	8.30	14.77	374	374	27.17	107	30
T5	4.50	2	7.93	8.93	15.77	286	286	26.23	106	31
T6	4.03	6	9.07	8.07	18.10	330	308	26.37	129	22
T7	3.63	7	7.43	7.27	14.90	264	264	26.67	104	37
Exp. mean	4.32		8.72	8.62	17.42	354	343	26.80	111	31
CD(0.05)	1.43		3.91	2.89	7.83	111.07	95.15	1.22	5.26	2.76
CV	18.59		25.21	18.85	25.26	17.66	15.61	2.56	2.66	4.99
res	NS		NS	NS	NS	*	*	NS	**	**
Soil type	-									
pH	-									
EC	-									
Variety	-									
Applied NPK kg/ha	90:45:45									
Available NPK kg/ha	-									

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₄: 125% RDF of T₁

T₅: 125% RDF of T₁ + FYM@5 t/ha

T₆: T₁+ Application of micro nutrient (deficient to that location)

T₇ : Optional -(Farmers Practice 220:40:20 Kg/ha NPK+ ZnSo₄ & FeSO₄ 0.50% folior spray)

Table 4.5.1: Contd.

Treatment	RAIPUR									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-filled grains/panicle
T1	4.12	7	5.23	8.24	10.47	244	211	21.27	110	52
T2	4.47	4	5.60	8.94	11.21	271	245	21.90	131	49
T3	4.85	2	6.37	9.70	12.73	325	294	22.33	147	42
T4	5.13	1	6.69	10.26	13.38	356	317	22.40	151	42
T5	4.49	3	5.81	8.98	11.62	288	252	21.97	133	49
T6	4.19	6	5.30	8.38	10.59	248	214	21.53	119	51
T7	4.36	5	5.78	8.72	11.56	268	241	21.70	126	51
Exp. mean	4.52		5.83	9.03	11.65	286	253	21.87	131	48
CD(0.05)	0.58		0.84	1.16	1.69	51.66	54.71	1.9	22.84	6.74
CV	7.24		8.15	7.24	8.15	10.17	12.13	4.89	9.8	7.92
res	*		*	*	*	**	**	NS	*	*
Soil type	Vertisols									
pH	-									
EC	-									
Variety	Vikram TCR, 122 days									
Applied NPK kg/ha	120:60:60									
Available NPK kg/ha	-									

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: 125% RDF of T₁

T₄: 125% RDF of T₁ + FYM@5 t/ha

T₅: T₁+ Application of micro nutrient (deficient to that location)

T₆: T₁+ Application of Biochar @ 500 kg/ha*

T₇ : Optional (According to location)

Table 4.5.1: Contd.

Treatment	RANCHI									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-filled grains/panicle	Total uptake (kg/ha) in plant		
								N	P	K
T1	5.86	6	8.63	252	25.25	103	27	99.27	17.40	50.82
T2	6.16	3	9.18	263	25.96	108	16	108.85	18.83	59.60
T3	6.46	2	9.41	270	26.08	115	19	115.24	20.34	63.13
T4	6.67	1	10.18	293	26.13	121	21	125.56	21.52	71.75
T5	5.94	4	8.77	255	25.30	106	19	102.38	17.93	56.21
T6	5.89	5	8.73	254	25.27	103	21	99.45	17.44	52.59
T7	1.90	7	3.04	98	25.17	40		31.27	5.49	15.96
Exp. mean	5.55		8.28	241	25.59	99	21	97.43	16.99	52.87
CD(0.05)	0.51		1.35	37.56	2.1	11.47	8.86	13.2	2.22	12.56
CV	5.2		9.15	8.77	4.61	6.5	23.63	7.61	7.36	13.35
res	**		**	**	NS	**	NS	**	**	**
Soil type	Clay loam									
pH	-									
EC	-									
Variety	-									
Applied NPK kg/ha	150:60:60									
Available NPK kg/ha	260;41.0:167									

T₁: Location specific recommended dose of fertilizer (RDF)T₂: T₁ + FYM@ 5t/haT₃: 125% RDF of T₁T₄: 125% RDF of T₁ + FYM@5 t/haT₅: T₁+ Application of micro nutrient (deficient to that location)T₆: T₁+ Application of Biochar @ 500 kh/ha*T₇ : Optional - Control

Table 4.5.1: Contd.

Treatment	TITABAR														
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Total uptake (kg/ha) in plant			Soil available kg/ha		
										N	P	K	N	P	K
T1	4.53	6	8.02	9.06	16.04	225	219	18.37	126	137.06	23.55	119.72	251.67	17.60	122.80
T2	4.72	5	9.36	9.44	18.71	233	227	18.30	197	152.62	28.37	132.17	251.40	17.07	125.10
T3	5.08	4	9.44	10.17	18.87	241	235	18.60	207	168.87	31.45	138.65	261.70	18.50	127.63
T4	5.77	1	13.96	11.55	27.92	259	251	19.43	217	225.72	45.35	184.08	274.30	19.33	127.17
T5	5.43	3	10.21	10.86	20.42	245	239	18.47	194	187.01	31.71	142.80	252.07	18.17	122.40
T6	5.63	2	12.55	11.26	25.11	251	245	18.03	215	202.04	41.08	176.30	271.10	18.40	122.17
T7															
Exp. mean	5.19		10.59	10.39	21.18	242	236	18.53	193	178.89	33.59	148.95	260.37	18.18	124.55
CD(0.05)	1.26		0.98	2.53	1.96	7.56	8.62	2.1	31.89	23.95	5.23	21.28	16.37	1.72	9.03
CV	13.38		5.07	13.38	5.07	1.72	2.01	6.22	9.1	7.36	8.56	7.85	3.45	5.21	3.99
res	NS		**	NS	**	**	**	NS	**	**	**	**	*	NS	NS
Soil type	Clay loam														
pH	-														
EC	-														
Variety	-														
Applied NPK kg/ha	60:20:40														
Available NPK kg/ha	-														

T₁: Location specific recommended dose of fertilizer (RDF)T₂: T₁ + FYM@ 5t/haT₃: 125% RDF of T₁T₄: 125% RDF of T₁ + FYM@5 t/haT₅: T₁+ Application of micro nutrient (deficient to that location)T₆: T₁+ Application of Biochar @ 500 kh/ha*T₇: Optional (According to location)

Table 4.5.1: Contd.

WARANGAL																
Treatment	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Un-filled grains/panicle	Total uptake (kg/ha) in plant			Soil available kg/ha		
											N	P	K	N	P	K
T1	5.27	5	4.00	10.90	8.40	418	418	12.67	273	11	1.22	0.23	1.46	228.33	93.00	569.00
T2	5.47	4	4.97	11.37	10.33	437	437	12.33	267	11	1.13	0.24	1.58	230.67	122.67	502.00
T3	5.57	3	4.97	11.53	10.33	423	422	12.67	273	11	1.99	0.23	1.52	229.00	102.33	485.00
T4	5.73	2	4.63	11.90	9.67	442	442	13.00	267	11	1.83	0.29	1.71	233.00	102.33	537.67
T5	5.27	5	4.80	10.97	10.00	450	450	12.67	274	11	1.55	0.24	1.42	232.00	100.00	555.00
T6	5.93	1	4.30	12.33	9.00	416	416	13.33	254	10	1.41	0.22	1.59	227.67	104.33	481.67
T7	3.53	7	4.17	7.33	8.70	369	369	12.00	248	10	1.88	0.29	1.44	223.67	106.67	458.33
Exp. mean	5.25		4.55	10.90	9.49	422	422	12.67	265	11	1.57	0.25	1.53	229.19	104.48	512.67
CD(0.05)	1.03		1	2.12	2.02	49.62	49.85	1.41	40.04	1.54	0.08	0.04	0.05	7.99	23.6	61.69
CV	11.03		12.37	10.94	11.97	6.61	6.64	6.25	8.49	8.13	2.98	10.06	1.77	1.96	12.7	6.76
res	**		NS	**	NS	NS	NS	NS	NS	NS	**	*	**	NS	NS	*
Soil type	-															
pH	-															
EC	-															
Variety	-															
Applied NPK kg/ha	120:60:40															
Available NPK kg/ha	141.45:443															

T₁: Location specific recommended dose of fertilizer (RDF)
T₂: T₁ + FYM@ 5t/ha
T₃: 125% RDF of T₁
T₄: 125% RDF of T₁ + FYM@5 t/ha
T₅: T₁+ Application of micro nutrient (deficient to that location)
T₆: T₁+ Application of Biochar @ 500 kh/ha*
T₇ : Optional - 75% RDF

Table 4.5.1: Contd.

Treatment	KARAIKAL (Kharif)									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/ panicle	Un-Filled grains/ panicle
T1	4.83	7	5.95	9.67	11.91	433	392	24.93	134	9
T2	5.47	2	7.38	10.94	14.76	451	413	25.03	138	18
T3	5.34	5	7.19	10.68	14.39	438	414	24.60	127	13
T4	4.94	6	7.74	9.88	15.47	405	376	25.70	123	17
T5	5.81	1	6.61	11.63	13.21	442	420	25.47	125	15
T6	5.37	4	7.14	10.75	14.29	570	524	26.37	122	21
T7	5.44	3	6.31	10.89	12.61	431	400	26.07	126	23
Exp. mean	5.31		6.90	10.63	13.81	453	420	25.45	128	17
CD(0.05)	0.72		1.28	1.43	2.57	72.54	60.84	1.47	18.34	5.26
CV	7.57		10.46	7.57	10.48	9.01	8.14	3.25	8.07	17.75
res	NS		NS	NS	NS	**	**	NS	NS	**
Soil type	-									
pH	-									
EC	-									
Variety	-									
Applied NPK kg/ha	150:50:50									
Available NPK kg/ha	-									

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: T₁ + Sampoorna (KAU) @10 g per litre of water twice in the cropping season (250 litre/hectare/application), ie., one week prior to maximum tillering stage and one week prior to panicle initiation (1% foliar application of 'Sampoorna KAU Multimax' @ 2.5 kg/ha each at the above two stages).

T₄: 125% RDF of T₁

T₅: 125% RDF of T₁ + FYM@5 t/ha

T₆: T₁+ Application of micro nutrient (deficient to that location) 0.5% ZnSO₄

T₇ : Optional (According to location) - 100%NP+150%K

Table 4.5.1: Yield maximization of rice in different Zones, Rabi 2024-25

Treatment	CHINSURAH (Rabi)								
	Grain yield (t/ha)	Rank	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Soil available kg/ha			Soil OC
						N	P	K	
T1	5.04	6	325	287	3.07	486.96	89.93	290.09	1.16
T2	5.58	3	360	318	3.44	505.60	99.66	293.20	1.22
T3	5.22	4	348	307	3.22	503.55	98.51	292.00	1.20
T4	5.12	5	342	299	3.14	507.65	100.06	296.36	1.18
T5	5.90	1	393	346	3.56	512.07	101.18	298.70	1.24
T6	5.71	2	379	333	3.52	492.09	99.79	293.11	1.21
T7	4.73	7	307	270	2.87	461.75	86.83	282.66	1.10
Exp. mean	5.33		350	309	3.26	495.67	96.57	292.30	1.19
CD(0.05)	0.77		33.41	29.9	0.47	30.06	8.79	15.33	0.1
CV	8.08		5.36	5.44	8.02	3.41	5.12	2.95	4.64
res	NS		**	**	NS	*	*	NS	NS
Soil type	Clay loam								
pH	7.10								
EC	0.22								
Variety	Muktashree								
Applied NPK kg/ha	130:65:65								
Available NPK kg/ha	-								

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: T₁ + Sampoorna (KAU) @10 g per litre of water twice in the cropping season (250 litre/hectare/application), ie., one week prior to maximum tillering stage and one week prior to panicle initiation (1% foliar application of 'Sampoorna KAU Multimix' @ 2.5 kg/ha each at the above two stages).

T₄: 125% RDF of T₁

T₅: 125% RDF of T₁ + FYM@5 t/ha

T₆: T₁+ Application of micro nutrient - (Two sprays of Zn)

T₇ : Optional (According to location) - 125% RDF of T₁ + Sampoorna KAU Multimix (02 Sprays) + Zn (02 Sprays)

Table 4.5.1(R): Contd.

Treatment	PATTAMBI (Rabi)								
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/20 m ²)	Straw yield (kg/20 m ²)	Tillers/m ² (No.)	Panicle/m ² (No.)	Filled grains/panicle	Un-Filled grains/panicle
T1	3.50	6	10.00	6.90	19.93	330	295	53	26
T2	3.60	5	8.20	7.10	16.37	301	247	66	24
T3	5.67	1	9.90	11.30	19.77	409	395	96	24
T4	3.23	7	8.13	6.43	16.17	339	319	61	23
T5	3.87	2	8.27	7.70	16.47	329	294	67	23
T6	3.70	4	7.90	7.37	15.77	249	225	59	23
T7	3.83	3	7.40	7.63	14.77	363	345	63	23
Exp. mean	3.91		8.54	7.78	17.04	331	303	66	24
CD(0.05)	0.77		1.54	1.58	3.07	70	83.28	10.37	3.86
CV	11.12		10.11	11.39	10.13	11.87	15.46	8.77	9.17
res	**		*	**	*	*	*	**	NS
Soil type	-								
pH	-								
EC	-								
Variety	-								
Applied NPK kg/ha	90:45:45								
Available NPK kg/ha	-								

T₁: Location specific recommended dose of fertilizer (RDF)

T₂: T₁ + FYM@ 5t/ha

T₃: T₁ + Sampoorna (KAU) @10 g per litre of water twice in the cropping season (250 litre/hectare/application), ie., one week prior to maximum tillering stage and one week prior to panicle initiation (1% foliar application of 'Sampoorna KAU Multimax' @ 2.5 kg/ha each at the above two stages).

T₄: 125% RDF of T₁

T₅: 125% RDF of T₁ + FYM@5 t/ha

T₆: T₁+ Application of micro nutrient (deficient to that location) 0.5% ZnSO₄

T₇ : Optional - Control

4.5.2. Agronomic evaluation of package of practices of the best farmers of the state/region and yield gap analysis of the region

India, being one of the largest rice-producing countries, has witnessed significant disparities in rice yields across states and districts due to variations in agro-climatic conditions, input use efficiency, access to technology, and institutional support. Identifying and quantifying these yield gaps can help in formulating targeted interventions to maximize returns on investment, reduce per-unit production costs, and ensure food security.

Impact of Conventional Cultivation system on Yield Variability Across Indian States

In the context of growing food demand, limited arable land, and the imperative for sustainable agriculture, analysing yield gaps in major crops like rice has become crucial. Yield gap refers to the difference between the potential yield (as realized under experimental or optimal farm conditions) and the actual yield obtained by farmers under conventional management. In economic terms, the yield gap serves as a proxy for assessing technical efficiency, resource utilization, and scope for productivity enhancement without the need for additional land or water resources.

The present study was undertaken in selected districts across five rice-growing states of India **Assam, Gujarat, Kerala, Puducherry, Uttarakhand** and **West Bengal** in four zones — to assess the yield gap in rice cultivation. To obtain a comprehensive understanding, primary data were collected from 25 to 50 farmers in each state using a structured interview schedule through the personal interview method. Additionally, data on potential yields from research stations and yields achieved by progressive farmers were gathered to serve as benchmarks for evaluating the yield gap under field conditions.

The yield gap index (YGI) was computed using the following formula:

$$\text{Yield Gap (\%)} = \frac{Y_p - Y_a}{Y_p} * 100$$

Where, Y_p is the Research station yield; Y_a is the Average farmers' yield

Table 4.5.2(1). Yield gap in different states

Sl. No.	State	Potential Yield (t/ha)	Farmers' Yield (t/ha)	Yield Gap (%)
1	Assam (Titabar)	5.02	4.80	-4.38
2	Gujarat (Navsari)	4.68	4.82	+2.99
3	Kerala (Moncompu)	7.00	6.52	-6.86
4	Kerala (Pattambi)	5.00	4.25	-15.00
5	Puducherry (Karaikal)	4.78	5.10	+6.69
6	Uttarakhand (Pantnagar)	5.50	5.00	-9.09
7	West Bengal (Chinsurah)	5.21	4.74	-9.02
Average		5.31	5.08	-4.35

The analysis revealed considerable variation in rice yield gaps across the selected states (Table 4.5.2(1)). The average potential yield was estimated at 5.31 t/ha, while the actual yield at the farmers' field level averaged 5.08 t/ha, resulting in an overall yield gap of -4.35%. Kerala (-15.00%) , Uttarakhand (-9.09) and West Bengal (-9.02%) exhibited the highest yield gaps. In contrast, Puducherry (+6.69%) and Gujarat (+2.99%) recorded more farmers yield over potential yield, reflecting better adoption of recommended practices and stronger institutional support.

The study clearly demonstrates the presence of yield gaps in rice cultivation across Indian states, ranging from -15% to -4.38%, with an average of -4.35%. These yield gaps are indicative of untapped productivity potential. Policies aiming at technology dissemination, capacity building, site-specific nutrient management, and strengthened extension systems are essential for converting this potential into realized gains. From an economic standpoint, closing yield gaps is one of the most efficient strategies to enhance rice output, improve livelihoods, and contribute to national food security.

Impact of Direct Seeded Rice (DSR) system on Yield Variability Across Indian States

Calculating the yield gap between Direct Seeding of Rice (DSR) and Transplanted Rice (TPR) is essential to evaluate the potential of DSR in improving productivity, resource-use efficiency, and sustainability. This analysis helps identify the comparative performance of both methods, recognize adoption constraints, and highlight areas for agronomic or institutional improvements. It also supports informed policy decisions, technology transfer, and extension services to optimize rice production, especially in regions facing labor shortages or water scarcity. Understanding the yield gap further aids in assessing the economic viability of transitioning from TPR to DSR.

Table 4.5.2(2): Comparative Yield Performance of Direct Seeded Rice (DSR) and Transplanted Rice (TPR) in Different States of India

Sl. No.	State	TPR	DSR	% change of yield in DSR over TPR
1	Assam (Titabar)	5.00	4.00	-20.00
2	Gujrat (Navsari)	4.40	2.40	-45.45
3	Kerala (Moncompu)	7.00	7.25	3.57
4	Puducherry (Karaikal)	5.08	4.65	-8.46
Average		5.37	4.58	-14.80

Keeping this in view, an attempt was made to compare the yields under Direct Seeding of Rice (DSR) and Transplanted Rice (TPR) methods. Using the same structured questionnaire mentioned earlier, yield data were collected from farmers practicing DSR across selected districts in four major rice-growing states (**Assam, Gujarat, Kerala and Puducherry**) of three **zones**. These DSR yields were then compared with the TPR yields from the same locations to ensure consistency and enable a meaningful assessment of the yield differences between the two methods.

The above table 4.5.2(2) presents a comparative analysis of rice yield performance under Direct Seeded Rice (DSR) and Transplanted Rice (TPR) systems across selected Indian states. The percentage change in yield highlights the productivity response of rice under DSR relative to conventional TPR. On average, DSR yields are -14.80% lower than TPR, indicating that despite its resource-conserving potential, DSR may currently be facing agronomic and adoption challenges in several regions.

Significant yield reductions in Gujarat (-44.45%), Assam (-20%), and Puducherry (-8.46%) suggest constraints such as weed infestation, poor crop establishment, and moisture stress due to limited water control. However, Kerala shows a positive yield gain (3.57%), possibly due to better-suited agroecological conditions and more effective management practices under DSR. These variations underscore the importance of region-specific adaptation strategies, including improved DSR-compatible varieties, weed and water management, and capacity-building efforts to enhance the yield reliability and scalability of DSR in India's rice-based production systems.

4.5.3. Evaluation of Organic fertilizers and Natural farming practices for enhancing the productivity and soil health

For detailed report refer Soil Science Progress Report.

4.5.4. Nano-fertilizers for increasing nutrient use efficiency, yield and economic returns in transplanted rice

For detailed report refer Soil Science Progress Report.

4.5.5. Evaluation of drone for its suitability to various agronomy interventions

As much as India depends upon the agriculture, still it is far short from adapting latest technologies in it to get good farm. Developed countries have already started using UAV's in their precision agriculture. It is very fast and it could reduce the workload of a farmer. A technical analysis of UAVs in precision agriculture is to analyse their applicability in agriculture operations like pesticide spraying, soil and field analysis. Drones have long been thought of as expensive equipment's. One area that has been seen little attention from drones, perhaps to its detriment, is the agricultural sector. Drones are preferred over full size aircrafts due to major factors like combination of high spatial resolution and fast turnaround capabilities together with low operation cost and easy to trigger. Drone being a modern technology can be solution for farmers to achieve these challenges. Agricultural drones provide relief for the modern-day farmer to drudgery and with less time lots of work can be achieved to bring sustainability in futuristic rice cultivation. Although the use of UAVs in agriculture has been steadily increasing, such growth is hindered by many technical challenges that still need to be overcome. In this context, the objective of this trial is to provide aa comprehensive overview of the application of Drone (UAVs) for agronomy operations in rice for its suitability and cost effectiveness. As indicated, UAV's have been used in many areas in agriculture, although they still have many limitations and challenges to overcome. To evaluate the suitability of drones to various Agronomic practices (sowing, herbicide spray and top dressing of fertilizers) drone technology, a new trial was formulated with the following objectives 1. To evaluate the efficacy of drone based spraying of herbicides, insecticides and fungicides for the management of weeds, major insect pests and diseases of rice 2. To compute the labour saving, economics and feasibility of drone applications in rice cultivation. The trial consisted of 3 treatments and laid out in RBD design. Treatments are T₁: Drone, T₂: Battery operated knapsack sprayer, T₃: Untreated control. The trial was conducted at eight locations (**Ludhiana, Mandya, Rajendranagar, Navsari, Nawagam, Puducherry, Chinsurah and Moncompu**) in zones.

In **Zone II**, at **Ludhiana**, knapsack spraying and drone based application recorded higher grain yield, straw yield and comparable. Similar result also observed in case of plant height, panicles/m² and panicle weight. However, test weight was not influenced by the spraying methods. Grasses population two weeks after pre-emergence herbicide application was found to be controlled effectively both in drone and knapsack sprayer treated plots. However, there was no sedges population and broad leaved weeds population was not influenced by spraying at two weeks after pre-emergence application of herbicide. There was no grasses and sedges population in knapsack and drone based application plots at two weeks after post-emergence application of herbicide. Broad leaved weeds population two weeks after post-emergence application was found to be controlled effectively both in drone and knapsack sprayer treated plots. Similar results were also observed in weed dry matter production.

In **Zone III**, at **Chinsurah**, swarna variety resulted in higher grain yield of 5.78 t/ha under pre-and post-emergence application of herbicide through knapsack sprayer and it was at par with drone based application (5.66 t/ha). Similarly, knapsack sprayer treated plot recorded higher number of panicles/m² and panicle weight and it was comparable with drone based application. Grasses and sedges population two weeks after pre-emergence application was

found to be effectively controlled both in knapsack and drone treated plots. Similarly, broad leaved weeds also effectively controlled in knapsack sprayer treated plot. Similar results were also observed two weeks after post-emergence applications of herbicide. Biomass production of weeds also recorded the similar trend at two weeks after pre as well as post-emergence application of herbicide.

In **Zone VI**, at **Navsari**, higher grain and straw yield was recorded in drone based application plot and comparable with knapsack spraying plot. Similar results were observed in plant height, panicles/m² and panicle weight. Grasses, Sedges and BLW population at two weeks after pre-emergence herbicide application was found to be controlled effectively both in knapsack and drone based application. Similar results were also recorded at two weeks after post-emergence herbicide application. Dry matter production of weeds reflected similar results at two weeks after pre-emergence and post-emergence application of herbicide. At **Nawagam**, drone based application recorded higher grain and straw yield and comparable with knapsack spraying. However, there was no significant difference in plant height, panicle/m², panicle weight and test weight among the treatments. Drone based application significantly reduced the grasses population at two weeks after pre-emergence herbicide application and comparable with knapsack spraying. There was no significant difference among the treatments in case of sedges and broad leaved weeds population. At two weeks after post-emergence herbicide application weed population of grasses, sedges and broad leaved weeds were not significant among all treatments. Dry matter production of grasses and sedges significantly reduced in both knapsack and drone based application. Similar results were also observed in dry matter production of grasses, sedges and broad leaved weeds. Higher cost of cultivation was recorded in knapsack spraying followed by drone based application.

In **Zone VII**, at **Mandya**, higher grain and straw yield was recorded in knapsack spraying plot and comparable with drone based application. Higher number of panicles/m² and panicle weight was recorded with drone based application was on par with knapsack spraying plot. However, there was no significant difference among the treatments in plant height and test weight. Grasses population two weeks after pre-emergence herbicide application was found to be controlled effectively in knapsack spraying plot and comparable with drone based application. Similar results were also observed in sedges and broad leaved weeds population. Drone based application significantly reduced the population of grasses, sedges and broad leaved weeds at two weeks after post-emergence herbicide application and was comparable with knapsack spraying plot. Biomass production of weeds also reflected similar results at two weeks after pre-emergence as well as post-emergence application of herbicide. At **Moncompu**, pre-emergence herbicide was not applied, only post-emergence herbicide was applied. Drone based application resulted in higher grain (7.68 t/ha) and straw yield (9.76 t/ha) and comparable with knapsack spraying plot. The highest plant height was recorded in knapsack spraying plot. However, higher number of panicles/m² and panicle weight was recorded in both knapsack and drone application plots. Similarly, higher test weight was recorded in drone based application plot and was comparable with knapsack spraying plot. Drone based application significantly reduced the grasses, sedges and broad leaved weeds population at two weeks after post-emergence herbicide application and was on par with knapsack spraying plot. Similar results

were also observed in dry matter production of weeds at two weeks after post-emergence herbicide application. The highest cost of cultivation was recorded in knapsack spraying followed by drone based application. At **Puducherry** higher grain yield, straw yield was recorded in drone based application and comparable with knapsack spraying. Similar results were also observed in plant height and panicle weight. Drone based application recorded higher number of panicles/m² and test weight among the treatments. Drone based application significantly reduced the weed population at two weeks after pre-emergence as well as post-emergence application of herbicide. The similar results were also observed in biomass production of weeds at two weeks after pre-emergence and post-emergence application of herbicide. The highest cost of cultivation was recorded in drone based application followed by knapsack spraying. Higher gross, net returns and Benefit-cost ratio were recorded in drone based application. At **ARI-Rajendranagar**, the highest grain and straw yield was recorded under drone based application. Similar results were observed in panicle weight and test weight. However, there was no significant difference in plant height and panicles/m². Grasses population at two weeks after pre-emergence herbicide application was found to be controlled effectively both in knapsack and drone based application. There was no significant difference in sedges and broad leaved weeds population. The population of grasses, sedges and broad leaved weeds were significantly reduced in both knapsack and drone based application plots at two weeks after post-emergence application of herbicide. Dry matter production of weeds also reflected similar results at two weeks after pre-emergence as well as post-emergence application of herbicide. The highest cost of cultivation was recorded in drone based application followed by knapsack spraying.

The results of eight locations revealed that pre-emergence and post-emergence application of herbicides by drone based application and knapsack spraying was comparable in weed control efficacy and reduced group wise weed population and weed biomass resulted in higher crop growth, yield attributes and grain yield.

Table 4.5.5: Evaluation of drones for spraying of agrochemicals (herbicides, insecticides, and fungicides) in rice pest management (EDAPM), kharif 2025.

ZONE-III CHINSURAH											
Methods of crop establishment	Grain yield (t/ha)	Rank	Panicle/m ² (No.)	Panicle wt (g)	Weed population 2 weeks after pre emergent herbicide application (no/m ²)			Weed population 2weeks after Post emergent herbicide application(no/m ²)			
					Grasses	Sedges	BLW	Grasses	Sedges	BLW	Total
S1	5.66	2	355	3.37	2.15(1.63)	2.35(1.68)	2.96(1.85)	2.73(1.79)	3.03(1.87)	4.52(2.24)	10.28(3.28)
S2	5.78	1	362	3.44	1.11(1.27)	1.86(1.53)	2.00(1.58)	1.98(1.54)	2.52(1.73)	2.66(1.77)	7.16(2.76)
S3	3.47	3	217	2.06	33.48(5.81)	19.14(4.43)	16.95(4.17)	73.72(8.56)	38.38(6.22)	31.64(5.65)	143.73(11.99)
Expt. Mean	4.97		312	2.96	2.9	2.55	2.53	3.97	3.27	3.22	6.01
C.D. (0.05)	0.28		19.03	0.17	0.38	0.27	0.26	0.84	0.46	0.41	0.55
C.V. (%)	3.81		4.19	4	9.01	7.3	7.02	14.56	9.7	8.66	6.24
res(f)	**		**	**	**	**	**	**	**	**	**
Soil type	Clay loam										
pH	-										
EC	-										
Variety & Duration	Swarna (145-147 days)										
Applied NPK kg/ha	80:40:40										
Available NPK kg/ha	-										

ZONE-III CHINSURAH (Contd.)									
Methods of crop establishment	Weed Bio mass 2weeks after pre emergent herbicide application(g/m ²)			Weed Bio mass 2weeks after Post emergent herbicide application(g/m ²)					
	Grasses	Sedges	BLW	Grasses	Sedges	BLW	Grasses	Sedges	Total
S1	0.55	0.17	1.15	1.87	0.58	0.45	1.26	2.29	
S2	0.36	0.12	0.65	1.14	0.38	0.41	0.75	1.54	
S3	3.01	1.36	6.52	10.89	17.16	7.27	10.24	34.67	
Expt. Mean	1.31	0.55	2.77	4.63	6.04	2.71	4.08	12.83	
C.D. (0.05)	1	0.59	2.25	1.71	6.06	2.55	3.19	10.19	
C.V. (%)	52.2	73.06	55.53	25.32	68.76	64.45	53.49	54.42	
res(f)	**	**	**	**	**	**	**	**	**

T1 - Drone
T2 - Battery operated Knapsack sprayer
T3 - Untreated control

Table 4.5.5: Contd.

Methods of crop establishment	ZONE-II LUDHIANA																	
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/ m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population 2 weeks after pre emergent herbicide application (no/m ²)			Weed population 2weeks after Post emergent herbicide application(no/m ²)			Weed Bio mass 2weeks after Post emergent herbicide application(g/m ²)				
								Grasses	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
S1	4.18	2	7.20	107.87	237	1.86	26.33	0.33(0.88)	0.67(1.05)	1.00(1.17)	0.00(0.71)	0.00(0.71)	0.33(0.88)	0.33(0.88)	0.00	0.00	0.53	0.53
S2	4.20	1	7.20	107.23	240	1.84	26.37	0.33(0.88)	0.67(1.00)	1.00(1.17)	0.00(0.71)	0.00(0.71)	0.33(0.88)	0.33(0.88)	0.00	0.00	0.60	0.60
S3	3.47	3	6.01	95.20	199	1.69	26.33	2.67(1.77)	1.33(1.34)	4.00(2.11)	3.33(1.95)	1.33(1.34)	2.33(1.68)	7.00(2.73)	2.73	1.30	6.37	10.40
Expt. Mean	3.95		6.80	103.43	225	1.80	26.34	1.18	1.13	1.48	1.12	0.92	1.15	1.5	0.91	0.43	2.50	3.84
C.D. (0.05)	0.22		0.47	2.4	23.59	0.04	0.37	0.38	0.48	0.29	0.12	0.17	0.34	0.29	0.65	0.22	1.18	1.61
C.V. (%)	2.51		3.04	1.02	4.62	0.93	0.61	21.99	29.41	13.54	7.44	12.92	20.61	13.39	49.22	35.25	32.41	28.9
res(t)	**		**	**	*	**	NS	*	NS	**	**	**	**	**	**	**	*	**
Soil type	-																	
pH	7.7																	
EC	0.46																	
Variety	Pusa basmati 1121, 137 days																	
Applied NPK	40:30:30																	
Available NPK	269;18.5:205																	

T1 - Drone
T2 - Battery operated Knapsack sprayer
T3 - Untreated control

Table 4.5.5: Contd.

Methods of crop establishment	ZONE-VII MANDYA										
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population 2 weeks after pre emergent herbicide application (no/m ²)			
								Grasses	Sedges	BLW	Total
S1	5.99	2	8.03	62.25	381	3.10	26.29	2.75(1.80)	2.25(1.64)	2.00(1.46)	7.00(2.71)
S2	6.05	1	8.14	60.23	379	3.18	26.88	2.00(1.48)	2.75(1.76)	2.00(1.48)	6.75(2.60)
S3	4.58	3	6.55	64.22	297	2.51	25.94	13.00(3.52)	9.50(3.14)	12.50(3.57)	35.00(5.92)
Expt. Mean	5.54		7.57	62.23	352	2.93	26.37	2.27	2.18	2.17	3.74
C.D. (0.05)	1.02		0.97	4.84	59.56	0.41	2.37	0.98	0.48	1.2	1.16
C.V. (%)	8.11		5.66	3.43	7.46	6.12	3.96	24.93	12.7	32.01	17.94
res(t)	*		*	NS	*	*	NS	**	**	**	**
Soil type	Red sandy loam										
pH	7.98										
EC	-										
Variety & Duration	Jyothi, 140-145 days										
Applied NPK kg/ha	125:62:62										
Available NPK kg/ha	3192;78.5;297										

Methods of crop establishment	ZONE-VII MANDYA (Contd.)													
	Weed population 2weeks after Post emergent herbicide application(no/m2)					Weed Bio mass 2weeks after pre emergent herbicide application(g/m2)					Weed Bio mass 2weeks after Post emergent herbicide application(g/m2)			
	Grasses	Sedges	BLW	Total		Grasses	Sedges	BLW	Total		Grasses	Sedges	BLW	Total
S1	0.75(1.06)	0.50(0.97)	1.25(1.27)	2.50(1.71)		2.92	2.6	0.88	6.39		0.26	0.1	0.23	0.6
S2	1.00(1.18)	1.25(1.31)	0.50(0.97)	2.75(1.76)		2.07	1.94	1.01	5.02		0.4	0.34	0.13	0.87
S3	19.00(4.39)	18.75(4.31)	22.25(4.71)	60.00(7.77)		13.8	7.41	6.94	28.15		35.44	23.2	23.75	82.39
Expt. Mean	2.21	2.2	2.32	3.75		6.26	3.98	2.94	13.18		12.03	7.88	8.04	27.95
C.D. (0.05)	0.89	1.01	1.18	0.7		8.09	3.07	2.03	7.21		6.95	7.51	6.93	4.51
C.V. (%)	23.35	26.71	29.41	10.84		74.69	44.59	39.83	31.63		33.38	55.06	49.8	9.33
res(t)	**	**	**	**		*	**	**	**		**	**	**	**

T1 - Drone
T2 - Battery operated Knapsack sprayer
T3 - Untreated control

Table 4.5.5: Contd.

ZONE-VII MONCOMPU																
Methods of crop establishment	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population 2weeks after post emergent herbicide application(g/m2)				Weed Bio mass 2weeks after Post emergent herbicide application(g/m2)				Cost of cultivation (Rs/ha)
								Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	
S1	7.68	1	9.76	99.00	400	3.53	24.50	2.33(1.68)	1.67(1.46)	1.00(1.17)	5.00(2.34)	2.33	3.33	0.80	6.47	79500
S2	7.56	2	9.40	105.00	400	3.53	24.17	3.67(2.04)	2.67(1.76)	1.67(1.39)	8.00(2.91)	7.00	5.17	1.33	13.50	82500
S3	3.86	3	5.63	86.33	267	2.27	21.00	13.67(3.75)	4.67(2.27)	5.33(2.41)	23.67(4.91)	11.67	9.33	4.27	25.27	70000
Expt. Mean	6.37		8.26	96.78	356	3.11	23.22	2.49	1.83	1.66	3.39	7.00	5.94	2.13	15.08	
C.D. (0.05)	0.66		1.83	5.6	23.9	0.8	1.51	0.32	0.29	0.46	0.19	17.64	1.89	0.95	19.06	
C.V. (%)	4.58		9.77	2.55	2.96	11.34	2.87	8.74	10.8	19.14	3.97	173.74	21.9	30.62	87.18	
res(t)	**		**	**	**	*	**	**	*	*	**	NS	*	**	NS	
Soil type	Clay loam															
pH	-															
EC	-															
Variety & Duration	MO 16-Uma, 120 days															
Applied NPK kg/ha	90:45:45															
Available NPK kg/ha	250:25:180															

T1 - Drone
T2 - Battery operated Knapsack sprayer
T3 - Untreated control

Table 4.5.5: Contd.

Methods of crop establishment	ZONE-VI NAVSARI									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Panicle wt (g)	Weed population 2 weeks after pre emergent herbicide application (no/m ²)			
							Grasses	Sedges	BLW	Total
S1	5.10	1	6.13	134.32	336	4.88	0.40(0.91)	0.20(0.81)	0.30(0.86)	0.90(1.12)
S2	5.01	2	6.02	131.90	328	4.71	0.60(0.99)	0.40(0.91)	0.50(0.95)	1.50(1.36)
S3	3.87	3	4.68	122.85	311	4.25	2.00(1.56)	1.10(1.23)	1.40(1.34)	4.50(2.21)
Expt. Mean	4.66		5.61	129.69	325	4.61	1.15	0.98	1.05	1.57
C.D. (0.05)	0.35		0.44	6.46	10.22	0.44	0.3	0.3	0.33	0.39
C.V. (%)	7.95		8.31	5.3	3.35	10.3	28.14	32.42	33.35	26.18
res(f)	**		**	**	**	*	**	*	*	**
Soil type	Clayey									
pH	-									
EC	-									
Variety & Duration	GNR-3, 120-125 days									
Applied NPK kg/ha	100:30:0									
Available NPK kg/ha	256.24:40.57:866.38									

Methods of crop establishment	ZONE-VI NAVSARI Contd.											
	Weed population 2weeks after Post emergent herbicide application(no/m2)				Weed Bio mass 2weeks after pre emergent herbicide application(g/m2)				Weed Bio mass 2weeks after Post emergent herbicide application(g/m2)			
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
S1	0.20(0.81)	0.20(0.81)	0.20(0.81)	0.60(0.98)	0.63	0.32	0.56	1.51	0.27	0.36	0.3	0.94
S2	0.50(0.97)	0.20(0.81)	0.40(0.91)	1.10(1.17)	1.07	0.28	0.97	2.32	0.67	0.22	0.75	1.65
S3	2.30(1.66)	1.10(1.21)	1.70(1.40)	5.10(2.34)	2.66	1.28	2.29	6.23	2.85	1.31	2.45	6.61
Expt. Mean	1.15	0.94	1.04	1.49	1.45	0.63	1.27	3.35	1.26	0.63	1.17	3.06
C.D. (0.05)	0.19	0.25	0.32	0.4	1.09	0.86	1.2	1.74	0.55	0.94	1.13	1.95
C.V. (%)	17.97	28.68	32.9	28.31	79.49	145	100	55.1	46.08	158.2	103	67.6
res(f)	**	**	**	**	**	*	*	**	**	NS	**	**

T1 - Drone
T2 - Battery operated Knapsack sprayer
T3 - Untreated control

Table 4.5.5: Contd.

Methods of crop establishment	ZONE-VI NAWAGAM										
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population 2 weeks after pre emergent herbicide application (no/m ²)			
								Grasses	Sedges	BLW	Total
S1	4.64	1	5.65	121.67	250	4.88	15.06	43.75(6.37)	45.25(6.49)	22.25(4.47)	111.25(10.41)
S2	4.27	2	5.48	118.67	241	5.03	15.03	58.25(7.33)	31.00(5.46)	28.00(4.90)	117.25(10.75)
S3	3.55	3	5.14	115.67	236	4.81	14.83	159.50(12.42)	88.00(9.25)	79.00(8.76)	326.50(17.95)
Expt. Mean	4.15		5.42	118.67	242	4.91	14.97	8.71	7.07	6.04	13.04
C.D. (0.05)	0.85		0.38	8.43	50.31	0.41	1.17	3.5	3.43	3.92	3.7
C.V. (%)	8.98		3.08	3.13	9.15	3.71	3.46	23.2	28.07	37.49	16.38
res(t)	NS		*	NS	NS	NS	NS	*	NS	NS	**
Soil type	Clay loam										
pH	-										
EC	-										
Variety & Duration	GNR 11, 125-130 days										
Applied NPK kg/ha	100:25:00										
Available NPK kg/ha	256.24:40.57:866.38										

Methods of crop establishment	ZONE-VI NAWAGAM (contd.)											
	Weed population 2weeks after Post emergent herbicide application(no/m ²)				Weed Bio mass 2weeks after pre emergent herbicide application(g/m ²)				Weed Bio mass 2weeks after Post emergent herbicide application(g/m ²)			
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
S1	30.50(5.13)	43.25(6.33)	23.50(4.52)	97.25(9.69)	12.56	11.49	6.28	30.34	8.68	9.79	7.16	25.63
S2	38.75(6.14)	41.25(6.18)	23.50(4.55)	103.50(10.01)	18.57	7.79	7.83	34.19	12.71	10.63	8.91	32.24
S3	75.00(8.40)	113.25(10.29)	67.25(8.02)	255.50(15.80)	59.66	31.05	21.17	111.89	21.76	30.44	21.43	73.64
Expt. Mean	6.55	7.6	5.69	11.83	30.27	16.77	11.76	58.80	14.38	16.95	12.50	43.84
C.D. (0.05)	4.39	5.12	3.55	4.6	32	16.9	14.15	44.86	17.09	21.61	15.96	31.65
C.V. (%)	38.7	38.94	36.07	22.48	61.11	58.22	69.56	44.09	68.65	73.68	73.81	41.73
res(t)	NS	NS	NS	*	*	*	NS	**	NS	NS	NS	*

T1 - Drone

T2 - Battery operated Knapsack sprayer

T3 - Untreated control

Table 4.5.5: Contd.

Methods of crop establishment	ZONE-VII PUDUCHERRY									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population 2 weeks after pre emergent herbicide application		Weed population 2weeks after Post emergent herbicide application (no/m ²)
								(no/m ²)	Total	
S1	6.99	1	9.10	74.50	281	2.42	26.82	123.17(11.12)	92.31(9.63)	
S2	6.67	2	8.74	72.27	270	2.35	26.00	141.47(11.91)	112.25(10.62)	
S3	5.73	3	8.25	69.07	235	2.19	25.77	171.43(13.11)	136.00(11.68)	
Expt. Mean	6.46		8.70	71.95	262	2.14	26.20	12.05	10.64	
C.D. (0.05)	0.21		1.35	4.18	2.55	0.09	0.41	0.19	0.22	
C.V. (%)	1.4		6.85	2.56	0.43	1.63	0.69	1.06	1.45	
res(f)								**	**	
Soil type	Clay loam									
pH	6.95									
EC	0.06									
Variety & Duration	CSR - 76, 120-130 days									
Applied NPK kg/ha	120:40:40									
Available NPK kg/ha	134.4:26.5:91									

Methods of crop establishment	ZONE-VII PUDUCHERRY						
	Weed Bio mass 2weeks after pre emergent herbicide application(g/m2)	Weed Bio mass 2weeks after Post emergent herbicide application(g/m2)		Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	Benefit: Cost Ratio
		Total	Total				
S1	72.7		54.84	68425	162805	94380	2.38
S2	84.05		66.25	67575	157685	90110	2.33
S3	101.18		80.8	65425	142805	77380	2.18
Expt. Mean	85.97		67.3				2.30
C.D. (0.05)	2.99		2.41				0.04
C.V. (%)	2.4		2.47				0.78
res(f)	**		**				

T1 - Drone

T2 - Battery operated Knapsack sprayer

T3 - Untreated control

Table 4.5.5: Contd.

Methods of crop establishment	ZONE-VII RAJENDRANAGAR										
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Weed population 2 weeks after pre emergent herbicide application (no/m ²)			
								Grasses	Sedges	BLW	Total
S1	6.86	1	9.09	99.30	399	4.55	96	15.75(4.01)	16.75(4.12)	12.00(3.52)	44.50(6.69)
S2	5.75	2	7.72	99.33	363	2.84	95	13.50(3.72)	16.75(4.14)	13.50(3.66)	43.75(6.63)
S3	4.42	3	6.07	98.19	327	3.20	96	29.75(5.49)	22.75(4.76)	20.50(4.55)	73.00(8.54)
Expt. Mean	6.86		7.63	98.94	363	3.53	96	4.41	4.34	3.91	7.29
C.D. (0.05)	1.01		1.24	4.04	118.79	0.73	0.76	0.78	0.67	1.01	1.2
C.V. (%)	7.83		7.2	1.8	14.44	9.1	0.35	10.23	8.91	14.97	9.52
res(f)	**		**	NS	NS	**	*	**	NS	NS	*
Soil type	-										
pH	-										
EC	-										
Variety & Duration	-										
Applied NPK kg/ha	-										
Available NPK kg/ha	-										

Methods of crop establishment	ZONE-VII RAJENDRANAGAR (Contd.)														
	Weed population 2weeks after Post emergent herbicide application(no/m2)					Weed Bio mass 2weeks after pre emergent herbicide application(g/m2)					Weed Bio mass 2weeks after Post emergent herbicide application(g/m2)				Cost of cultivation (Rs/ha)
	Grasses	Sedges	BLW	Total		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total		
S1	16.00(4.05)	16.25(4.08)	13.25(3.67)	45.50(6.77)		2.58	1.55	3.03	7.16	3.25	2.48	3.56	9.29	46200	
S2	13.50(3.73)	13.75(3.76)	13.25(3.67)	40.50(6.39)		2.41	2.06	3.52	7.98	2.48	2.15	3.56	8.18	45000	
S3	51.50(7.18)	48.75(6.95)	53.50(7.24)	153.75(12.39)		4.08	3.05	5.51	12.63	16.33	14.96	15.68	46.96	39250	
Expt. Mean	4.99	4.93	4.86	8.52		3.02	2.22	4.02	9.25	7.35	6.53	7.60	21.48		
C.D. (0.05)	0.46	0.89	1.48	0.85		1.06	0.94	1.99	2.94	2.97	6.36	6.99	6.21		
C.V. (%)	5.31	10.42	17.55	5.74		20.3	24.61	28.66	18.33	23.38	56.25	53.19	16.72		
res(f)	**	**	**	**		*	*	*	**	**	**	**	**		

T1 - Drone
T2 - Battery operated Knapsack sprayer
T3 - Untreated control

CLIMATE CHANGE MITIGATION TRIALS



4.6. CLIMATE CHANGE MITIGATION TRIALS (CCMT's)

4.6.1. Evaluating the potential impact of CleanRise™ on mitigating greenhouse gas emission and yield improvement in Paddy, *Kharif-2025*

Rice cultivation is a major contributor to greenhouse gas (GHG) emissions, particularly methane (CH₄) and nitrous oxide (N₂O), posing challenges to environmental sustainability under changing climate conditions. In this context, microbial-based biostimulants offer a promising approach to enhance productivity while reducing environmental impacts. CleanRise™ is a methanotroph-based biostimulant that helps in oxidizing methane, thereby reducing CH₄ emissions, while also improving root growth, nutrient use efficiency and overall crop performance. Previous studies have reported significant yield improvement along with substantial reduction in GHG emissions with its application, indicating its potential for sustainable rice cultivation. However, its performance under different crop establishment methods such as transplanted rice and direct-seeded rice (DSR), along with varying nitrogen levels and agro-ecological conditions, needs systematic evaluation. Keeping this in view, the present study was undertaken to (i) evaluate the effect of CleanRise™ on growth and yield of paddy, (ii) assess its carbon mitigation potential, and (iii) analyze its economic feasibility. The experiment was conducted during *Kharif*, 2025 at 12 locations in six zones viz; **Pantnagar, Ludhiana, Varanasi, Titabar, Raipur, Karjat, Nawagam, Coimbatore, Gangavathi, IIRR, Maruteru, Moncompu**. The trial was laid out in a randomized block design (RBD) with eight treatments and three replications. The treatments included T1: Transplanting method with (100% RDF)-Control, T2: Transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage), T3: Transplanting method with 100% RDF + 180g/ha one application (Seedling treatment), T4: Transplanting method with 75% RDF + 180g/ha one application (Seedling treatment), T5: DSR (Direct seeded rice) method with (100% RDF)-Control, T6: DSR method with 100% RDF+60g/ha three applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage), T7: DSR method with 100% RDF + 180g/ha one application (foliar spray at 20-25 Days after sowing), T8: DSR method with 75% RDF + 180g/ha one application (20- 25 Days after sowing) on crop growth, yield attributes and yield. Coimbatore, Nawagam only two locations have recorded the Methane (CH₄) and Nitrous oxide (N₂O) gas emissions. The results obtained are presented in Table 4.6.1, and the salient findings are discussed below.

In Zone II, in silt loam soils of Pantnagar, transplanting method with 75% RDF + 180g/ha one application (Seedling treatment) recorded higher grain yield and comparable to transplanting method with 100% RDF + 180g/ha one application (Seedling treatment), transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage), transplanting method with (100% RDF) and DSR method with 100% RDF. Yield attributes such as higher panicles m⁻², filled grains per panicle, panicle weight and test weight, which collectively contributed to better grain formation and overall productivity. **In sandy loam soils of Ludhiana**, transplanting method with 100% RDF + 180g/ha one application (Seedling treatment) recorded the highest grain yield, followed by transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar

spray at maximum tillering & PI stage). No significant differences were observed in straw yield among treatments.

In Zone III, in loam soils of Varanasi, transplanting method with (100% RDF)-control recorded the highest grain yield, significantly outperforming all other treatments followed by transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage). Similar trend was observed for straw yield. Although DSR method with (100% RDF) control recorded higher panicles m^{-2} , it did not result in the highest grain yield.

In Zone IV, in clay loam soils of Titabar, transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage) recorded the highest grain yield, significantly outperforming all other treatments followed by DSR method with 100% RDF + 60g/ha three applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage). A similar trend was evident for straw yield. Yield attributes, particularly higher panicles m^2 , greater filled grains per panicle, lower chaffy grains, higher filled grain percentage, and increased panicle weight contributed to higher grain yield.

In Zone V, in vertisol of Raipur, DSR method with 100% RDF + 180 g/ha one foliar application (20-25 DAS) recorded the numerically higher grain yield, closely followed by transplanting method with 100% RDF + 60 g/ha applied in three splits. However, the differences were non-significant and similar trend was observed in case of straw yield and yield attributes.

In Zone VI, at Karjat, among the treatments, transplanting method with 100% RDF + 180g/ha one application (Seedling treatment) recorded the higher grain yield and comparable with transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage). The higher yield is due to higher yield attributes, viz; higher spikelets per plant and filled grains per panicle. **In clay loam soils of Nawagam**, both grain and straw yield were highest in transplanting method with 100% RDF + 180 g/ha one application (seedling treatment) on par with DSR method with 100% RDF + 180 g/ha one application and DSR method with 100% RDF + 60 g/ha applied in three splits, due to higher panicles m^{-2} and panicle weight. Methane (CH_4) emissions were lowest in DSR method with 100% RDF + 60 g/ha applied in three splits, followed by DSR method with 100% RDF + 180 g/ha one application and DSR method with 75% RDF + 180 g/ha one application, while the transplanting method control (100% RDF) recorded the highest emissions.

In Zone VII, in clay loam soils of Coimbatore, transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage) recorded the highest grain yield due to yield attributes, viz; panicles m^{-2} , panicle weight. Similar trend was observed for straw yield. Methane (CH_4) and nitrous oxide (N_2O) emissions varied among treatments. Lower methane emissions were recorded in DSR method with 100% RDF + 60g/ha three applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage), followed by DSR method with (100% RDF)-control, whereas the transplanting method with (100% RDF)-control recorded the highest emissions. In contrast, N_2O emissions were lower in transplanting method with 100% RDF + 60g/ha three applications (Seedling

treatment, foliar spray at maximum tillering & PI stage). **In black soils of Gangavathi**, transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage) recorded the highest grain yield and comparable with transplanting method with 100% RDF + 180g/ha one application (Seedling treatment) and transplanting method with (100% RDF)-control. Straw yield was significantly higher in DSR method with 100% RDF + 60g/ha three applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage) which was on par with DSR method with 100% RDF + 180g/ha one application (foliar spray at 20-25 Days after sowing) and DSR method with 75% RDF + 180g/ha one application (20- 25 Days after sowing). The higher yield attributes are in support of grain yield. The higher yield attributes are in support of grain yield. **In black clay soils of IIRR**, the highest grain yield was recorded in transplanting method with 100% RDF + 60g/ha three application (Seedling treatment, foliar spraying at maximum tillering & PI stage) and comparable with other cleanrise treatments in transplanted and DSR method except control. Number of panicles m^{-2} , grains per panicle contributed to better yield performance in the treatment plots. Straw yield was significantly higher in DSR method with (100% RDF)-control which was on par with DSR method with 75% RDF + 180g/ha one application (20- 25 Days after sowing) and DSR method with 100% RDF + 180g/ha one application (foliar spray at 20-25 Days after sowing). **In alluvial soils of Maruteru**, transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage) recorded the highest grain yield followed by DSR method with 100% RDF + 60g/ha three applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage); however, the differences were non-significant. A similar non-significant trend was observed for straw yield. Among yield attributes, panicles m^{-2} did not vary significantly, while panicle weight was significantly higher in transplanting method with 100% RDF + 60g/ha three applications (Seedling treatment, foliar spray at maximum tillering & PI stage), which was on par with DSR method with 100% RDF + 60g/ha three applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage). **In clay loam soils of Moncompu**, both grain and straw yield were highest in DSR method with 100% RDF + 60g/ha three applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage) and were on par with DSR method with 100% RDF + 180g/ha one application (foliar spray at 20-25 Days after sowing) and DSR method with 75% RDF + 180g/ha one application (20- 25 Days after sowing), with higher yield attributes viz; increased spikelets per plant and filled grains per panicle.

Results of the multi locational Field trial conducted in six different Zones showed that, CleanRise™ application in Transplanting method with 100% Recommended Dose of Fertilizers+60 g ha^{-1} application three times i.e., seedling treatment, foliar spray at maximum tillering and foliar spray recorded higher grain yield across 12 locations due to improved yield attributes. The results of greenhouse gas emission data from two locations showed lowest methane (CH_4) emission from Direct Seeded Rice with 100% RDF + 60 g ha^{-1} in three foliar applications at 20–25 DAS, maximum tillering and panicle initiation indicating the potential of cleanrise bacterial culture and DSR method in reducing methane emissions in rice cultivation.

Table 4.6.1. Evaluating the potential impact of CleanRise™ on mitigating greenhouse gas emission and yield improvement in Paddy, Kharif-2025.

Treatments	Zone-VII COIMBATORE													
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Methane Emissions (kg/ha/season)			Nitrous Oxide Emissions (kg/ha/season)		
									35DAT/58DAS	49DAT/72DAS	98DAT/114DAS	35DAT/58DAS	49DAT/72DAS	98DAT/114DAS
T1	5.66	3	7.18	86.90	342	3.41	13.99	101	20.6	28.2	3	2.9	3.5	1
T2	6.04	1	7.75	88.43	344	3.44	14.08	101	17.9	20.6	2	2.2	2.5	1
T3	5.78	2	7.40	87.70	343	3.42	14.01	101	-	-	-	-	-	-
T4	5.13	5	6.12	81.80	336	3.25	13.87	100	-	-	-	-	-	-
T5	5.00	7	6.74	85.10	316	2.93	13.76	98	12.6	13.4	2	3.5	4.4	2
T6	5.32	4	7.04	86.30	319	2.97	13.83	98	9.5	12.6	2	2.9	3.5	1
T7	5.10	6	6.72	85.60	317	2.94	13.77	98	-	-	-	-	-	-
T8	4.47	8	5.67	80.40	309	2.38	13.65	98	-	-	-	-	-	-
Expt. Mean	5.31		6.83	85.28	328	3.09	13.87	100						
C.D. (0.05)	0.18		0.23	3.61	6.41	0.09	0.39	1.62						
C.V. (%)	1.96		1.92	2.42	1.11	1.69	1.62	0.93						
Soil type	Clay loam													
pH	8.03													
EC	-													
Variety & Duration	CO 59, 130 days													
Applied NPK kg/ha	100:50:50													
Available NPK kg/ha	239:21:469													

- T1: Transplanted method (100% RDF) - Control
- T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)
- T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)
- T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)
- T5: DSR method (100% RDF) - Control
- T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)
- T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)
- T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-VII GANGAVATHI								Zone-VII IIRR						
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Plant height (cm)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle wt (g)	Test wt (g)	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Grains/panicle (No.)	Panicle wt (g)	Test wt (g)
T1	3.74	3	2.82	105.33	207	196	5.27	29.90	5.94	6	6.94	299	144	1.95	15.66
T2	4.30	1	3.49	126.67	256	229	6.33	32.00	6.98	4	6.88	501	187	2.58	16.45
T3	4.21	2	3.18	117.67	210	212	5.67	30.00	6.73	1	6.30	437	180	2.60	16.45
T4	3.53	4	3.04	100.00	200	146	4.93	28.17	6.52	2	6.86	402	189	2.51	16.69
T5	2.53	7	4.00	116.33	139	120	4.40	28.00	5.76	8	9.82	363	149	2.08	15.31
T6	3.26	5	5.02	128.67	184	164	5.87	32.00	6.79	3	8.96	427	147	2.30	15.40
T7	3.17	6	4.64	120.67	144	138	5.40	31.00	6.63	7	9.37	348	184	2.22	16.30
T8	2.20	8	4.39	114.33	100	101	4.20	30.00	6.57	5	9.58	331	153	2.20	16.04
Expt. Mean	3.37		3.82	116.21	180	163	5.26	30.13	6.49		8.09	388	167	2.30	16.04
C.D. (0.05)	0.72		0.91	21.06	41.03	29.24	0.99	4.59	0.59		2.50	74	24	0.46	0.45
C.V. (%)	12.17		13.56	10.35	13.02	10.23	10.79	8.7	5.18		17.65	11	8	11.44	1.60
Soil type	Black soil								Black Clay						
pH	-								7.84						
EC	-								-						
Variety & Duration	Spoorthi, 130-135 days								DRR Dhan 60						
Applied NPK kg/ha	-								120:60:40						
Available NPK kg/ha	-								-						

T1: Transplanted method (100% RDF) - Control

T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)

T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)

T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)

T5: DSR method (100% RDF) - Control

T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)

T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)

T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-VI KARJAT														
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Grain yield (kg/plot)	Straw yield (kg/plot)	Plant height (cm)		Panicle/m ² (No.)	Spikelets/plant (No.)	Filled Grains/panicle (No.)	Chaffy Grains/panicle (No.)	Filled grain (%)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
						60 DAS	Harvest								
T1	4.72	3	7.48	10.58	16.78	89.60	98.67	354	159	136	23	88.67	3.23	23.02	93
T2	5.02	2	7.99	11.26	17.94	90.27	100.33	374	177	156	21	89.51	3.52	22.43	92
T3	5.32	1	8.38	11.93	18.79	89.20	99.63	372	177	158	19	85.29	3.44	22.20	92
T4	4.68	4	7.45	10.51	16.72	88.93	98.47	373	158	135	20	80.86	3.20	22.24	93
T5	4.00	8	5.74	8.96	12.89	90.47	97.80	326	122	98	24	85.77	3.13	22.60	87
T6	4.45	6	6.21	10.00	13.93	90.73	100.00	325	163	140	23	87.98	3.32	22.21	86
T7	4.58	5	6.59	10.28	14.78	91.20	97.07	348	167	147	21	80.90	3.43	22.33	87
T8	4.03	7	5.83	9.05	13.07	90.40	98.20	325	127	103	24	103.00	3.16	22.66	89
Expt. Mean	4.60		6.96	10.32	15.61	90.10	98.77	350	156	134	22	87.75	3.30	22.46	90
C.D. (0.05)	0.53		1.27	1.2	2.85	3.98	5.41	54.59	17.4	19.11	5.66	11.25	0.65	2.16	1.38
C.V. (%)	6.63		10.41	6.63	10.42	2.52	3.13	8.92	6.37	8.14	14.9	7.32	11.18	5.48	0.88
Soil type	-														
pH	-														
EC	-														
Variety & Duration	Karijat 3, 115-120 days														
Applied NPK kg/ha	100:50:50														
Available NPK kg/ha	245;12.20:350.25														

T1: Transplanted method (100% RDF) - Control

T2: Transplanted 100% RDF + 60g/ha Applications (Seedling treatment, foliar spray at maximum tillering & PI stage)

T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)

T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)

T5: DSR method (100% RDF) - Control

T6: DSR 100% RDF + 60g/ha Applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)

T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)

T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-II LUDHIANA							Zone-VII MARUTERU						
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
T1	6.15	4	7.62	225	4.718	22.37	92	4.72	4	7.87	297	4.48	11.83	95
T2	6.75	2	7.96	224	4.848	22.43	91	5.22	1	8.70	308	5.34	13.57	89
T3	6.84	1	8.06	231	4.964	22.50	91	4.73	3	7.88	273	5.07	13.00	90
T4	6.58	3	8.21	230	5.063	22.50	92	4.34	7	7.23	260	4.80	12.87	90
T5	-	-	-	-	-	-	-	4.50	6	7.51	288	4.39	11.47	100
T6	-	-	-	-	-	-	-	5.03	2	8.38	308	5.18	13.50	90
T7	-	-	-	-	-	-	-	4.55	5	7.58	273	4.96	12.77	91
T8	-	-	-	-	-	-	-	4.23	8	7.06	271	4.71	12.63	92
Expt. Mean	6.58		7.96	228	4.90	22.45	92	4.67		7.78	285	4.87	12.71	92
C.D. (0.05)	0.55		0.55	23	0.44	0.18	2	0.76		1.27	97.05	0.6	0.55	3.93
C.V. (%)	5.14		4.34	6	5.61	0.49	1	9.3		9.31	19.47	7.04	2.45	2.44
Soil type	Sandy loam							Alluvium soil						
pH	7.7							7.5						
EC	2.4							0.39						
Variety & Duration	PR 126: 123 days							MTU 1262, 140 days						
Applied NPK kg/ha	105:30:30							90:60:60						
Available NPK kg/ha	272:26:198							151:11.75:257						

T1: Transplanted method (100% RDF) - Control
T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)
T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)
T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)
T5: DSR method (100% RDF) - Control
T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)
T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)
T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-VII MONCOMPU										
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Spikelets/plant (No.)	Filled Grains/panicle (No.)	Chaffy Grains/panicle (No.)	Filled grain (%)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
T1	4.08	8	5.24	228	155	125	30	81.00	3.24	2.33	78
T2	4.40	5	5.93	200	176	144	33	81.67	4.18	2.50	77
T3	4.09	7	5.60	232	174	131	42	75.67	3.88	2.51	78
T4	4.31	6	5.80	224	176	134	42	76.67	3.48	2.38	79
T5	4.64	4	6.15	225	148	122	26	82.67	3.23	2.50	75
T6	5.29	1	6.96	236	122	96	26	78.33	2.72	2.49	75
T7	4.97	2	6.23	253	135	106	29	78.33	2.95	2.44	74
T8	4.67	3	6.32	241	131	106	25	80.33	2.83	2.49	73
Expt. Mean	4.56		6.03	230	152	120	32	79.33	3.31	2.46	76
C.D. (0.05)	0.63		0.84	32.76	27.32	15.35	14.72	6.05	0.51	0.14	1.32
C.V. (%)	7.88		7.99	8.13	10.25	7.28	26.54	4.35	8.75	3.25	0.99
Soil type	Clay loam										
pH	-										
EC	-										
Variety & Duration	-										
Applied NPK kg/ha	90:45:45										
Available NPK kg/ha	250:25:180										

T1: Transplanted method (100% RDF) - Control

T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)

T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)

T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)

T5: DSR method (100% RDF) - Control

T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)

T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)

T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-VI NAWAGAM									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Filled Grains/panicle (No.)	Chaffy Grains/panicle (No.)	Filled grain (%)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
T1	4.96	4	5.69	205	126	32	80.00	3.86	28.90	84
T2	4.93	5	6.20	235	134	20	86.59	4.49	29.82	84
T3	5.39	1	6.65	247	146	19	88.61	4.39	29.80	84
T4	4.93	5	6.16	212	122	33	78.96	4.32	28.64	85
T5	4.43	7	5.39	192	122	26	82.48	3.78	29.18	73
T6	5.11	3	6.11	199	136	25	84.58	3.67	29.18	73
T7	5.13	2	6.43	236	137	24	85.24	3.75	30.47	74
T8	4.24	8	5.17	198	119	30	79.90	3.43	28.92	73
Expt. Mean	4.89		5.98	215	130	26	83.30	3.96	29.36	79
C.D. (0.05)	0.62		0.87	22.98	20.47	14.11	9.24	0.65	1.51	2.37
C.V. (%)	7.24		8.27	6.09	8.98	31.08	6.34	9.41	2.93	1.72
Soil type	Clay loam									
pH	8.12									
EC	0.8.									
Variety & Duration	GAR 201, 100-117 days									
Applied NPK kg/ha	80:25:25									
Available NPK kg/ha	266:25:315									

T1: Transplanted method (100% RDF) - Control
T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)
T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)
T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)
T5: DSR method (100% RDF) - Control
T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)
T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)
T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-VI NAWAGAM Contd.													
	Methane emission (kg/ha/season)													
	7 DAT / 30 DAS	14DAT/ 37DAS	21DAT/ 44DAT	28DAT/ 51DAS	35DAT/ 58DAS	42DAT/ 65DAS	49DAT/ 72DAS	56DAT/72DAS	63DAT/ 79DAS	70DAT/ 86DAS	77DAT/ 93DAS	84DAT/100DAS		
T1	43.01	50.32	68.24	106.88	107.09	104.28	95.98	80.22	65.62	52.25	36.19	28.55		
T2	24.20	29.54	33.98	56.50	58.24	55.23	51.84	44.59	35.37	24.92	17.44	13.15		
T3	26.73	34.00	46.15	73.79	69.20	77.84	63.21	57.71	47.52	36.36	26.29	20.30		
T4	23.38	32.07	40.79	59.53	67.53	63.42	57.50	49.86	42.02	33.39	21.51	17.77		
T5	10.95	17.79	23.03	37.98	40.99	38.58	39.21	34.24	24.64	16.61	11.11	8.69		
T6	3.91	5.60	10.42	20.60	21.02	20.96	18.07	15.02	9.79	5.89	2.75	1.21		
T7	5.56	8.89	14.91	25.96	28.81	27.10	22.35	23.05	18.54	10.29	6.33	3.85		
T8	4.46	8.00	11.97	23.09	28.02	24.33	20.62	19.42	13.37	9.57	4.79	2.86		
Expt. Mean	17.77	23.27	31.19	50.54	52.61	51.47	46.10	40.51	32.11	23.66	15.80	12.05		
C.D.(0.05)	3.07	4.85	3.26	5.94	6.77	6.40	3.96	4.98	6.21	4.67	1.56	2.43		
C.V. (%)	7.31	8.81	4.42	4.97	5.45	5.26	3.63	5.20	8.18	8.36	4.18	8.52		

T1: Transplanted method (100% RDF) - Control
T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)
T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)
T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)
T5: DSR method (100% RDF) - Control
T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)
T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)
T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-II PANTNAGAR									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Filled Grains/panicle (No.)	Chaffy Grains/panicle (No.)	Filled grain (%)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
T1	5.31	4	6.25	229	99	16	85.90	2.74	27.20	69
T2	5.35	3	5.57	241	99	17	85.33	2.62	27.80	70
T3	5.36	2	6.13	244	97	15	86.40	2.58	28.30	75
T4	5.39	1	6.01	241	97	16	85.80	2.59	28.00	69
T5	4.90	8	5.28	299	74	21	77.80	1.97	27.60	86
T6	4.99	5	5.27	304	72	21	77.73	1.92	27.40	86
T7	4.97	6	5.77	278	78	22	76.73	2.07	27.30	86
T8	4.93	7	5.74	291	75	23	76.40	1.98	27.70	87
Expt. Mean	5.15		5.75	266	86	19	81.51	2.31	27.66	79
C.D. (0.05)	0.22		0.79	16.51	3.47	2.82	2.38	0.13	0.35	7.11
C.V. (%)	2.39		7.89	3.55	2.3	8.5	1.67	3.17	0.73	5.17
Soil type	Silt loam									
pH	-									
EC	-									
Variety & Duration	-									
Applied NPK kg/ha	-									
Available NPK kg/ha	230.22:25.1:212.0									

T1: Transplanted method (100% RDF) - Control

T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)

T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)

T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)

T5: DSR method (100% RDF) - Control

T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)

T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)

T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-V RAIPUR									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Filled Grains/panicle (No.)	Chaffy Grains/panicle (No.)	Filled grain (%)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
T1	4.97	6	6.04	231	203	27	88.25	4.53	19.20	96
T2	5.27	2	6.45	248	235	25	90.47	5.24	19.70	96
T3	5.12	4	6.25	240	221	26	89.19	5.04	19.37	96
T4	4.81	8	5.88	220	195	28	87.52	4.38	19.00	96
T5	5.10	5	6.20	234	219	27	89.08	5.01	19.30	94
T6	5.19	3	6.38	241	227	26	89.64	5.16	19.40	95
T7	5.29	1	6.55	250	236	24	90.63	5.28	19.70	95
T8	4.90	7	5.98	224	201	27	88.01	4.41	19.18	94
Expt. Mean	5.08		6.22	236	217	26	89.10	4.88	19.36	95
C.D. (0.05)	0.9		1.33	48.44	40.75	4.66	2.71	0.97	1.22	0.65
C.V. (%)	10.09		12.25	11.72	10.72	10.16	1.73	11.33	3.61	0.39
Soil type	Vertisol									
pH	-									
EC	-									
Variety & Duration	Bhavya, 130-135 days									
Applied NPK kg/ha	120:60:60									
Available NPK kg/ha	241.5:18.1:351.8									

T1: Transplanted method (100% RDF) - Control

T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)

T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)

T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)

T5: DSR method (100% RDF) - Control

T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)

T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)

T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-IV TITABAR									
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Filled Grains/panicle (No.)	Chaffy Grains/panicle (No.)	Filled grain (%)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
T1	4.72	7	7.32	203	149	22	86.92	3.60	23.67	106
T2	5.84	1	9.89	285	242	10	95.89	5.53	24.73	104
T3	5.38	3	8.76	264	209	15	93.51	4.93	23.63	105
T4	5.16	5	8.12	232	171	19	90.31	4.67	24.30	103
T5	4.36	8	6.78	190	141	25	84.78	3.20	24.60	104
T6	5.45	2	9.25	272	229	14	94.24	5.20	23.13	104
T7	5.22	4	8.57	245	196	18	91.81	4.80	23.90	104
T8	4.96	6	7.57	204	158	21	88.09	4.13	22.90	103
Expt. Mean	5.14		8.28	237	187	18	90.69	4.51	23.86	104
C.D. (0.05)	0.26		0.74	23.74	17.24	3.6	1.83	0.41	1.62	1.73
C.V. (%)	2.89		5.11	5.72	5.27	11.43	1.15	5.25	3.87	0.95
Soil type	Clay loam									
pH	-									
EC	-									
Variety & Duration	Numoli, 130-135 days									
Applied NPK kg/ha	-									
Available NPK kg/ha	-									

T1: Transplanted method (100% RDF) - Control
T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)
T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)
T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)
T5: DSR method (100% RDF) - Control
T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)
T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)
T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

Table 4.6.1. Contd..

Treatments	Zone-III VARANASI								Over all Mean	Rank	% Grain Yield Increase over control
	Grain yield (t/ha)	Rank	Straw yield (t/ha)	Panicle/m ² (No.)	Filled Grains/panicle (No.)	Chaffy Grains/panicle (No.)	Panicle wt (g)	Test wt (g)			
T1	6.23	1	12.40	243	179	47	35.83	17.97	5.09	3	
T2	5.63	2	10.80	231	167	37	30.83	17.13	5.44	1	6.8
T3	5.40	5	10.67	191	158	46	37.33	17.47	5.36	2	5.4
T4	5.47	4	10.60	261	180	48	42.70	17.50	5.06	5	-0.6
T5	5.60	3	11.70	265	153	35	27.30	17.90	4.60	7	
T6	5.03	6	10.63	245	147	29	29.27	17.47	5.09	4	10.4
T7	4.87	8	10.30	246	150	39	41.43	16.83	4.97	6	7.9
T8	4.93	7	10.03	229	179	55	49.97	15.53	4.53	8	-1.6
Expt. Mean	5.40		10.89	239	164	42	36.83	17.23	5.09		
C.D. (0.05)	0.47		1.06	28.21	61.78	29.23	2.28	1.62			
C.V. (%)	4.94		5.57	6.75	21.48	39.7	3.54	5.36			
Soil type	Loam										
pH	-										
EC	-										
Variety & Duration	HUR 156, 130-135 days										
Applied NPK kg/ha	120:60:40										
Available NPK kg/ha	-										

T1: Transplanted method (100% RDF) - Control
T2: Transplanted 100% RDF + 60g/ha 3applications (Seedling treatment, foliar spray at maximum tillering & PI stage)
T3: Transplanted 100% RDF + 180g/ha 1 application (Seedling treatment)
T4: Transplanted 75% RDF + 180g/ha 1 application (Seedling treatment)
T5: DSR method (100% RDF) - Control
T6: DSR 100% RDF + 60g/ha 3applications (foliar spray at 20-25 Days after sowing, maximum tillering & PI stage)
T7: DSR 100% RDF + 180g/ha 1 application (foliar spray at 20-25 Days after sowing)
T8: DSR 75% RDF + 180g/ha 1 application (20- 25 Days after sowing)

ANNEXURES

Annexure - I**Major weeds observed during Kharif - 2025**

Grasses	Sedges	BLW
<i>Cynodon dactylon</i> <i>Chloris barbata</i> <i>Dactylactenium aegyptium</i> <i>Digiteria sanguinalis</i> <i>Echinochloa acolona</i> <i>Echinochloa crusgalli</i> <i>Echinochloa stagnina</i> <i>Eleusine indica</i> <i>Isachne miliacea</i> <i>Ischaemum rugosum</i> <i>Leptochloa chinensis</i> <i>Leersia hexandra</i> <i>Panicum repens</i> <i>Panicum tripheron</i> <i>Paspalum dilatatum</i> <i>Weedy rice (Oryzasativa f. spontanea)</i>	<i>Cyperus difformis</i> <i>Cyperus esculentus</i> <i>Cyperus iria</i> <i>Cyperus haspan</i> <i>Cyperus laevigatus</i> <i>Cyperus procerus</i> <i>Scirpus spp</i> <i>Cyperus rotundus</i> <i>Fimbristylis miliacea</i>	<i>Alternanthera sessilis</i> <i>Alternanthera philoxeroides</i> <i>Ammania baccifera</i> <i>Alternanthera spp</i> <i>Bergia capensis</i> <i>Commelina diffusa</i> <i>Cynotis cristata</i> <i>Cynotis spp</i> <i>Chara zeylanica</i> <i>Ceratophyllum</i> <i>Eclipta alba</i> <i>Eichhornia crassipes</i> <i>Euphorbia prostrata</i> <i>Glinus oppositifolia</i> <i>Ipomoea aquatica</i> <i>Ludwigia parviflora</i> <i>Ludwigia perennis</i> <i>Ludwigia hyssopifolia</i> <i>Marsilea quadrifolia</i> <i>Monochoria vaginalis</i> <i>Rotala densiflora</i> <i>Sphenoclea zeylanica</i> <i>Sphagneticola trilobata</i> <i>Sagittaria guayanensis</i> <i>Trianthema monogyna</i> <i>Vallisneria spp</i>

Annexure - II

WEATHER DATA – KHARIF 2025

ADUTHURAI						
Latitude :	11o N		Longitude:	79.3oE		Elevation(m) :
Soil type:	Clay		Soil pH :	7.2		Soil texture :
	June	July	Aug	Sep	OCT	Total / Range
No. of Rainy days	3	1	5	9	13	31
Total Rainfall (mm)	109.4	16.2	121.4	253.8	279.6	780.4
Avg. Max. Temp. (°C)	34.9	35.6	34	33.8	33.1	35.6-33.1
Avg. Mini. Temp. (°C)	25.0	25.3	23.0	23.7	23.2	23.0-25.3
Avg. Sunshine hours	3.3	4.1	4.0	3.3	2.6	3.46
Avg. wind velocity (kmph)	6.8	9.4	5.7	5.4	3.1	6.08

ALMORA						
Latitude :	290.36'N		Longitude:	79o.40 E		Elevation(m) :
Soil type:	Clay loam		Soil pH :	6.5		Soil texture :
	May	June	July	Aug	Sep	Oct
No. of Rainy days	12	14	19	21	9	3
Total Rainfall (mm)	75.6	66.5	161	329.75	145.5	36.5
Avg. Max. Temp. (°C)	30.5	29.9	29.6	30.9	29	26
Avg. Mini. Temp. (°C)	13.3	16.1	18.6	20	20.1	12.5
Avg. Sunshine hours	-	-	-	-	-	-

BANKURA						
Latitude :	23.24185		Longitude:	87.05715		Elevation (m):
Soil type:	Red & Lateritic		Soil pH :	4.5 – 6.0		Soil texture
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
No. of rainy days	24	16	10	5	0	0
Total rainfall (mm)	7.64	6.25	10.12	13.22	0	0
Avg. Max Temp. (°C)	33.83	34.45	32.22	32.4	24.3	22.6
Avg. Min.Temp. (°C)	26.61	25.41	24.22	25.3	17.36	15.25
* Avg. Sunshine hours	-	-	-	-	-	-
* Avg. wind velocity	-	-	-	-	-	-

CANNING						
Latitude :	22.30489° N		Longitude:	88.6656° E		Elevation (m) :
Soil type:	Saline		Soil pH :	7.0-8.0		Soil texture
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
No. of Rainy days	17	19	19	11	9	1
Total Rainfall (mm)	289	738	470.8	234	160	7.4
Avg. Max. Temp. (°C)	34	32.4	32.3	33.2	32.8	29.9
Avg. Mini. Temp. (°C)	26.7	26.4	26.1	26	24.6	17.7
Avg. Sunshine hours	4.5	2.7	3.8	5.4	5.9	7.9
Avg. wind velocity	6	3	3.1	2.8	1.5	1.8

CHATHA						
Latitude:	32o 40'N		Longitude:	74o 48'E		Elevation (m) :
Soil type:	-		Soil pH :	-		Soil texture:
	June	July	Aug	Sep	Oct	Nov
No. of Rainy days	4	13	14	4	4	1
Total Rainfall (mm)	60.6	275.8	880.6	131.4	73.4	3.8
Avg. Max. Temp. (°C)	37.4	33.6	32.2	33.5	31.3	26.5
Avg. Mini. Temp. (°C)	25.1	26.1	24.7	24.3	16.6	8.6
Avg. Sunshine hours	5.1	3.7	4.1	6.3	7.9	7
Avg. wind velocity	4.8	4.3	3.4	2.1	1.6	1

CHINSURAH							
Latitude :	22°52' N		Longitude	88°24' E		Elevation:	8.62 m MSL
Soil type:	Clay Loam		Soil pH :	7.3		Soil texture:	Gangetic Alluvial
	June	July	Aug	Sep	Oct	Nov	Total/Range
No. of Rainy days	18	26	22	15	11	1	93
Total Rainfall (mm)	185.5	322.3	307.5	281.2	117.1	0.1	1213.7
Avg. Max. Temp. (°C)	34.7	32.3	32.6	33.9	31.7	28.8	34.7-28.8
Avg. Mini. Temp. (°C)	26.4	25	25.4	25.7	23.8	15.8	15.8-26.4

CHIPLIMA							
Latitude :	20°21'N		Longitude:	80°55'E		Elevation (m) :	178.8 m MSL
Soil type:	Mixed Red, Black & Lateritic		Soil pH :	-		Soil texture:	-
	July	Aug	Sep	Oct	Nov	Dec	Total / Range
No. of Rainy days	14	22	16	12	8	0	72
Total Rainfall (mm)	11.21	13.97	7.19	11.03	2.88	0	46.28
Avg. Max. Temp. (°C)	33.53	30.94	32.25	32.31	31.69	28.93	33.53-28.93
Avg. Mini. Temp. (°C)	24.99	24.61	25.01	25.64	22.98	13.6	13.6-25.64

GANGAVATHI							
Latitude:	15°15'40"		Longitude:	76°31'40"		Elevation (m):	406
Soil type:	Medium black		Soil pH:	6.5 to 7.5		Soil texture:	Clay soil
	July	Aug	Sep	Oct	Nov	Dec	Total / Range
No. of Rainy days	5	12	11	6	0	0	34
Total Rainfall (mm)	34.5	87.3	133.5	71.5	0	0	326.8
Avg. Max. Temp. (°C)	30.55	29.49	29.27	29.9	29.74	29.15	30.55-29.9
Avg. Mini. Temp. (°C)	24.37	23.5	23.07	21.88	18.72	15.08	15.08-24.37

JAGDALPUR							
Latitude:	19.05 °N		Longitude:	82.02°E		Elevation (m):	552
Soil type:	Alfisol		Soil pH:	6.5		Soil texture:	Sandy loam
	June	July	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	11	20	16	21	11	0	79
Total Rainfall (mm)	137	550.7	501.1	287.3	141.4	0	1617.5
Avg. Max. Temp. (°C)	31.4	28.5	29.8	30.7	30.4	29.5	31.4-29.5
Avg. Mini. Temp. (°C)	22.6	22.1	22.3	22	19.8	12.6	12.6-22.6
Avg. Sunshine hours	3.3	1.5	2.9	3.3	5.2	8.3	4.083
Avg. wind velocity	4	5.4	3.4	2.7	2.6	1.3	3.233

KARJAT							
Latitude:	18° 55' N		Longitude:	73° 18' N		Elevation (m):	51 m
Soil type:	Medium Black		Soil pH:	6.2		Soil texture:	Clay Loam
	June	July	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	24	30	26	21	13	2	116
Total Rainfall (mm)	825.2	1125.5	1170	853.1	178.7	41.5	4194
Avg. Max. Temp. (°C)	31.64	28.84	28.52	29.08	33.42	32.41	33.42-28.52
Avg. Mini. Temp. (°C)	24.63	24.63	23.82	23.49	22.72	17.92	17.92-24.63
Avg. Sunshine hours	1.47	24.63	0.91	0.86	5.77	6.97	6.768
Avg. wind velocity	78.36	0.52	44.99	23.64	18.21	10.99	29.452

KAUL							
Latitude:	29° 51' 29.5"N		Longitude:	76° 39' 24.3" E		Elevation (m):	230.7
Soil type:	Clay Loam		Soil pH:	8.04		Soil texture:	Clay
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Total / Range
No. of Rainy days	2	10	11	5	1	0	29
Total Rainfall (mm)	26.5	260.6	308.1	163.4	16.7	1.5	776.8
Avg. Max. Temp. (°C)	36.5	33.7	32.3	33	32.1	27.8	36.5-27.8
Avg. Mini. Temp. (°C)	26	27	26.1	24.8	18.6	9.7	9.7-27
Pan evaporation (mm)	5	3.2	3.5	2.4	1.2	1.1	
Avg. Sunshine hours	5.3	3.5	2.5	6.5	6.4	5.8	5
Avg. wind velocity	4.3	3.8	2.8	3.5	1.8	1.7	2.983

KHUDWANI								
Latitude:	34°N		Longitude:	73°E		Elevation (m):	1560 m amsl	
Soil type:	Clayey loam		Soil pH:	Neutral		Soil texture:	Silty clay loam	
	Apr	May	June	July)	Aug	Sep	Oct	Total / Range
No. of Rainy days	5	4	2	7	5	5	1	29
Total Rainfall (mm)	77	64.6	49	82.8	118.4	75.2	35	502
Avg. Max. Temp. (°C)	23.1	27.4	31.2	30.9	29.7	28.8	23.5	31.2-23.1
Avg. Mini. Temp. (°C)	6.8	11.7	16.2	18.9	17.3	13.1	4.9	4.9-18.9
Avg. Sunshine hours	9.68	6.8	8.3	6.6	5.53	6.5	6.52	7.132
Avg. wind velocity	0.73	0.63	0.46	0.34	0.37	0.11	0.14	0.397

LUDHIANA							
Latitude:	30° 54'N		Longitude:	75° 48'E		Elevation (m):	247 MSL
Soil type:	Loamy Sand		Soil pH:	7.7		Soil texture:	-
	June	July	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	6	10	11	6	3	0	36
Total Rainfall (mm)	128.2	260.9	314.6	142.4	52.4	1.2	899.7
Avg. Max. Temp. (°C)	37.7	32.9	32.2	33.4	30.9	26.3	37.7-26.3
Avg. Mini. Temp. (°C)	27.7	27.4	26.4	25.1	18.5	9.9	9.9-27.7
Avg. Sunshine hours	6.1	3.4	4.1	8.3	7.7	7	6.1
Avg. wind velocity	5.1	4.4	3.3	2.1	1.5	1.6	3

MALAN							
Latitude :	32° 1' N		Longitude:	76° 20' E		Elevation(m) :	950m
Soil type:	Alfisol		Soil pH :	5.6-5.8		Soil texture	Silty clay loam
	June	July	Aug	Sep	Oct.	Nov	Total / Range
No. of Rainy days	9	18	23	15	5	-	70
Total Rainfall (mm)	541	811.2	1050.2	772.6	100.6	-	3275.6
Avg. Max. Temp. (°C)	31.2	27.38	23.83	24.12	23.21	-	31.2-23.21
Av-g. Mini. Temp. (°C)	19.6	17.07	15.67	16.66	16.11	-	15.67-19.6

MANDYA							
Latitude :	12.45-13.57 N		Longitude:	76.48 - 78.24 E		Elevation(m) :	695 M
Soil type:	Sandy loam		Soil pH :	6.5 – 7.1		Soil texture	Sandy loam
	July	Aug	Sep	Oct.	Nov	Dec	Total / Range
No. of Rainy days	4	4	6	7	2	0	23
Total Rainfall (mm)	41	87	64	180	7	0	379
Avg. Max. Temp. (°C)	28.52	28.19	29.53	28.9	27.73	27.94	29.53-27.3
Avg. Mini. Temp. (°C)	20.48	20.52	20.47	19.48	18.13	15.48	15.48-20.52
* Avg. Sunshine hours	3.71	4.05	3.9	5.42	5.5	5.35	4.66
*Avg. wind velocity	6.18	4.5	4.45	2.7	2.26	2.55	3.77

MARUTERU							
Latitude :	16.38° N		Longitude:	81.44° E		Elevation (m):	5m
Soil type:	Black alluvial clay		Soil pH :	6.5-7.5		Soil texture	Delta alluvial
	July	Aug	Sep	Oct	Nov	Dec	Total / Range
No. of rainy days	9	10	8	10	1	2	40
Total rainfall (mm)	159	259	134.7	210.9	25.8	19.8	809.2
Avg. Max Temp. (°C)	30.77	30.81	30.7	28.77	28.1	27.9	30.81-27.9
Avg. Min.Temp. (°C)	25.52	26.48	26.33	25.03	25.1	21.1	21.1-26.48

MONCOMPU							
Latitude :	9°26'15"N		Longitude:	76°25'42"E		Elevation(m) :	1-2.5m below MSL
Soil type:	Alluvial clay		Soil pH :	5.5		Soil texture :	Silty Clay Loam
	July	Aug	Sep	Oct	Nov	Dec	Total / Range
No. of Rainy days	24	16	14	13	5	0	72
Total Rainfall (mm)	569.4	232.8	205.8	300.9	101	0	1409.9
Avg. Max. Temp. (°C)	31.5	30.7	31.2	32.2	32.3	33	33-30.7
Avg. Mini. Temp. (°C)	24.2	24.6	24.7	25.2	22.3	24.6	22.3-25.2
* Avg. Sunshine hours	13	58.9	78.3	107.1	177.3	232.2	111.133

NAGINA							
Latitude :	29° 28'N		Longitude:	78° 32'E		Elevation(m) :	450
Soil type:	Sandy loam		Soil pH :	7.5		Soil texture :	
	June	July	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	9	16	14	9	1	0	49
Total Rainfall (mm)	206.4	491.2	446.2	248.5	45.2	0	1437.5
Avg. Max. Temp. (°C)	35.1	32.7	32	34.4	31.3	21.1	35.1-21.1
Avg. Mini. Temp. (°C)	24.4	25.9	24.8	23.5	17.6	8	8-25.9
Avg. Sunshine hours	4.7	3.3	3.4	5.6	5.9	7.5	5.0667
Avg. wind velocity	4.6	4.2	4.4	3.3	1.9	1.8	3.3667

NAVASARI								
Latitude:	20º 29'		Longitude:	73o 29'		Elevation (m):		105 m
Soil type:	Clayey		Soil pH :	7.5		Soil texture		Loamy
	June	July	Aug	Sep	Oct	Nov	Dec	Total / Range
No. of rainy days	16	21	18	14	6	1	0	76
Total rainfall (mm)	305	546	402	293	220	11	0	1777
Avg. Max Temp. (°C)	32	30.3	30.6	31.1	33.3	32	31.8	33.3-30.3
Avg. Min.Temp. (°C)	24.3	24	23.6	23.2	23.4	18.8	16.9	16.9-24.3
* Avg. Sunshine hours	4.3	1.6	1.7	2.4	6.3	7.9	8.6	4.6857
* Avg. wind velocity	6.8	5.8	4.9	3	3.4	2.6	3.4	4.271

NAWAGAM							
Latitude:	22° 48'		Longitude:	71° 3'		Elevation (m):	32.4
Soil type:	Medium Black		Soil pH :	7.8		Soil texture	Sandy Clay loam
	May	June	July	Aug	Sep	Oct	Total / Range
No. of rainy days	6	11	12	9	19	4	61
Total rainfall (mm)	141.4	270	276.3	105.6	151.6	37.4	982.3
Avg. Max Temp. (°C)	38.31	33.96	31.44	31.11	31.19	32	38.31-31.11
Avg. Min.Temp. (°C)	24.17	25.57	26.02	25.52	24.83	20.51	20.51-26.02
* Avg. Sunshine hours	8.98	4.69	8.72	3.54	5.33	6.35	6.26833
* Avg. wind velocity	5.74	7.26	6.2	3.83	3.3	3.14	4.9117

NRRI CUTTACK								
Latitude	20.27N		Longitude:	85o 52'N			Elevation (m):	23
Soil type:	Alluvial		Soil pH :	6.8			Soil texture	Clay loam
	JUNE	July	Aug	Sep	Oct	Nov	Dec	Total / Range
No. of rainy days	13	17	17	16	12	0	0	75
Total rainfall (mm)	315.8	249.6	212.3	272.7	160	0	0	1210.4
Avg. Max Temp. (°C)	32.96	31.02	31.39	30.99	30.98	29.64	26.55	32.96-26.55
Avg. Min.Temp. (°C)	27.38	27.04	27.13	26.93	26.15	19.92	15.37	15.37-27.38
* Avg. Sunshine hours	1.43	1.47	2.53	2.87	4.16	5.94	1.02	2.7743

PANVEL							
Latitude:	18° 59'		Longitude:	73° 10'E		Elevation (m) :	5 m MSL
Soil type:	Coastal saline		Soil pH :	7 - 8		Soil texture :	Silty clay
	June	July	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	24	30	31	27	9	7	128
Total Rainfall (mm)	664.8	871.4	1255.4	637.8	52.6	40.6	3522.6
Avg. Mini. Temp. (°C)	32.52	30.05	29.35	29.5	34.13	34.15	34.15-29.35
Avg. Sunshine hours	23.16	22.39	21.84	21.47	21.61	17.83	17.83-23.16

PATNA							
Latitude :	25.30° N		Longitude:	85.15° E		Elevation (m) :	52 m
Soil type:	Recent alluvial		Soil pH :	7.5		Soil texture	Clay loam
	June	July	Aug.	Sep.	Oct.	Nov	Total / Range
No. of Rainy days	5	15	14	8	5	1	48
Total Rainfall (mm)	61.7	405.2	387.7	147.9	96.5	9.8	1108.8
Avg. Max. Temp. (°C)	36.7	34.2	32.8	33.7	31.4	27.9	36.7-27.9
Avg. Mini. Temp. (°C)	28.8	27.6	27.3	27.7	24.5	17.9	17.9-28.8
Avg. Sunshine hours	NR	NR	NR	NR	NR	NR	NR
Avg. wind velocity	NR	NR	NR	NR	NR	NR	NR

PATTAMBI							
Latitude:	10.80		Longitude:	76.19		Elevation (m):	63M
Soil type:	LATERITE		Soil pH:			Soil texture:	
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Total / Range
No. of Rainy days	19	21	17	20	9.1	4	90.1
Total Rainfall (mm)	349.1	325.6	407	581.3	183.6	14.9	1861.5
Avg. Max. Temp. (°C)	30.4	29.6	29.9	29.5	30.9	32.8	32.8-29.5
Avg. Mini. Temp. (°C)	20.6	21.5	22	22	22.9	20.9	20.6-22.9
Avg. Sunshine hours	108.7/3.6	295.6/9.5	121.53/3.9	127.7/4.1	195/6.2	214.9/7.9	
Avg. wind velocity	55.9/1.8	53.8/1.7	77.1/2.4	64.1/2.1	56.1/1.8	68/2.3	

PUSA							
Latitude:	25.97 N		Longitude:	85.64 E		Elevation (m):	52.0
Soil type:	calcareous		Soil pH:	8.2-8.4		Soil texture:	Sandy-loam
	June	July	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	9	12	16	14	7	1	59
Total Rainfall (mm)	47.8	235.5	304	128.9	182.9	25	924.1
Avg. Max. Temp. (°C)	36.2	34.2	32.6	33.3	32	28.1	36.2-28.1
Avg. Mini. Temp. (°C)	25.8	26	25.4	25.3	21	14.1	14.1-26
Avg. Sunshine hours	5.9	6	4.4	5	5.4	5.9	5.4333
Avg. wind velocity	10.7	11.4	8.6	6.9	5.9	5.7	8.2

RAIPUR							
Latitude:	21°16' N		Longitude:	80° 36' E		Elevation (m):	298
Soil type:	Sandy loam		Soil pH:	-		Soil texture:	Clay loam
	July	Aug	Sep	Oct	Nov	Dec	Total / Range
No. of Rainy days	13	14	12	7	1	0	47
Total Rainfall (mm)	489.8	186	218.6	139	8.2	0	1041.6
Avg. Max. Temp. (°C)	29.9	31.5	31.4	30.8	29.2	27.7	31.5-27.7
Avg. Mini. Temp. (°C)	25.2	25.5	25.2	23.4	14.6	8.7	8.7-25.5
Avg. Sunshine hours	1.2	3.9	3.8	5	7	6.4	4.55
Avg. wind velocity	8.5	6.1	3.7	4.1	2.2	1.7	4.383

RANCHI							
Latitude:	27° 17' N		Longitude:	85°19' E		Elevation (m):	625 m
Soil type:	Red Lateritic		Soil pH:	5.6		Soil texture:	Sandy loam
	June	July	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	14	18	19	18	7	1	77
Total Rainfall (mm)	982.6	563	360.1	400.6	61.6	4	2371.9
Avg. Max. Temp. (°C)	32.7	26.6	27.9	28.4	27	24.5	32.7-24.5
Avg. Mini. Temp. (°C)	21.6	16.3	21.6	19.9	16.3	10.1	10.1-21.6
Avg. Sunshine hours	NA	NA	NA	NA	NA	NA	NA
Avg. wind velocity	3	2.3	2.2	2.3	2.4	2.8	2.5

REWA							
Latitude:	24° 30' N		Longitude:	81° 2' E		Elevation (m):	360 msl
Soil type:	Clay loam		Soil pH:	7.3		Soil texture:	Silty Clay loam
	Jun	Jul	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	10	14	14	9	8	0	55
Total Rainfall (mm)	132	516.7	494.9	133.8	123.2	0	1400.6

TITABAR							
Latitude:	26°34'34.5"N		Longitude:	94°10'56.8"E		Elevation (m):	96 m
Soil type:	-		Soil pH:	-		Soil texture:	-
	Jun	Jul	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	12	17	17	10	6	5	67
Total Rainfall (mm)	244	348.2	355	195.8	71.2	14.8	1229
Avg. Max. Temp. (°C)	33.8	34.6	33.1	33.8	32.3	28.7	34.6-28.7
Avg. Mini. Temp. (°C)	22.1	21.8	20.8	20.1	18	13.7	13.7-22.1
Avg. Sunshine hours	4	4.5	3.7	5	5.4	5.9	4.75

WANGBAL							
Latitude:	24°8'N		Longitude:	94°E		Elevation (m):	781m
Soil type:	Clay loam		Soil pH:	5.5		Soil texture:	Fine
	Jun	Jul	Aug	Sep	Oct	Nov	Total / Range
No. of Rainy days	15	20	19	9	4	5	72
Total Rainfall (mm)	231.2	284.9	226.4	112.8	45.8	22.1	923.2
Avg. Max. Temp. (°C)	33	33	33	33	33	29	33-29
Avg. Mini. Temp. (°C)	23	23	21	21	18	15	15-23

Annexure - III**Details of product/material provided by private company/organization in Kharif - 2025**

S.No.	Name of the product	Agro-Input-Agency
1	CleanRise™	String Bio Pvt. Ltd. R&D Lab: Centre for Cellular and Molecular Platforms, GKVK PO, Bangalore - 560065, India Registered Office: No. 456G, 1st main road, Vinayaka Nagar, 9th Mile, Tumkur Road, Nagasandra, Bangalore - 560073, India.

Annexure - IV**ABBREVIATIONS**

ADT	Aduthurai	MDZ	Medziphema
ALM	Almora (VPKAS)	MNC	Moncompu
ARD	Arundhutinagar	MND	Mandya
BNK	Bankura	MTU	Maruteru
CBT	Coimbatore	NGN	Nagina
CHN	Chinsura	NLR	Nellore
CHP	Chiplima	NVS	Navsari
CHT	Chatha	NWG	Nawagam
CKD	Chakdha	PDG	Phondaghat
CNG	Canning (CSSRI)	PNT	Pantnagar
CTK	Cuttak (NRRI)	PNV	Panvel
DNG	Dhangain	POB	Port Blair (CIARI)
FZB	Faizabad(Masodha)	PSA	Pusa
GER	Gerua (NRRI)	PTB	Pattambi
GGT	Ghaghraghat	PTN	Patna (Dhangain)
GNV	Gangavati	PDC	Puducherry
GRD	Giridih	RCI	Ranchi
HZB	Hazaribagh (NRRI)	REW	Rewa
JDP	Jagadalpur	RGL	Ragolu
KHD	Khudwani	RNR	Rajendranagar
KJT	Karjat	RPR	Raipur
KNP	Kanpur	SBR	Sabour
KRK	Karaikal	TLJ	Tuljapur
KRL	Karnal(CSSRI)	TTB	Titabar
KTA	Kota	USG	Upper Shillong
KUL	Kaul	VDG	Vadagaon
LCK	Lucknow	VRN	Varanasi
LDN	Ludhiana	VTL	Vytilla
MLN	Malan	WBL	Wangbal (Imphal)

Annexure – V

**ADDRESSES OF COOPERATORS - AGRONOMY
2025-26**

FUNDED CENTRES:

1	Dr. S. Elamathi, Associate professor (Agronomy) Rice Agronomist -AICRIP Tamil Nadu Rice Res. Institute ADUTHURAI - 612 101 (Tamil Nadu) Phone: 0435 – 2472098 (O) FAX: 0435 – 2472881 Mobile: 08973649570 Email: elamathi_aadiu@yahoo.co.in	2	Dr. Rajib Das, Asst Agronomist, Rice Research Station, BANKURA – 722 101 (West Bengal) Phone: 03242-251306 Mobile: 8250920259 Email: rajibdasagro@gmail.com rrsbankura@gmail.com
3	Dr. Anuradha Saha, Chief Scientist Division of Agronomy, SKUAST – J, CHATHA - 181 009, JAMMU (Jammu & Kashmir) Phone : 0191-2434716 (R) Mobile : 09419202983 Email: anuradha_agron@yahoo.co.in	4	Dr. Malay Kumar Bhowmick Agronomist (AICRIP), Rice Research Station Govt. of West Bengal P.O. CHINSURAH RS - 712 102 Hoogly Dist. (West Bengal) Phone: 033 – 26862484 FAX : 033 – 26861149 Mobile : 6290551339 E-mail: bhowmickmk@gmail.com
5	Ms. Sarita Barla Junior. Agronomist (AICRP on Rice) Regional Research & Technology Transfer Station, CH IPLIMA - 768 025 Sambalpur (Orissa) Phone - 0663-2460515 Mobile No. +91 8455922363 E-mail: saritabarla65@gmail.com	6	Dr. G. Senthil Kumar, Associate Professor (Agronomy), Department of Rice, Tamil Nadu Agricultural University, COIMBATORE - 641 003 Tamil Nadu. Mobile: 9443916294 Email: senthilkumar.g@tnau.ac.in senthilkolathur@gmail.com
7	Dr. Kamlesh Kumar Prasad Scientist (Agronomy) Botanical Research Unit (BRU) PO: Bikramganj, Dist. Rohtas, Bihar DHANGAIN – 802 212 Mobile : 09430220110, 7739079713 Email: dr.kamleshkprasad.agron@gmail.com aicripricebrudhangain@gmail.com	8	Dr. Sanjay Kumar M.Sc. Ph.D.(Agronomy) Assistant Agronomist / Assistant Professor,, Crop Research Station, Masodha, P.O.: Dabhasemar, MASODHA -224 133 (Uttar Pradesh) Phone: 05278 – 254153 FAX: 05278 – 244242 / 243033 Mobile: 6392217329 Email: sanjay.psbvb@gmail.com

9	Dr. Shwetha B N , Scientist (Agronomy), AICRP on Rice, ARS, GANGAVATHI – 583 227 Dist. Bellary (Karnataka) Phone: 08533-270144 (O) Fax: 08533-270130 Mobile: 8310096211 Email: shwethaagon@gmail.com	10	Dr. Mahendra Singh Assistant Agronomist Crop Research Station GHAGHRAGHAT - 271 901 P.O. Jarwal Road, Bahraich Dist. (Uttar Pradesh) Phone: 05270 – 262066 (O) Fax: 05270-262917,262097 Mobile : 9934318392 Email: singhm7@yahoo.com
11	Dr. Ashwani Kumar Thakur Principal Scientist (Agronomy) S.G. College of Agriculture and Res. Station (IGKV) Kumhrawand, JAGDALPUR - 494 005, (Chhattisgarh) Phone: 07782 – 229150, 229360 (O) FAX : 07782 – 229360, 229046 Mobile: 6267937841 Email : scientist_agrosgcars@rediffmail.com	12	Dr. Vijay V. Sagvekar , Agronomist, Reg. Agri. Res. Station, KARJAT - 410 201 Dist. Rajgad (Maharashtra) Phone: 02148 - 222031 FAX: 02148 – 222035 Mobile: 8329683319/ 9423303232 Email : vvsagvekar.2011@gmail.com vvsagvekar@dbskv.ac.in
13	Dr. Yogendra Kumar Singh Assistant Professor (Agronomy) Department of Agronomy CSA University of Agriculture & Technology KANPUR , Uttar Pradesh-208 002 Mob: 9451169013 Email: dryksingh1209@gmail.com	14	Dr. Amit Kumar , Asst. Scientist (Agronomy) Rice Res Station (HAU) KAUL (KAITHAL) - 136 021 / 132020 (Haryana) Phone: 01746 – 254550 (O) FAX: 01746 - 254946 Mobile- 9897981827 Email: akumar.dr2014@gmail.com
15	Dr. Tasneem Mubarak Chief Scientist (Agronomy) KHUDWANI - 192 102 P.O. Vanpoh, Anantnag Dist. (Jammu & Kashmir) FAX : 01931 – 238246 Mobile: 6006912428 Email: drtasneem.mubarak@gmail.com	16	In-Charge Directorate of Agriculture AG Colony, KOHIMA , Nagaland – 797001 Phone: 0370-2243116 Email: agrilan-nql@gov.in
17	Dr. Krishna Murari Sharma Professor(Agronomy) Agril. Research Station, Ummedganj Farm, Kaithoon Road, Post box no. 7, GPO Nayapura, KOTA -324001 (Rajasthan) Mobile: +9829088726 (O) Email: kmsharma.kvk@gmail.com arskota@hotmail.com	18	Dr. Buta Singh Dhillon Asstt. Agronomist (Rice) Punjab Agriculture University Ludhiana, PAU, LUDHIANA – 141 004 (Punjab) FAX : 0161-2400945 Mobile : 9463805324, 8146100360 Email: bsdhillon@pau.edu dhillonbs1@gmail.com
19	Dr. Gurudev Singh Scientist (Agronomy)-cum-P.I. (Linseed), Department of Genetics & Plant Breeding COA CSKHPKV Rice and Wheat Research Centre, MALAN , Palampur H.P. 176 062	20	Dr. Denesh. G.R. Agronomist ZARS, V.C.Farm, MANDYA Karnataka-571045 Mobile: 9448980134 E-mail : grdenesh@rediffmail.com

	Mobile : +919418479856 E mail: gdevsaandil@rediffmail.com		
21	Dr. P.V. RAMESH BABU, Scientist (Agronomy), AICRIP on Rice Acharya N.G. Ranga Agricultural University Regional Agricultural Research Station MARUTERU - 534 122, West Godavari District Andhra Pradesh, INDIA Mobile no: +91 9866787072 Phone: 08819 –2462483 Email : pv.rameshbabu@angrau.ac.in	22	Dr. Nimmy Jose Professor (Agron.), M S Swaminathan Rice Res. Station (KAU), Thekkekara Post MONCOMPU - 688 503 Alapuzha Dist. (Kerala) Phone: 0477 – 2702245 Mobile: 09495671971 08078491971 E-mail: nimmy.jose@kau.in, rrsmoncompu@kau.in
23	Dr. Vivek Yadav Jr. Agronomist (AICRIP) Rice Res.Station(SVBPUA&T) NAGINA - 246 762 Bijnor Dist., (U.P.) Phone: 01343 – 250271 (O) FAX: 01343-2411505 Mobile: 07017199335 Email : vivekzrsnagina@gmail.com	24	Dr. Darpana Patel Assistant Research Scientist (Agronomy), Main Rice Research Centre, Soil & Water Management Research Unit, Navsari Agricultural University, NAVSARI – 396 450 (Gujarat) Mobile: 09925508070 Email: darpana_srs@yahoo.com
25	Dr. D. J. Kacha, Assistant Res. Scientist (Agronomy) Main Rice Research Station Anand Agricultural University (AAU) NAWAGAM – 387 540 Kheda Dist. Ta. (Kheda) (Gujarat) Phone-: 02694 – 284278 (O): Fax: 02694 – 284208 Mobile: 09825598707 E-mail: kacha_dharmesh@yahoo.com rsrice_mrrs@yahoo.com	26	Dr. D.K. Singh Professor Agronomy Department of Agronomy College of Agriculture (GBPUAT) PANTNAGAR - 263 145 Dist: U.S. Nagar (Uttaranchal) Phone: 05944 – 233034 (O) 233239 (R) FAX: 05944 – 233473 Mobile : 09411320066 Email: ghananjayrahul@rediffmail.com
27	Ms. Prasanthi .K., Agronomist Reg. Agril. Res. Station Kerala Agricultural University PATTAMBI - 679 306 Palakkad Dist. (Kerala) Phone: 0466 – 2212275 FAX : 0466 – 2 212228 Mele Pattambi (PO) -679 306, Palakkad, Kerala. Mob: 9846218085 Email: prasanthi.k@kau.in	28	Dr. S. Ravi Junior Agronomist Perunthalavar Kamaraj Krishi Vigyan Kendra (PKKV), Kurumbapet, PUDUCHERRY - 605 009 Phone: 0413 – 2271292 FAX: 0413 – 2279758 Mobile: 09443293376, 09442526994 Email: drsraviapkvvkp@gmail.com pkkvk.py@gov.in pkkvk.py@gmail.com pondicherrykvk@yahoo.co.in
29	Dr. Biswajit Pramanick Assistant Professor Department of Agronomy Dr. Rajendra Prasad Central Agricultural University PUSA (SAMASTIPUR) - 848 125 (Bihar)	30	Dr. Pragya Pandey Principal Scientist, AICRIP, Department of Agronomy College of Agriculture (IGKV) RAIPUR - 492 006 (Chhattisgarh) Tel fax: 0771 – 2443035 (O) Mobile : 079877 58329

	FAX: 06274 – 240255 Mobile: 8630795237 Email: biswajit@rpcau.ac.in bipra.its4u@gmail.com		74153 02203 Email: pragya.pandey@gmail.com gyan.pragya89@gmail.com
31	Dr. Parimal Kumar, Scientist (Agronomy), AICRIP on Rice Research centre. PJ TSAU, Agricultural Research Institute, ARI RAJENDRANAGAR, Hyderabad-500 030, Ph No : 040-2401 5817(O), Mobile : 9948589387 Email : mparimalkumar@gmail.com	32	Dr. Ashok Kumar Singh Junior Agronomist (Rice) Birsa Agricultural University, Kanke, RANCHI – 834 006 (Jharkhand) Ph. 0651-2450608 (Office) Mobile: 08789333028 Email : aksinghbau65@gmail.com
33	Agronomist Senior Scientist JNKVV, College of Agriculture, REWA - 486 001 (Madhya Pradesh) FAX: 07662 – 220857, 07662 -220732 Mobile: Email:	34.	Dr. Nilotpal Hazarika Scientist (Agronomy) AICRIP Regional Agricultural Research Station (AAU), TITABAR – 785 630 DIST.JORHAT (ASSAM) Phone : 03771-, 248453 (O) Fax : 0376 – 2340044 Mobile : 7399599370 Email : nilotpal.hazarika@aau.ac.in
35	Dr. Pynhunlin Nola K. Dohling Scientific officer (Rice), Shillong, AICRIP, Research office, UPPER SHILLONG - 793 009 East Khasi Hills (Meghalaya) Phone: 0364 – 2224713 (O) 2521114 (R) Mobile: 9774559193 (M) Email: agriroshg@gmail.com aicrip.uppshq@gmail.com	36.	Dr. Nikhil Kumar Singh Assistant Professor, Department of Agronomy Institute of Agricultural Sciences Banaras Hindu University VARANASI-221 005(Uttar Pradesh) Phone:0542 –2 30712(O),2224519 (R) FAX: 0542 – 2312059 236838 Mobile: 09454192864 Email: nikhilkumar@bhu.ac.in
37	Dr. Ngamreishang, Junior Agronomist, AICRIP Rice Research Station WANGBAL - 7595138 Khangabok BPO, Thoubal (Manipur) Mobile: 8731869011 Email: ngamreishang777@gmail.com	38.	Dr. B. Madavi, Scientist (Agronomy), AICICP on Rice, RARS, WARANGAL, PJ TSAU, Warangal-506 007 Dist: Warangal Mob: 8897774968 Ph: 0870-2100236 Email: bodigemadavi@gmail.com

VOLUNTARY CENTERS:

1.	Dr. R.P. Meena, Scientist (Agronomy) Crop production division, ICAR - V.P.K.A.S. ALMORA - 263 601 Uttarakhand <i>Phone:</i> 91-8004851723; <i>FAX:</i> 91-5962-241250 <i>Mobile :</i> +918750880717 (ND), +919460314471 (Raj.). <i>E-mail:</i> rajagroicar@gmail.com	2.	Dr. S.K. Sarangi, Principal Scientist, ICAR-Central Soil Salinity Research Institute, Regional Research Station, CANNING TOWN – 743329, West Bengal E-mail: sksarangicanning@gmail.com
3.	Dr. C.R. Satpathi, Professor(Incharge, RRSS) Bidhan Chandra Krishi Viswavidyalaya, Department of Agricultural Entomology Faculty of Agriculture PO. Krishiviswavidyalaya Mohanpur, Nadia, West Bengal CHAKDAHA - 741252, Mob: 8777521450 Email : csatpathi2003@yahoo.co.in	4.	Dr Dinesh Kumar Principal Scientist, Division of Agronomy, IARI, New Delhi - 12 Mobile – 9968233749 E-mail : dineshctt@yahoo.com
5.	Dr. V. Sreedevi, Assistant Professor (Agronomy), Department of Agronomy PAJANCOA & RI KARAIKAL .609 603 <i>Mobile:</i> 09344833782 <i>Phone:</i> 04368-261372 (O) <i>Email:</i> srideviagr@gmail.com	6.	Dr. Anand .K. Gore Agronomist & Officer In-Charge Upland Paddy Research Scheme Vasanthrao Naik Marathwada Krishi Vidyapeeth(VNMKV) PARBHANI – 431402(M.S.) Ph No: 02452-220121 Fax: 02452-220121 Mobile: 09588648242, 07588082874 E-mail: uprsmkv@gmail.com akgoremkv@gmail.com uprsmkv@rediffmail.com
7.	Dr.Birendra kumar, Associate Professor / Senior Scientist, Agronomy, Bihar Agricultural University, SABOUR , Bhagalpur- 813 210 (Bihar) <i>Mob:</i> 9431925801,8210006439 <i>Email:</i> agrobacbr76@rediffmail.com	8.	Dr. Narendra V. Kashid Officer in charge Agricultural Research Station, VADGAON Maval, Tal. Maval, Dist. Pune – 412 106, Maharashtra <i>Phone:</i> 02114-235229 <i>Mob:</i> 09422851505, 09881590745 <i>Email:</i> ars_vadgaonmaval@rediffmail.com kashidnv@gmail.com
9.	Dr. Deepa Thomas Assistant Professor (Agronomy) Rice Research Station Kerala Agricultural University Vyttila Kochi-682019 E-mail - deepa.thomas@kau.in	10.	Dr. U. Vineeta Senior Scientist & Head (Agronomy), Agriculture Research Station, Near Akuthota, Muthukuru Road, NELLORE – 542 003, Tel ; 08612327803, Mobile: 9885364406 Email: vineethaharanath@yahoo.co.in Vineethaharanath5@gmail.com arsnellore@yahoo.co.in

			arsnellore@gmail.com

**Department of Agronomy, Indian Institute of Rice Research,
Rajendranagar, Hyderabad – 500 030**

1. Dr. R. Mahender Kumar	Retd. Principal Scientist and Head (Agronomy)	kumarrm21364@gmail.com
2. Dr. B. Sreedevi	Principal Scientist and Head (Agronomy)	sreedevipalakolanu@gmail.com (Mobile: 9440089607)
3. Dr. Mangal Deep Tuti	Principal Scientist (Agronomy)	mangal.iari@gmail.com (Mobile: 9456108509)
4. Dr. Vijayakumar S	Scientist, Sr. Scale (Agronomy)	vijayakumar.s@icar.org.in
Other Scientists Involved		
Dr. B. Shailaja , Principal Scientist, Computer Application Dr. Ch. Padmavathi , Principal Scientist, Entomology Dr. Annie Poonam , Principal Scientist, Agronomy, NRRI, Cuttack Dr. Gopalakrishnan , Principal Scientist & Head, Genetics, ICAR-IARI, New Delhi		

For Correspondence: piagroirr@gmail.com, sreedevi.palakolanu@gmail.com, **director.iirr@icar.org.in**
Fax: 040-24591217, Office No. 040-24591235, Mob: 0944089607

ACKNOWLEDGEMENT

*This is the 61st year of successful conduct of Agronomy trials in All India Coordinated Research Project on Rice and new innovative programme for 2026-27. Our sincere thanks are due to all **Agronomy Co-operating Scientists** and their technical staff located at different Centres and also of ICAR-IIRR. Our thanks are also due to **Dr. B. Sailaja** Computer Scientist, **Mrs. Gayathri** for their timely help in the statistical analysis of the data (the software used for statistical analysis is **DRRstat**) and AICRPR experimental database portal (<http://www.aicrip-intranet.in/>). Thanks are also due to **Dr. D. Srinivas**, Project Manager, **Dr. S. Kavi Raju**, Research Associate, **Mrs. A. Sandhya Rani**, **Mr. B. Venkatanna**, **Mr. E. Giri Prasad**, **Nirmal Karan**, Young Professionals, **Hussain Basha**, Ph.D Scholar for their pertinacious efforts. We also appreciate the efforts of Technical Staff of Department – **Mr. S. Vijay Kumar** and **Mr. Vivek Kumar Tiwari** for their unstinted technical support in conduct of AICRIP field trials. We thank immensely our **Director, ICAR-IIRR** for his constant guidance and support to Agronomy Department.*

Soil Science

Progress Report of Soil Science Coordinated Program

SOIL SCIENCE

CONTENTS

Chapter	Title	Page
	Executive Summary	5.3
5.1	Long-term soil fertility management in rice-based cropping systems (RBCS)	5.7
5.2	Management of sodic soils using nano Zn formulation	5.29
5.3	Management of acid soils	5.43
5.4	Residue management in rice-based cropping systems	5.60
5.5	Nano-fertilisers for increasing nutrient use efficiency, yield and economic returns in transplanted rice	5.79
5.6	Yield maximization of rice in different Zones <i>(Included in the Agronomy report)</i>	-
5.7	Evaluation of Organic fertilisers and Natural farming practices for enhancing Productivity and soil health	5.95
5.8	Assessment of biofortified rice genotypes' response to Zn application and assessing agronomic biofortification potential	5.123
5.9.	Assessment of Carbon dynamics in rice ecologies and decarbonising rice soils for sustainable production	5.141
Appendix I	List of cooperators centres of Soil Science and allotment of trials-2024-25	5.148
Appendix II	Scientists involved in the Soil Science Coordinated Evaluation Programme 2024-25	5.149
	Acknowledgements	5.151

5. SOIL SCIENCE

Summary

The coordinated multi-location evaluation programme in Soil Science addresses critical issues pertaining to the long-term sustainability of soil and crop productivity, management of sodic soils using nano Zn formulation; management of acid soils; residue management in rice-based cropping systems; nano-fertilisers for increasing NUE, yield and economic returns in transplanted rice; yield maximization in different rice growing zones; evaluation of organic fertilisers and natural farming practices for enhancing the crop productivity and soil health; assessment of biofortified rice genotypes response to Zn application and assessing agronomic biofortification potential and assessment of carbon dynamics in rice ecologies and recarbonising rice soils for sustainable production. Nine trials were conducted during *Rabi*-2024-25 and *Kharif*-2025 at 23 locations (11 funded and 12 voluntary centres) representing typical soil and crop systems and important rice-growing regions.

5.1. Long-term soil fertility management in rice-based cropping systems

The long-term fertiliser experiment (37th year) on soil fertility management in rice-based cropping systems across Maruteru, Titabar, and Mandya clearly demonstrated the superiority of integrated nutrient management (INM) involving RDF + FYM in sustaining productivity and soil health. During *Kharif* 2025, RDF + FYM recorded the highest grain yields at all locations—Maruteru (6.13 t ha⁻¹), Titabar (5.61 t ha⁻¹) and Mandya (5.92 t ha⁻¹)—compared to control (2.92, 1.53 and 2.32 t ha⁻¹, respectively), though it was on par with RDF at TTB and MTU during *Rabi* and superior at TTB and MND during *Kharif*. FYM alone performed comparably with RDF and RDF + FYM at select locations and seasons. Nutrient omission resulted in significant yield penalties (up to ~29% for N, 19% for P and 16% for K omission at Maruteru), highlighting the importance of balanced fertilisation. Higher SYI was sustained with RDF + FYM at MTU and TTB, and with 50% NPK + 25% FYM + 25% GM at Mandya. INM and organic treatments improved soil fertility, with higher organic carbon under FYM and RDF + FYM. The long-term application of organics in combination with RDF showed strong positive yield trends (up to 80 kg ha⁻¹ yr⁻¹ at Maruteru) and resulted in a significant buildup of SOC and P (up to 77.9% and 190.2% increase, respectively) at all locations and K at TTB, compared to RDF. Overall, the study establishes that integration of organics with fertilisers is essential for long-term productivity, nutrient use efficiency, and sustainability of rice-based systems. Preliminary analyses indicate that while fertilization strategies do not significantly impact the overall alpha and beta microbial diversity, the treatments influenced the abundance of certain bacterial genera. Functional analyses of the metagenome are in progress and help in further delineating site specific responses of different functional groups of microbes involved in nutrient and carbon cycling.

5.2. Management of sodic soils using nano Zn formulation

In a study on “Management of Sodic soils using nano zinc formulations”, two genotypes were evaluated with seven different set of nutrient management practices at four different locations. Significant genotypic and location-specific differences in yield parameters and yield were observed across all four locations. Foliar application of nano Zn @ 50 ppm recorded significantly higher grain yields (4.42 and 6.03 t/ha) and straw yields (5.45 and 6.79 t/ha) at Kanpur and Mandya, respectively, and also resulted in higher straw yield at Pusa (6.00 t/ha). By contrast, at Pusa, soil application of ZnSO_4 @ 50 kg/ha produced a significantly higher grain yield (4.78 t/ha). At Navsari, foliar application of silicic acid @ 80 ppm recorded higher grain yield (4.32 t/ha) and straw yields (13.31 t/ha). Between the two varieties, CSR 23 was superior at Kanpur, Mandya, and Navsari, while DRR Dhan 48 performed better at Pusa. Nutrient uptake followed a trend similar to that of grain and straw yields. DRR Dhan 48 accumulated a higher quantity of NPK and Zn at Pusa and Navsari, whereas CSR 23 recorded higher nutrient uptake at Kanpur and Mandya.

5.3. Management of acid soils

The multi-location trial on management of acid soils in rice (*Kharif* 2025) conducted across four locations (Moncompu, Hazaribagh, Titabar and Umam) demonstrated that integrated nutrient management significantly improved crop performance across locations. Application of RDF + dolomite + silicate/silixol recorded the highest grain yields, notably at Moncompu (5.68 t ha^{-1}) compared to RDF alone (3.94 t ha^{-1}), and at Titabar (4.51 t ha^{-1} under RDF + dolomite + silixol vs. 3.62 t ha^{-1} under RDF). Similarly, at Umam, RDF + rice husk ash recorded higher yields (4.06 t ha^{-1}) compared to RDF/control (3.75 t ha^{-1}). Yield attributes such as tillers and panicles were also highest under integrated treatments, e.g., at Moncompu (409 and 300 m^{-2} under RDF + dolomite + silicate). The variety Uma consistently outperformed Vasundhara, with higher grain yield at Moncompu (5.05 vs. 4.90 t ha^{-1}) and Titabar ($4.22 \text{ vs. } 3.94 \text{ t ha}^{-1}$). Integrated treatments also enhanced nutrient uptake and soil fertility. At Moncompu, RDF + dolomite + silicate recorded the highest uptake of N ($122.54 \text{ kg ha}^{-1}$), P (56.74 kg ha^{-1}), and K ($133.20 \text{ kg ha}^{-1}$), compared to RDF alone (68.30, 28.76, and 75.14 kg ha^{-1} , respectively). Post-harvest soil nutrient status improved under integrated treatments, with higher available N ($256.68 \text{ kg ha}^{-1}$) and K ($171.35 \text{ kg ha}^{-1}$) under RDF + dolomite + silicate compared to RDF (230.32 and $147.55 \text{ kg ha}^{-1}$). Although changes in soil pH and organic carbon were limited, treatments involving dolomite and rice husk ash improved soil pH (up to ~ 5.95 at Titabar) and nutrient availability, confirming their role in ameliorating soil acidity. Overall, the study establishes that integration of liming and silicate sources with RDF is critical for enhancing productivity and sustaining soil health in acid soils under rice systems.

5.4. Residue management in rice-based cropping systems

Substituting 25% of the recommended nitrogen requirement through crop residue, combined with Pusa Decomposer application, maintained rice grain yield on par with the full

chemical fertiliser dose (100% RDF) at seven of the nine centres tested in *Kharif* 2025, and at three of four centres tested in the succeeding *Rabi* season. Nutrient uptake under 25% residue substitution was marginally lower than 100% RDF but remained significantly higher than the absolute control, while nitrogen use efficiency was consistently higher for residue treatments than for chemical fertiliser alone — reflecting better N synchrony and reduced fertiliser N losses. Post-harvest soil nutrient status was maintained across all residue treatments on par with 100% RDF, indicating no soil fertility degradation in the short term.

5.5. Nano-fertilisers for increasing nutrient use efficiency, yield and economic returns in transplanted rice (*collaborative trial with Agronomy*)

The multi-location trial on “Nano-fertilisers for increasing nutrient use efficiency, yield, and economic returns in transplanted rice” was conducted across 25 centres during *Kharif* 2025 to evaluate the effectiveness of nano-urea in improving crop performance and nitrogen use efficiency (NUE). Application of nano urea along with recommended dose of nitrogen (RDN) improved growth parameters, grain yield, and nitrogen uptake in rice across most locations compared to the control. The treatment 100% RDN + two sprays of nano urea (T2) was the most consistent, recording yield advantage at a majority of centers with gains ranging from 1% to 23% over RDN, indicating stable performance across agro-ecologies. Replacement of 25% RDN with three sprays of nano urea (T5) resulted in yield improvement at 6 centres (Pattambi, Rajendranagar, Puducherry, Maruteru, Nagina, Khudwani) with gains ranging from 1.0% to 16.4%, but responses were location-specific and not consistently superior to RDN. In contrast, two sprays under reduced nitrogen (T4) showed inconsistent performance, with yield penalties observed at several locations (up to ~23%), indicating inadequate compensation for nitrogen reduction. The benefit: cost (B:C) ratio was highest with T2 at several centres, but remained largely comparable to 100% RDN, indicating that nano urea application did not confer a significant economic advantage over the recommended fertilizer practice.

5.6. Yield maximization of rice in different zones (*collaborative trial with Agronomy*)

Included in the Agronomy progress report

5.7. Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health (*collaborative trial with Agronomy*)

The results of the fourth year of study (except CHP, KUL and MTU, second year) clearly indicated that the Recommended Dose of Fertilisers (RDF) consistently recorded the highest grain and straw yields across most locations, with yield advantages ranging from ~15 to 68% over complete natural farming. Among alternative approaches, Integrated Crop Management (ICM), particularly with need-based pest management, performed comparably well and emerged as the most effective sustainable option, significantly improving yield parameters, nutrient uptake, and overall crop performance. Natural farming and organic packages (AI-NPOF) showed relatively lower yields but contributed positively to soil health parameters in certain locations. Soil nutrient status (N, P, K) and organic carbon improved under integrated

and organic treatments depending on site-specific conditions, indicating their role in long-term soil sustainability. Overall, the study demonstrates that while RDF ensures maximum productivity in the short term, integrated approaches combining organic and inorganic inputs offer a balanced strategy for sustaining yield, improving soil health, and promoting environmentally resilient rice production systems.

5.8. Assessment of biofortified rice genotypes' response to Zn application and assessing agronomic biofortification potential

Zinc application significantly influenced grain yield, yield attributes, Zn accumulation and post-harvest soil Zn status, with responses varying across genotypes and environments. Foliar spray of 0.5% Zinc at active tillering (AT) stage, panicle initiation (PI) stage and 1 week after flowering resulted in higher yields, improved harvest index, and enhanced yield traits. CR Dhan 315 and Swarna performed best in terms of yield, while CG Zinc Rice-1 showed superior grain Zn concentration, indicating strong biofortification potential. By contrast, Soil test-based Zinc application (STBZ)+ Foliar spray of 0.5% Zinc at PI stage and 1 week after flowering increased grain and straw Zn content, and improved post-harvest soil Zn availability.

5.9. Assessment of Carbon dynamics in rice ecologies and recarbonising rice soils for sustainable production

SOC declined consistently with depth across all centres, with the surface layer (0–20 cm) recording the highest values — ranging from a low of 0.15% at Kaul (Kurukshetra) to a high of 0.95% at Pantnagar. Moncompu, under continuous Rice-Rice cultivation, recorded an exceptionally high surface SOC of 2.75%, reflecting the carbon-sequestering potential of shallow lowland ecosystems. Carbon stocks ranged from 4.02 t/ha (Kaul, Kurukshetra) to 22.7 t/ha (Pantnagar, Nainital), with bulk density increasing progressively with depth (1.09–1.51 g cm⁻³). Across all centres and depths, carbon fractions followed the stability hierarchy: Very Labile < Labile < Less Labile < Non-Labile, with the non-labile fraction dominating, indicating strong long-term carbon stabilisation in rice soils. The Rice-Pulse cropping system consistently recorded the highest SOC and carbon stocks among all systems studied, underscoring the role of legume integration in enhancing soil carbon quality. Soils at Hazaribagh were found to be extremely acidic (pH 5.90–6.30), while Kaul soils were highly alkaline (pH 7.77–8.21), adversely affecting carbon retention at the latter. Overall, the study demonstrates that rice-based cropping systems — particularly Rice-Pulse — offer significant potential for recarbonising Indian rice soils, and that labile carbon fractions can serve as sensitive, early indicators of management-induced changes in soil organic carbon quality.

DETAILED REPORT-2025

5.1 Long-term soil fertility management in rice-based cropping systems (RBCS)

Long-term fertiliser experiments (LTFE) with well-defined nutrient management treatments and cropping systems were initiated in 1989–90 at four selected locations representing the major rice-growing regions and cropping systems of India viz., Mandya (MND) in Karnataka (rice-cowpea, Deccan Plateau), Maruteru (MTU) in Andhra Pradesh (rice-rice, Delta system), Titabar (TTB) in Assam (rice-rice, Alluvial soils) and Faizabad (FZB) in Uttar Pradesh (rice-wheat, Indo Gangetic plains) to study the dynamics of soil and crop productivity under different management regimes and to identify the constraints affecting the sustainability of these production systems. The trial at Faizabad (Masodha) was discontinued in 2007–08 owing to lack of manpower, and the experiment has since continued at three centres only. Hence, the results of the 37th year of cropping, *i.e.*, *Rabi* 2024–25 and *Kharif* 2025, are presented in Tables 5.1.1 to 5.1.11.

Crop productivity and soil fertility during *Rabi*-2024-2025

Grain and straw yields of rice at Maruteru (MTU) and Titabar (TTB) during *Rabi* 2024–25 are presented in Table 5.1.2. At MTU, grain yield ranged from 2.78 (control) to 6.40 t/ha (RDF+FYM) with a mean of 5.30 t/ha. RDF, 100% N + 50% PK, 50% NPK + 25% GM-N + 25% FYM, and organic inputs alone treatments, *i.e.*, FYM at 10 t/ha + vermicompost + oil cakes, were on par and significantly superior to other treatments. At Maruteru, the omission of N, P, K, Zn and S resulted in a yield reduction of 29, 19, 16, 5.5 and 4% corresponding to yields of 4.22, 4.83, 5.01, 5.64 and 5.73 t/ha in -N, -P, -K, -Zn and -S plots respectively over the recommended dose of fertiliser (RDF). The STCR-based treatment was comparable to FYM alone at both locations. At Titabar, grain yield ranged from 1.25 t/ha (control) to 4.43 t/ha (100% RDF + FYM), which was on par with FYM alone, RDF and FYM+VC+oilcakes treatments. Nutrient omission plots registered lower yields than the RDF treatment during *Rabi* at TTB. A 50% reduction in RDF resulted in a 22% yield decline in the clay loam soils of MTU and the silty loam soils of TTB relative to 100% RDF. Replacement of 50% NPK with biofertiliser, green manure, FYM and GM+FYM recorded grain yield variations, *i.e.*, -14, -3.8, 11.5 and 4% in Maruteru; -41, -23, -10 and 5% in Titabar, respectively. Straw yields followed a similar trend to that of grain yield at Maruteru.

Total nutrient (NPK) uptake exhibited different trends at the two locations. At Maruteru, total N uptake of 112.9 kg/ha was recorded under 100% RDF, followed by the K omission plot (101.6 kg/ha). However, the omission of P, K, Zn and S registered statistically on-par results for N uptake. The N omission plot registered lower total N uptake (53.5 kg/ha) in the clay loam soil of MTU; however, a similar trend was not observed at TTB. For P and K, higher uptake was recorded under 100% RDF + FYM (42.3 and 236.4 kg/ha), representing increments of 2% and 13%, respectively, over RDF. The lowest NPK uptake was recorded in the absolute control. At Titabar, 100% N + 50% PK registered the highest N uptake (79.5

kg/ha), which was on par with 100% RDF (74.6 kg/ha), 100% RDF+ FYM (77.3 kg/ha) and FYM+VC+oilcakes (73.5 kg/ha) treatments. Significantly higher P and K uptake was noted in the 100% RDF + FYM (18.9 and 102.5 kg/ha), followed by 100% RDF (17.5 and 91.7 kg/ha), respectively. Organic replacement treatments recorded improvement over control and STCR recommendations across locations (Table 5.1.3). Post-harvest soil fertility status at MTU showed that organic carbon content was significantly higher (1.41%) under organics alone and 50% N replacement through FYM and 25% GM + 25% FYM, compared to RDF (1.38%). Similarly, RDF + FYM treatment registered *on-par* results with FYM alone treatment, reflecting the nutrient sustainability imparted by organic supplements, such as *i.e.*, FYM. No definite trend was observed in soil N levels, though there was an improvement with the addition of organics (Table 5.1.4). At TTB, nearly all soil fertility parameters (OC, P, Zn) attained their maximum values under the RDF + FYM treatment. Nutrient omission plots exhibited a significant reduction in all soil fertility parameters compared to RDF and RDF + FYM at both centres (Table 5.1.4 a).

Crop productivity and soil fertility status during Kharif-2025

At MTU, RDF + FYM recorded the maximum grain yield (6.13 t/ha), which was significantly superior to all other treatments, followed by FYM alone (5.97 t/ha) and FYM + oil cake (5.95 t/ha). Application of 50% NPK (5.10 t/ha) and replacement of 50% NPK with biofertiliser (5.45 t/ha), GM-N (5.14 t/ha), FYM-N (4.91 t/ha) and GM-N+ FYM-N (4.98 t/ha) recorded grain yields on par with each other (Table 5.1.5). The omission of individual nutrients resulted in significant yield losses (0.35 t/ha in -N, 1.22 t/ha in -P, 1.04 t/ha in -K, 0.87 t/ha in -Zn and 0.55 t/ha in -S plots) compared to RDF. At TTB, a yield trend similar to Maruteru was observed, with the RDF+FYM plot registering the highest grain yield (5.61 t/ha), followed by 100% RDF (5.33 t/ha). Nutrient omission plots were poor yielders, registering grain yields between 2.75 and 4.79 t/ha, respectively. This yield loss was attributable to the omission of major and micronutrients. At MND, RDF+FYM recorded a maximum yield (5.92 t/ha), which was significantly superior to all other treatments. Significant yield reduction to an extent of 58% in the -N plot, followed by 53% in the -P plot, 52% in the -K plot, 31% in both the -Zn and -S plots, respectively. The FYM alone treatment recorded a significantly lower yield than RDF at Titabar, but on-par results at MTU and MND. Straw yield trends closely followed grain yield trends at all locations, with higher yields recorded in treatments receiving organics.

Total nutrient (N, P and K) uptake by the above-ground biomass was maximum under RDF+FYM across all locations, followed closely by RDF at Maruteru and Titabar, and by 50% RDF + GM + FYM at Mandya (Table 5.1.6). Regarding N uptake, 50% N replacement through FYM (104.7 kg/ha) also registered on-par results with RDF+FYM (120.5 kg/ha) at the clay soil of Maruteru. The FYM alone treatment displayed lower nutrient uptake only at Mandya. At Titabar and Maruteru, the FYM alone treatment registered results on par with 100% RDF + FYM. At Titabar, 50% NPK replacement with biofertiliser recorded the lowest NPK uptake

after the control. Nutrient omission plots exhibited reduced total nutrient uptake across all locations.

Soil fertility status at the end of *Kharif*-2025 (Tables 5.1.7) indicated an improvement in most of the soil properties with the addition of organics, and higher values were recorded in RDF+FYM and FYM alone treatments for most of the properties at all 3 locations. At MTU, available N was highest under RDF + FYM (139.3 kg/ha). Nutrient omission plots recorded reduced NPK test values compared to RDF at all three locations. Organic carbon values were significantly higher under RDF+FYM, followed by FYM alone, compared to other treatments at Maruteru, indicating that organic supplements can effectively support and sustain soil organic carbon levels. FYM alone and 50% NPK replacement treatments recorded higher organic carbon at Titabar and Mandya, while the control recorded the lowest values at all three locations.

Sustainable Yield Index (SYI)

Sustainability, defined as the maintenance of productivity on a long-term basis through integrated land management, was assessed using the Sustainable Yield Index (SYI). In the rice-rice system, the SYI of rice ranged from 28.8 – 55.3% and 20.9– 67.5% during *Kharif* and *Rabi*, respectively, at Maruteru. While in the same rice-rice system at Titabar, the SYI ranged from 22.2- 75.5% and 21.6 – 67.7% during *Kharif* and *Rabi* respectively in silty clay soil. The highest SYI was maintained under the RDF + FYM treatment across the years at both locations. However, the rice–cowpea system at Mandya registered a SYI ranging from 19.7 to 60.1% and the highest index was noted under the 50% NPK + 25% FYM + 25% GM treatment. The mean yield of rice under RDF+FYM was consistently higher owing to balanced nutrition, followed by RDF and 50% NPK + FYM at Maruteru and Titabar. At Mandya, 50% NPK + 25% FYM + 25% GM exhibited the highest mean yield, followed by 50% RDF+FYM-N.

Long-term changes in crop productivity and soil fertility over a period of 37 years

The trends in mean grain yields over 37 years (1989–2025) of *Kharif* and *Rabi* rice at MND, MTU and TTB were analysed by fitting linear functions to actual yields. The per cent change in important soil properties under selected treatments is presented below.

Linear trends in crop productivity

During *Kharif* 2025 (Table 5.1.9), RDF + FYM @ 5 t/ha recorded the maximum mean yield at MTU and TTB locations (MTU-5.42, TTB- 5.03 t/ha) and on par results at MND-5.35 t/ha) (where highest was observed at 50% RDF + 25% GM-N+ 25% FYM-N with an average increase of 4.4, 11.2 and 12.2%, respectively, at MTU, TTB and MND over RDF. Linear productivity trends under RDF indicated positive growth in the delta soils of MTU and the acid alluvial soils of TTB (25 and 43 kg grain/ha/year, respectively) and negative growth in the sandy loam of MND (-18 kg grain/ha/year). An additional dose of FYM @ 5 t/ha along with RDF improved the productivity growth rate substantially to 80, 61 and 51 kg/ha/year

at MTU, TTB and MND, respectively. The FYM-alone treatment also recorded positive growth rates of 30, 55 and 22 kg/ha/year at MTU, TTB and MND, respectively. The appropriate addition of RDF alone and along with FYM input improved the potential yield of the given treatment over the years, underscoring the importance of balanced nutrient application across locations. Omission plots exhibited a negative trend with declining yields over the years, particularly in the sandy loam soils of Mandya. During *Rabi* also, RDF+5t FYM recorded maximum mean grain yield both at MTU (6.34 t/ha) and TTB (4.36 t/ha) and this treatment recorded a growth rate of 3 and 26 kg/ha/year followed by FYM alone treatment 43 and 34 kg/ha/yr at MTU and TTB, respectively after 37th year of cultivation. Both locations displayed positive productivity growth rates over the years under the given treatments. In contrast to *Kharif*, *Rabi* rice crops recorded more improvement than the potential grain yield with given treatments at both locations (Table 5.1.10).

Changes in soil fertility compared to initial values (Table 5.1.11)

A greater positive change in organic carbon (OC) content was observed under organic-supplemented treatments at all three locations compared to RDF over 37 years. At TTB and MND, a negative change was observed in the control. The maximum increase in organic carbon was recorded under FYM alone at MTU (60.7%) and under and 50% RDF + 25% FYM + 25% GM at Mandya (114.3%). Available N decreased across all treatments at MTU; at MND, it decreased only in the control, with increases under RDF, RDF + FYM and FYM alone. For available P, there was a substantial buildup in all treatments compared to initial values at all locations except in the control at TTB, where the % change was -14.4%. In the case of available K at MTU, there was a decrease and a negative change in all treatments compared to the initial value in 1989. At MND and TTB, there was a negative change in control and a positive change (ranging between 6.4 to 119.2%) in other treatments, with the increase being more pronounced at MND and less so at TTB.

Metagenomics study

Soil samples in triplicate were obtained from 6 treatments (Control, 100% NPKZnS, 100% NPKZnS + FYM/PM @ 5t/ha, 50 % NPK, 50% NPK + 25% GM-N+25% FYM-N and FYM @ 10 t/ha) from all the centres and shotgun metagenomics was performed for all the samples using Illumina NovaSeq 6000 platform and libraries were generated using 2 X 150bp paired-end protocol. Rarefaction curves at all the centres (Fig 1A, B, C) show adequate sequencing depth, sufficient to capture the majority of microbial diversity across all treatments. A preliminary analysis of the data is presented in Fig 2-8.

Alpha diversity (Observed, Shannon, Chao1)

At Mandya (Fig 2A) the control treatment recorded significantly higher observed richness, followed by 100% NPKZnS, FYM, 50% NPK, and 100% NPKZnS + FYM/PM. The lowest richness was seen in the treatment with 50% NPK + 25% GM-N + 25% FYM-N. No significant differences in observed richness was observed at Maruteru, but higher observed richness was recorded in the treatment with FYM and 50% NPK + GM-N + FYM-N which lower

richness was seen in the control treatment (Fig 2B). At Titabar also no significant differences among treatments were recorded. No significant variation between treatments was observed for Shannon Diversity (Fig 2A, B, C) and Chao1 richness (Fig 2A, B, C) across all locations.

Beta diversity

Beta diversity as measured using Principal Coordinate Analysis (PCoA) with PERMANOVA (Permutational Multivariate Analysis of Variance) at Mandya (Fig 3A,) indicated moderate treatment effects with PC1 and PC2 (31.4%, and 13.6% respectively) explaining 45% of the variation, indicating a microbial composition shift that is not statistically significant ($p=0.06$). Non-metric Multidimensional Scaling (NMDS) analysis with a stress value of 0.075 also indicates partial changes in the microbial community (Fig. 4A). At Maruteru (Fig 3B), the PCoA analysis indicated that treatments explain 42.4 % of variation (PC1 = 25.8%, PC2 = 16.6%) but with no significant differences between treatments ($p=0.13$). NMDS ordination (Fig. 4B), with a stress value of 0.085, also showed that microbial communities are similar across treatments. PCoA (PC1 = 22.3% and PC2 = 16.3%) at Titabar (Fig 3C) showed a 38.6% contribution of treatments to microbial community composition; PERMANOVA indicated no statistically significant differences in community composition ($p = 0.181$). NMDS with a stress value of 0.1 also showed no distinct clustering of treatments (Fig 4C).

Phylum level relative abundance of bacteria

At Mandya, (Fig 5A) across all treatments, the dominant phyla were Actinomycetota (55–60%) and Pseudomonadota (30–35%). Myxococcota, Bacillota, Acidobacteriota and Planctomycetota were found to be minor contributors for bacterial phylum level composition. The dominant phyla at Maruteru was Actinomycetota (50–60%) and Pseudomonadota (35–45%), with minor contributions from Myxococcota, Planctomycetota, Acidobacteriota and Bacillota (Fig 5B). Pseudomonadota (50%) and Actinomycetota (40–45%) were the dominant phyla at Titabar across all treatments with minor relative abundance of Acidobacteriota, Bacteroidota, Chloroflexota and Planctomycetota (Fig 5C).

Genus level bacterial community structure

Across all centres, while the phylum level was dominated by very few groups, the genus level composition was treatment-sensitive, indicating that nutrient management affects the functional potential of the bacteria rather than taxonomy. Across all three locations, strong treatment-driven shifts with high relative abundance changes in genera were seen in Pseudomonadota, and Bacteroidota phyla.

At Mandya (Fig 6), the dominant phyla Pseudomonadota, and Actinomycetota exhibited clear treatment-specific responses. At Mandya, in the Pseudomonadota phyla the top five enriched genera were Rhizobium, Novosphingbium, Lysobacter, Ralstonia and Agrobacterium. In the treatment with 50% NPK + 25% GM-N + 25% FYM-N higher abundance was seen in Rhizobium, Agrobacterium and Novosphingobium genera while in the FYM (10 t/ha) treatment, Methylocaldum, and Rhodoplanes were enriched. A relative enrichment of Phynylobacterium and Sphingomonas was seen in the 50% NPK treatment. The treatments

with 100% NPKZnS + FYM/PM (5 t/ha), Control and 50% NPK showed relatively lower enrichment of genera in Pseudomonadota phyla. In Actinomycetota phyla the top 5 genera enriched were Actinosynnema, Pseudarthrobacter, Arthrobacter, Microbacterium and Humibacillus which occurred in the treatments 50% NPK + 25% GM-N + 25% FYM-N and 100% NPKZnS + FYM/PM. In the Bacillota phyla, the top five genera enriched were Polycladomyces, Cytobacillus, Thermobacillus, Thermoactinomyces and Acetivibrio which were enriched in 50% NPK + 25% GM-N + 25% FYM-N and 100% NPKZnS + FYM/PM and FYM (10 t/ha) treatments.

At Maruteru, in the Pseudomonadota phyla the top five enriched genera were Methylibium, Hydrogenophaga, Arenimonas, Hylemonella and Dokdonella (Fig 7). The treatment with 50% NPK + 25% GM-N + 25% FYM-N had the highest enrichment of Methylocystis and Hylemonella while in the FYM (10 t/ha) treatment, the genera Arenimonas were enriched. In the treatments 100% NPKZnS, Control and 100% NPKZnS + FYM/PM / 50% NPK moderate, low levels of enrichment of genera of the Pseudomonadota phyla were observed. In the Actinomycetota phyla the highly enriched genera Candidatus Poriferisodalis, Geodermatophilus, Nostocoides and Conexibacter which were enriched in the Control, and 50% NPK and 100% NPKZnS + FYM/PM treatments. In 50% NPK + 25% GM-N + 25% FYM-N treatment, the enriched genus was Solwaraspora while in the FYM (10 t/ha) treatment the genera Aurantimicrobium was enriched. In the Bacteroidota phyla the top five genera enriched were Niabella, Flavisolibacter, Niasella, Panacibacter and Lacibacter. The highest enrichment of these genera (Bacteroidota phylum) were observed in the 50% NPK + 25% GM-N + 25% FYM-N treatment (Panacibacter, Niasella, Flavisolibacter) followed by the FYM (10 t/ha) treatment with enrichment of Niabella, Lacibacter.

At Titabar (Fig.8), in the Pseudomonadota phyla the top five genera enriched were Rhizobium, Bradyrhizobium, Ensifer, NE rhizobium and Agrobacterium. In the treatment with 50% NPK + 25% GM-N + 25% FYM-N, the genera Peteryoungia, Pseudolabrys, Lentilitoribacter followed by Rhizobium, Bradyrhizobium were enriched while in the FYM (10 t/ha) treatment, enrichment of the genera Sinorhizobium, Rhodopseudomonas and Nitroreductor was observed. In the Bacteroidota phyla, the top five highly enriched genera in 50% NPK + 25% GM-N + 25% FYM-N included Mucilaginibacter, Flavisolibacter, Niabella, Chitinophaga, and Paraflavitalea which were also enriched in the 50% NPK treatment.

Summary

In the 37th year of the study on long-term soil fertility management in RBCS, RDF+FYM recorded the maximum yield; however, this treatment was on par with RDF at TTB and MTU in *Rabi* and significantly superior to RDF at TTB and MND in *Kharif*. FYM alone treatment was on par with RDF and RDF + FYM during *Rabi* at TTB and *Kharif* at MND. The omission of major and micro nutrients resulted in yield reductions at all three locations, ranging from 4-41% across the seasons. The higher SYI was maintained with the RDF + FYM added treatment across the years at MTU and TTB; 50% NPK + 25% FYM + 25% GM treatment in the rice-cowpea system at Mandya. Overall, INM and organics-alone treatments improved

soil fertility parameters, with OC being significantly higher under FYM and RDF+FYM treatments. Supplementary FYM @ 5 t/ha along with RDF resulted in greater nutrient accumulation compared to RDF alone at all three locations. Over 37 years, changes in soil fertility showed significant accumulation of OC and P at all 3 locations and K at TTB in INM and organics alone treatments over RDF. Preliminary analyses indicate that while fertilization strategies do not significantly impact the overall alpha and beta microbial diversity, the treatments influenced the abundance of certain bacterial genera. Functional analyses of the metagenome are in progress and help in further delineating site specific responses of different functional groups of microbes involved in nutrient and carbon cycling.

Table 5.1.1: Long-term soil fertility management in RBCS, 2024-25

Soil and crop characteristics			
Cropping system	Maruteru	Titabar	Mandya
	Rice-Rice	Rice-Rice	Rice-Cowpea
Variety - Kharif		Gitesh	KMP 220
<i>Rabi</i>		Gitesh	
Recommended Fertiliser Dose (kg NPK /ha)			
<i>Kharif</i>	90:60:60:50	40:20:20:20	100:50:50:20
<i>Rabi</i>	180:90:60:50	40:20:20	-
STCR-based dose			
<i>Kharif</i>	-	-	-
<i>Rabi</i>	-	-	-
Crop growth: Kharif	-	-	-
<i>Rabi</i>	-	-	-
% Clay	38	42	11.1
% Silt	28	28.5	18.1
% Sand	34	29.5	62.8
Texture	<i>Clay Loam</i>	<i>Silty Clay</i>	<i>Sandy loam</i>
pH (1:2)	6.54 (<i>Kharif</i>)	5.4	5.87
Organic carbon (%)	1.07	1.1	0.30
CEC (cmol (p ⁺)/kg)	48.9	12.5	-
EC (dS/m)	1.17	0.028	0.28
Avail. N (kg/ha)	124	495	208
Avail. P ₂ O ₅ (kg/ha)	57.7	22.4	19.7
Avail. K ₂ O (kg/ha)	326	112	117.6

Table 5.1.2: Long-term soil fertility management in RBCS, *Rabi* 2024-2025
Grain and straw yields of rice and cowpea

Treatments	Grain yield (t/ha)			Straw yield (t/ha)	
	Maruteru	Titabar	Mandya (Cowpea- kg/ha)	Maruteru	Titabar
Control	2.78	1.25	110	5.28	1.52
100% PK	4.22	3.47	205	6.19	4.13
100% NK	4.83	3.63	321	8.60	4.32
STCR recommendation	5.93	4.09	362	9.82	4.88
100% NP	5.01	3.72	201	8.15	4.40
100% NPKZnS	5.97	4.33	712	9.37	5.15
100% NPKZnS + FYM/PM @ 5t/ha	6.40	4.43	785	9.87	5.43
100% NPK – Zn	5.64	4.04	291	8.41	4.81
100% NPK – S	5.73	-	225	9.11	-
100%NPK-S+1tlime/ha	-	3.61	-	-	4.29
100% N+50% PK	5.77	4.17	214	9.33	4.98
50 % NPK	4.63	3.35	422	8.14	4.01
50 % NPK + Biofertiliser	5.11	2.55	393	8.86	3.06
50%NPK+ 50% GM-N	5.62	3.32	273	9.06	3.93
50% NPK + 50% FYM-N	5.96	3.88	489	8.85	4.62
50% NPK + 25% GM-N + 25% FYM-N	5.74	4.10	725	8.79	4.90
FYM @ 10 t/ha	5.28	4.19	664	7.30	4.98
FYM @ 10 t/ha + VC + Oil Cakes	5.50	4.37	701	7.92	5.21
Expt. Mean	5.30	3.67	417	8.14	4.39
CD (0.05)	0.77	0.30	31.8	0.99	0.40
CV (%)	8.7	6.7	3.59	7.1	6.4

Table 5.1.3: Long-term soil fertility management in RBCS, *Rabi* 2024-2025- Total Nutrient uptake (kg/ha)

Treatments	Maruteru			Titabar		
	N	P	K	N	P	K
Control	46.4	15.4	95.4	20.2	4.3	23.6
100% PK	53.5	23.7	151.2	56.1	12.7	69.9
100% NK	89.5	17.5	183.0	59.3	11.8	71.6
STCR recommendation	92.7	37.4	242.9	67.1	14.8	83.2
100% NP	101.6	34.3	169.5	62.4	13.8	69.5
100% NPKZnS	112.9	40.4	195.9	74.6	17.5	91.7
100% NPKZnS + FYM/PM @ 5t/ha	97.8	42.3	236.4	77.3	18.9	102.5
100% NPK – Zn	95.6	30.9	177.3	65.9	15.3	84.9
100% NPK – S	86.8	33.6	208.9	-	-	-
100%NPK-S+1tlime/ha	-	-	-	61.8	12.7	75.5
100% N+50% PK	97.4	31.1	196.1	79.5	14.5	89.4
50 % NPK	83.3	27.5	148.7	55.8	11.3	73.5
50% NPK + Biofertiliser	75.7	30.6	199.3	41.4	8.6	49.3
50% NPK+ 50% GM-N	92.9	30.4	203.1	54.9	13.0	69.4
50% NPK + 50% FYM-N	86.5	36.6	185.0	62.6	13.9	84.9
50% NPK + 25% GM-N+ 25% FYM-N	91.6	35.5	208.4	69.4	16.6	90.7
FYM @ 10 t/ha	64.3	36.2	145.9	70.6	16.3	89.7
FYM @ 10 t/ha + VC + Oil Cakes	83.4	26.7	206.9	73.5	15.4	80.6
Expt. Mean	85.4	31.2	185.5	61.9	13.6	76.5
CD (0.05)	16.9	5.6	31.6	6.4	2.4	18.6
CV (%)	11.9	10.8	10.2	6.5	10.6	14.6

Table 5.1.4: Long-term soil fertility management in RBCS, *Rabi* 2024-25
Soil fertility status at harvest

Treatments	Maruteru			
	Org C (%)	Avail. N (kg/ha)	Avail. P ₂ O ₅ (kg/ha)	Avail. K ₂ O (kg/ha)
Control	0.77	108.6	55.7	368
100% PK	1.09	98.0	74.3	393
100% NK	1.12	122.6	62.5	651
STCR recommendation	1.14	140.0	69.6	641
100% NP	1.02	130.0	70.2	295
100% NPKZnS	1.38	101.3	69.0	376
100% NPKZnS + FYM/PM @ 5t/ha	1.38	118.3	81.1	354
100% NPK – Zn	1.17	136.7	65.2	347
100% NPK – S	0.87	101.3	73.8	351
100%NPK-S+1t lime/ha	-	-	-	-
100% N+50% PK	0.89	110.0	68.3	364
50 % NPK	1.06	86.7	64.9	341
50% NPK + Biofertiliser	1.41	127.0	71.9	348
50% NPK+ 50% GM-N	1.05	115.0	65.8	348
50% NPK + 50% FYM-N	1.41	128.0	78.2	339
50% NPK + 25% GM-N+ 25% FYM-N	1.41	117.3	69.5	401
FYM @ 10 t/ha	1.41	108.0	78.2	383
FYM@10 t/ha + VC + Oil Cakes	1.03	105.6	82.4	369
Expt. Mean	1.20	115.0	82.4	392.3
CD (0.05)	0.30	NS	10.9	37
CV (%)	15.3	21.8	9.3	6.2

Table 5.1.4 a: Long-term soil fertility management in RBCS, *Rabi* 2024-25
Soil fertility status at harvest

Treatments	Titabar				Avail. Zn (kg/ha)
	Org C (%)	Avail. N (kg/ha)	Avail. P ₂ O ₅ (kg/ha)	Avail. K ₂ O (kg/ha)	
Control	0.55	141.8	11.8	78.5	0.54
100% PK	0.96	256.5	23.4	94.9	0.68
100% NK	1.17	177.8	26.8	112.8	0.81
STCR recommendation	1.21	285.0	35.4	96.2	0.85
100% NP	1.01	178.8	34.5	94.7	0.80
100% NPKZnS	1.56	347.8	39.5	151.5	0.93
100% NPKZnS + FYM/PM @ 5t/ha	1.77	386.5	41.5	161.5	1.20
100% NPK – Zn	1.04	285.8	37.9	148.8	0.80
100% NPK – S	-	-	-	-	-
100%NPK-S+1t lime/ha	1.12	354.1	36.7	151.2	0.86
100% N+50% PK	1.17	362.5	33.8	157.6	0.85
50 % NPK	1.01	278.5	27.0	161.5	0.73
50% NPK + Biofertiliser	0.78	220.6	36.4	158.8	0.81
50% NPK+ 50% GM-N	1.28	349.5	36.6	168.6	0.83
50% NPK + 50% FYM-N	1.63	384.8	37.0	160.6	0.86
50% NPK + 25% GM-N+ 25% FYM-N	1.56	347.8	38.2	168.8	0.89
FYM @ 10 t/ha	1.53	368.2	39.0	168.8	0.98
FYM@10 t/ha + VC + Oil Cakes	1.71	402.6	38.7	168.9	0.87
Expt. Mean	1.20	307.7	33.8	141.4	0.80
CD (0.05)	0.15	51.4	2.8	12.8	0.14
CV (%)	7.1	10.2	4.9	5.5	10.2

Table 5.1.5: Long-term soil fertility management in RBCS, *Kharif* -2025
Grain and straw yields of rice

Treatments	Grain yield (t/ha)			Straw yield (t/ha)		
	Maruteru	Titabar	Mandya	Maruteru	Titabar	Mandya
Control	2.92	1.53	2.32	4.04	2.16	3.17
100% PK	5.57	4.06	2.47	7.97	5.57	3.42
100% NK	4.70	4.18	2.76	7.35	5.84	3.77
STCR recommendation	5.00	4.75	3.94	7.69	6.64	2.39
100% NP	4.88	4.22	2.85	7.68	5.87	3.97
100% NPKZnS	5.92	5.33	5.05	7.75	7.44	5.83
100% NPKZnS + FYM/PM @ 5 t/ha	6.13	5.61	5.92	8.31	7.80	6.89
100% NPK –Zn	5.05	4.56	4.09	7.63	6.35	5.07
100% NPK – S	5.37	-	4.07	7.08	-	5.13
100%NPK-S+ 1timelime/ha	-	4.44	-	-	6.19	-
100% N+50% PK	5.27	4.50	4.57	7.76	6.28	5.72
50 % NPK	5.10	3.78	3.52	7.45	5.24	4.73
50 % NPK + Bio fertiliser	5.45	2.75	3.83	7.29	3.82	4.75
50% NPK+ 50% GM-N	5.14	4.22	4.83	7.90	5.88	5.94
50% NPK + 50% FYM-N	4.91	4.79	4.67	7.30	6.68	5.97
50% NPK + 25% GM-N+25% FYM-N	4.98	4.78	5.69	7.59	6.70	7.22
FYM @ 10 t/ha	5.97	5.06	5.03	7.55	7.04	5.54
FYM@10 t/ha + VC + Oil Cakes	6.95	4.97	4.65	9.36	6.90	5.83
Expt. Mean	5.25	4.33	4.13	7.50	6.02	5.02
CD (0.05)	0.47	0.19	0.20	0.99	0.87	1.71
CV (%)	5.4	3.3	2.3	7.9	4.49	15.9

Table 5.1.6: Long-term soil fertility management in RBCS, Kharif 2025
Total Nutrient uptake (kg/ha)

Treatments	Maruteru			Titabar			Mandya		
	N (kg/ha)	P (kg/ha)	K (kg/ha)	N (kg/ha)	P (kg/ha)	K (kg/ha)	N (kg/ha)	P (kg/ha)	K (kg/ha)
Control	42.1	15.1	18.9	19.6	4.3	29.8	28.9	7.1	38.5
100% PK	111.2	54.3	45.6	56.2	13.0	86.2	36.9	8.0	43.4
100% NK	73.6	29.8	38.3	54.8	45.3	88.8	40.5	8.8	49.8
STCR recommendation	95.3	45.0	45.1	67.7	14.5	102.4	50.2	11.2	38.3
100% NP	96.4	51.5	39.0	61.4	11.8	83.7	49.2	12.1	56.8
100% NPK + Zn + S	98.8	53.1	48.3	79.3	17.7	121.3	87.0	19.7	87.8
100% NPK + Zn + S + FYM/PM @ 5 t/ha	120.5	55.8	49.4	85.6	18.6	137.9	113.5	25.4	109.0
100% NPK – Zn	94.0	49.1	39.2	68.4	15.5	105.8	68.2	15.8	76.3
100% NPK – S	86.3	48.2	39.3	-	-	-	71.3	20.6	76.4
100%NPK-S+ 1timelime/ha	-	-	-	70.5	12.9	101.8	-	-	-
100% N+50% PK	86.9	45.1	17.1	75.5	12.3.	105.9	80.7	17.5	80.7
50 % NPK	82.4	45.9	40.3	55.8	10.4	89.5	63.8	13.1	62.5
50 % NPK + Biofertiliser	98.1	48.5	39.5	40.8	8.3	55.6	66.8	15.0	68.0
50% NPK+ 50% GM-N	91.2	38.5	40.2	64.8	13.8	99.9	86.3	21.0	83.7
50% NPK+ 50% FYM-N	104.7	50.5	41.7	69.4	14.5	112.3	88.8	21.1	89.2
50% NPK +25% GM-N +25% FYM-N	84.6	45.3	38.7	74.1	15.6	112.3	111.7	26.7	108.2
FYM @ 10 t/ha	89.7	51.3	43.2	77.6	16.4	118.4	87.3	19.5	80.1
FYM@10t/ha +3.0 t/ha Vermi+200 kg/ha oil cakes	119.2	54.5	45.9	74.4	17.0	118.2	84.6	17.4	79.4
Expt. Mean	92.6	46.0	39.4	64.5	15.6	98.2	71.5	16.5	72.2
CD (0.05)	20.6	10.5	5.6	6.1	NS	10.0	8.3	4.5	20.0
CV (%)	13.3	13.7	8.6	5.7	91.6	6.16	5.4	12.7	12.9

Table 5.1.7: Long-term soil fertility management in RBCS, Kharif-2025
Soil Parameters (kg/ha)

Treatments	Maruteru				Titabar				Mandya			
	Avail. N (kg/ha)	Avail. P (kg/ha)	Avail. K (kg/ha)	Org. carbon (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Org. carbon (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Org. carbon (%)
Control	106.0	62.3	368	1.17	145.1	11.3	67.7	0.52	225.8	39.3	99.6	0.26
100% PK	112.7	74.3	393	1.33	261.7	19.0	77.9	0.92	231.5	46.5	131.5	0.34
100% NK	101.3	62.5	351	1.32	181.5	21.6	93.0	1.12	245.8	42.1	141.5	0.36
STCR recommendation	136.3	69.6	341	1.32	292.8	28.2	99.8	1.15	260.3	47.8	146.2	0.40
100% NP	106.0	70.2	295	1.16	118.4	29.5	90.7	0.97	258.2	47.6	128.5	0.45
100% NPK + Zn + S	112.3	69.0	376	1.14	357.8	37.4	155.3	1.49	283.8	51.5	217.1	0.59
100% NPK + Zn + S + FYM/PM @ 5 t/ha	139.3	81.1	353	1.36	398.1	38.3	184.0	1.69	284.4	62.5	256.4	0.70
100% NPK -Zn	132.0	65.2	347	1.25	293.5	27.3	158.3	0.99	280.3	54.1	225.3	0.36
100% NPK - S	116.0	73.7	351	1.34	-	-	-	-	285.0	54.2	238.2	0.36
100%NPK-S+ 1timelime/ha	-	-	-	-	364.1	32.9	148.9	1.07	-	-	-	-
100% N+50% PK	114.3	68.3	364	1.23	372.7	31.5	152.7	1.11	277.4	50.0	240.2	0.44
50 % NPK	85.6	64.9	341	1.28	286.6	26.7	86.1	0.96	246.4	48.3	245.9	0.53
50 % NPK + Biofertiliser	135.0	71.9	348	1.26	225.2	26.9	86.3	0.75	291.3	53.6	230.9	0.55
50% NPK+ 50% GM-N	130.3	65.8	348	1.24	358.9	34.5	158.0	1.20	303.5	54.9	235.5	0.62
50% NPK+ 50% FYM-N	121.7	78.2	339	1.29	396.9	32.2	142.5	1.56	302.9	55.0	247.6	0.71
50% NPK +25% GM-N +25% FYM-N	129.7	69.5	401	1.39	357.1	33.0	159.8	1.50	319.2	61.8	256.5	0.75
FYM @ 10 t/ha	111.0	78.2	383	1.43	380.3	33.2	160.3	1.53	313.5	52.4	245.7	0.64
FYM@10t/ha +3.0 t/ha Vermi+200 kg/ha oil cakes	92.3	82.4	369	1.41	402.6	38.7	175.6	1.71	318.5	55.2	235.7	0.62
Expt. Mean	116.6	71.0	356.9	1.29	305.5	29.5	129.2	1.19	278.1	51.6	207.2	0.51
CD (0.05)	29.7	12.1	36.6	NS	54.5	6.3	16.4	0.14	8.3	2.7	9.6	0.05
CV (%)	15.3	10.3	6.2	10.5	10.6	12.8	7.6	7.3	1.40	2.5	2.2	3.5

Table 5.1.8: Long-term soil fertility management in RBCS, Sustainable Yield Index (SYI)

Treatments	Maruteru-Kharif			Maruteru-Rabi			Titabar-Kharif			Titabar-Rabi			Mandya-Kharif		
	SYI (%)	Mean Yield (kg/ha)	SD (kg/ha)	SYI (%)	Mean Yield (kg/ha)	SD (kg/ha)	SYI (%)	Mean Yield (kg/ha)	SD (kg/ha)	SYI (%)	Mean Yield (kg/ha)	SD (kg/ha)	SYI (%)	Mean Yield (kg/ha)	SD (kg/ha)
Control	28.8	2874	671	20.9	2358	778	22.2	1947	670	21.6	1676	444	19.7	2198	754
100% PK	35.9	3674	927	25.0	3143	1246	45.3	3351	744	43.3	3045	575	28.0	2683	631
100% NK	43.5	4191	865	42.6	4142	909	53.3	3657	585	48.6	3292	519	30.1	3317	1105
100% NP	47.3	4559	939	52.4	1979	1007	57.5	3853	542	51.7	3428	476	33.5	3701	1243
100% NPKZnS	54.8	5182	991	64.1	5778	920	61.8	4513	953	59.5	3916	521	53.3	4738	826
100% NPKZnS + FYM	55.3	5419	1190	67.5	6345	1227	75.5	5084	734	67.7	4357	494	54.7	5349	1333
100% NPK-Zn	50.5	4770	905	59.8	5216	682	59.3	4243	824	56.5	3716	493	48.6	4443	879
100% NPK-S	52.3	4821	822	59.7	5338	816	64.0	4196	510	55.7	3562	383	47.0	4364	915
100% NZnS + 50%PK	48.8	4570	841	54.6	5182	1046	55.7	3721	512	50.7	3411	519	40.3	4072	1115
50% NPK	46.0	4427	911	45.2	4303	879	45.9	3269	623	43.5	2856	374	39.5	3712	813
50% NPK + 50% GM-N	47.8	4610	955	52.8	4969	968	55.8	3921	707	51.6	3384	439	52.4	4746	903
50% NPK+ 50% FYM-N	50.5	4880	1020	54.1	5255	1157	59.8	4089	647	53.1	3512	482	52.9	4809	926
50% NPK + + 25%GM-N + + 25% FYM-N	47.8	4701	1048	53.0	5077	1059	59.4	4154	731	53.1	3535	505	60.1	5397	986
FYM (10 t/ha)	45.7	4611	1112	42.5	4258	1036	60.4	4216	735	48.8	3551	767	45.8	4210	846

SYI = Sustainable Yield Index, SD = Standard Deviation

Table 5.1.9: Long-term soil fertility management in RBCS
Linear trends of changes in *Kharif* rice yields (t/ha) from 1989 to 2025

Treatments	Maruteru			Titabar			Mandya		
	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)
Control	2.87	16	2.51	1.95	-44	2.80	2.20	-42	2.98
100% PK	3.67	50	2.68	3.35	46	2.47	2.68	-33	3.30
100% NK	4.19	14	3.92	3.66	31	3.06	3.32	-66	4.54
100% NP	4.56	3	4.50	3.85	28	3.32	3.70	-76	5.11
100% NPK + Zn + S	5.18	25	4.70	4.51	43	3.71	4.74	-18	5.08
100% NPKZnS + FYM	5.42	80	3.47	5.08	61	3.59	5.35	51	4.09
100% NPK – Zn	4.77	7	4.64	4.24	26	3.75	4.44	-45	5.28
100% NPK – S	4.82	11	4.60	4.20	12	3.97	4.36	-41	5.12
100% N + 50% PK	4.57	18	4.23	3.72	7	3.59	4.07	-42	4.85
50% NPK	4.43	18	4.07	3.27	-12	3.49	3.71	-36	4.38
50% NPK + 50% GM-N	4.61	24	4.15	3.92	31	3.34	4.75	-6	4.85
50% NPK + 50% FYM-N	4.88	27	4.37	4.09	40	3.33	4.81	0	4.80
50% NPK + 25% GM-N + 25% FYM-N	4.70	30	4.12	4.15	40	3.40	5.40	9	5.24
FYM @ 10 t/ha	4.61	30	4.02	4.22	55	3.17	4.21	22	3.80

Table 5.1.10: Long-term soil fertility management in RBCS
Linear trends of changes in *Rabi* rice yields (t/ha) from 1989 to 2025

Treatments	MTU			TTB		
	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)
Control	2.34	41	1.43	1.68	-25	2.11
100% PK	3.11	69	1.79	3.05	44	2.27
100% NK	4.12	26	3.62	3.29	23	2.88
100% NP	4.98	8	4.82	3.43	12	3.22
100% NPK + Zn + S	5.77	40	5.01	3.92	26	3.47
100% NPKZnS + FYM/PM	6.34	3	6.28	4.36	26	3.79
100% NPK – Zn	5.20	18	4.86	3.72	20	3.36
100% NPK – S	5.33	23	4.89	3.56	12	3.36
100% N + 50% PK	5.16	15	4.89	3.41	13	3.18
50% NPK	4.29	17	3.97	2.86	4	2.78
50% NPK + 50% GM-N	4.95	9	4.78	3.38	18	3.06
50% NPK + 50% FYM-N	5.23	35	4.56	3.51	30	2.98
50% NPK + 25% GM-N + 25% FYM-N	5.06	17	4.73	3.54	30	3.01
FYM @ 10 t/ha	4.23	43	3.41	3.55	34	2.96

Table: 5.1.11: Long-term soil fertility management in RBCS
Changes (%) in soil fertility parameters from 1989 to 2025

Treatments	Maruteru				Titabar			Mandya			
	OC	N	P	K	OC	P	K	OC	N	P	K
Control	31.5	-64.4	205	-9.4	-45.3	-14.4	-53.6	-25.7	-52.1	99.5	-14.9
100% NPK + Zn + S	28.1	-62.3	238	-7.4	56.8	183.3	6.4	68.6	4.4	161.4	85.6
100% NPK + Zn + S + 5 t/ha FYM	28.1	-62.3	298	-13.1	77.9	190.2	26.0	100.0	23.3	217.3	119.1
50% NPK + 25% GM-N + 25% FYM-N	56.2	-56.5	241	-1.2	57.9	150.0	9.5	114.3	23.3	213.7	119.2
FYM @ 10 t/ha	60.7	-62.8	283	-5.7	80.0	193.2	20.3	77.1	13.3	180.2	101.5

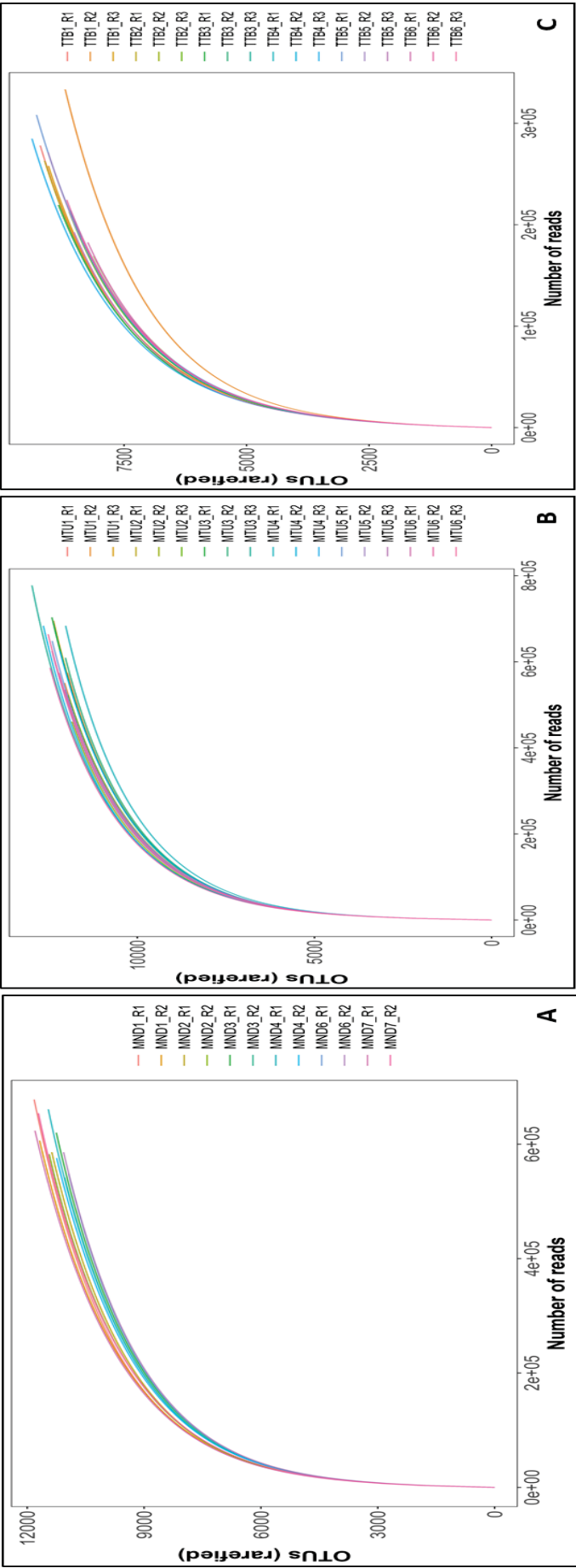


Fig 1. Rarefaction curves showing sequencing depth and coverage for all treatments at different locations –A. Mandya, B. Maruteru and C. Titabar

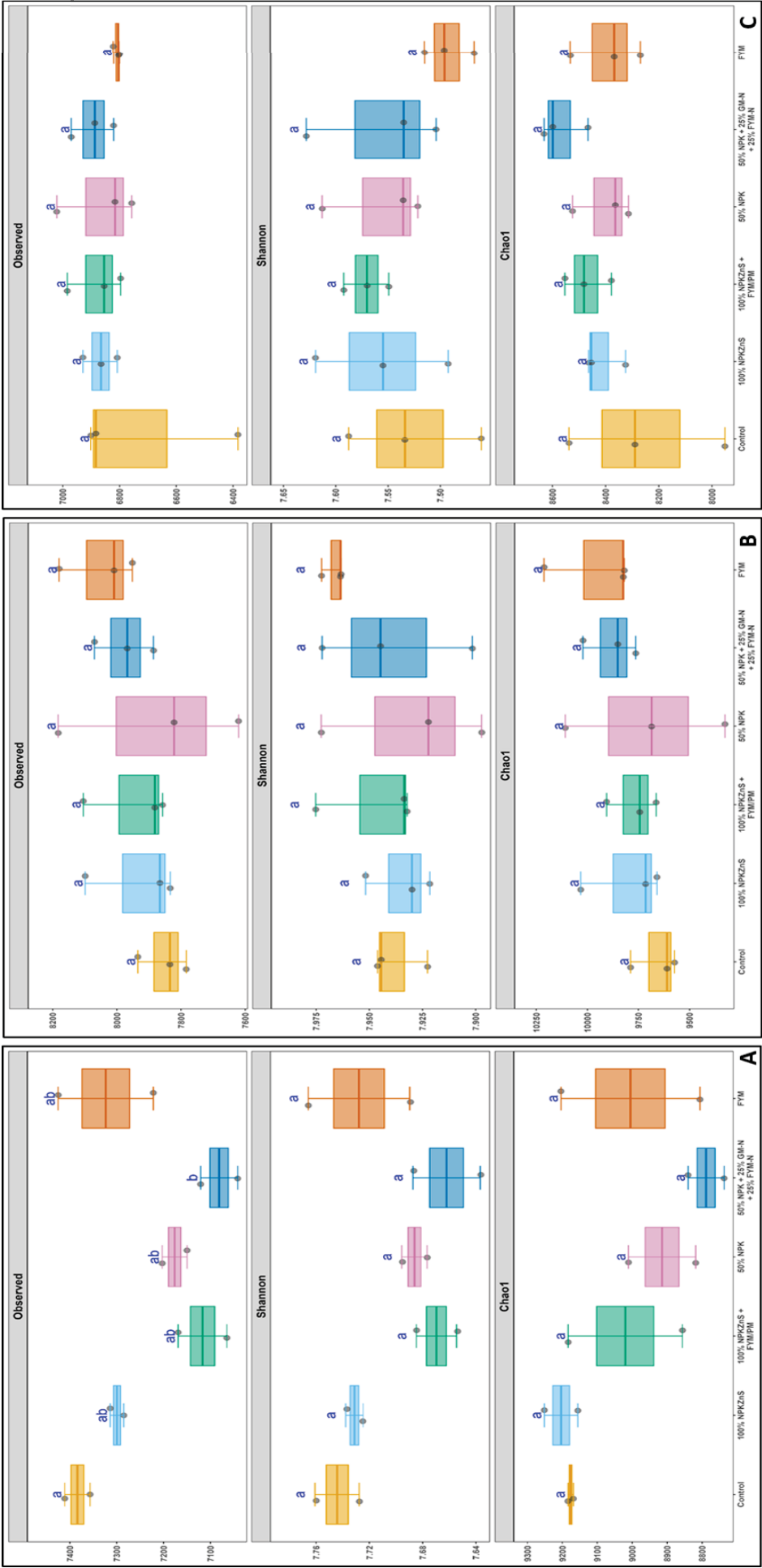


Fig 2. Alpha diversity indices at different locations –A. Mandya, B. Maruteru and C. Titabar

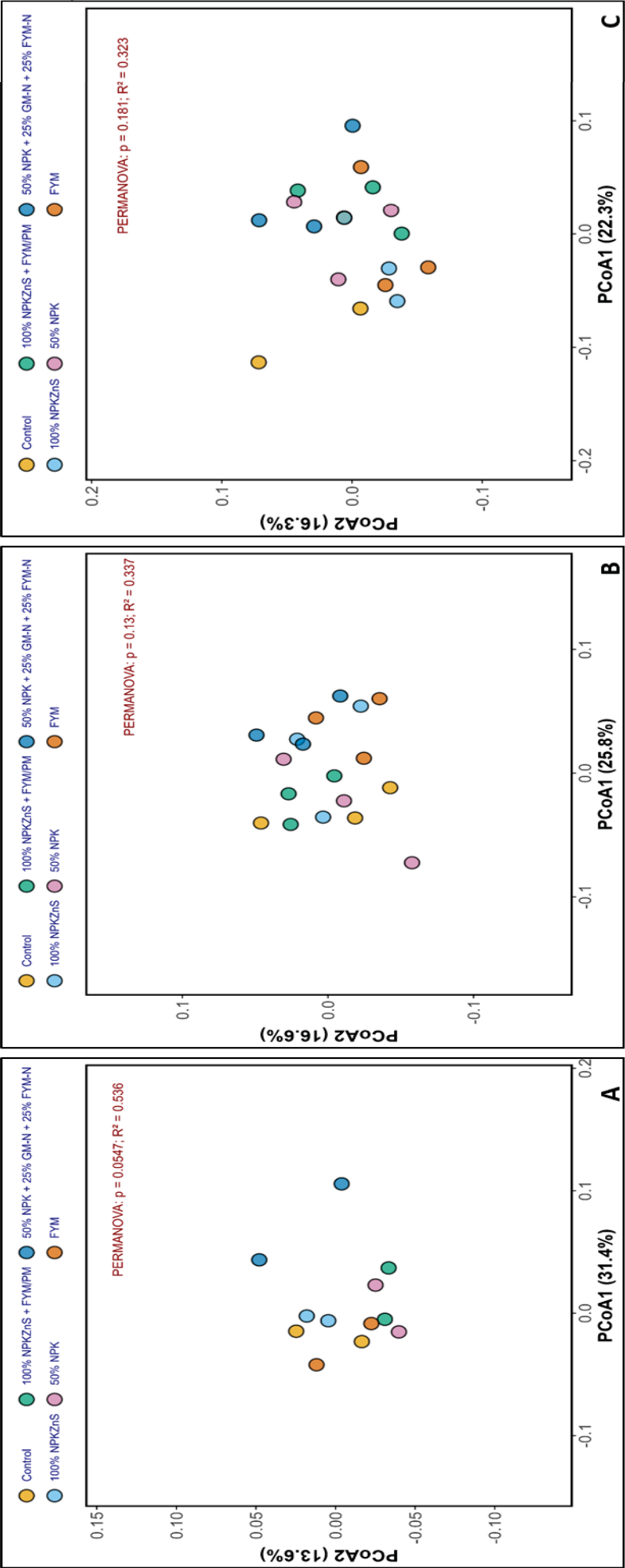


Fig 3. Beta diversity (PCoA) at different locations –A. Mandya, B. Maruteru and C. Titabar

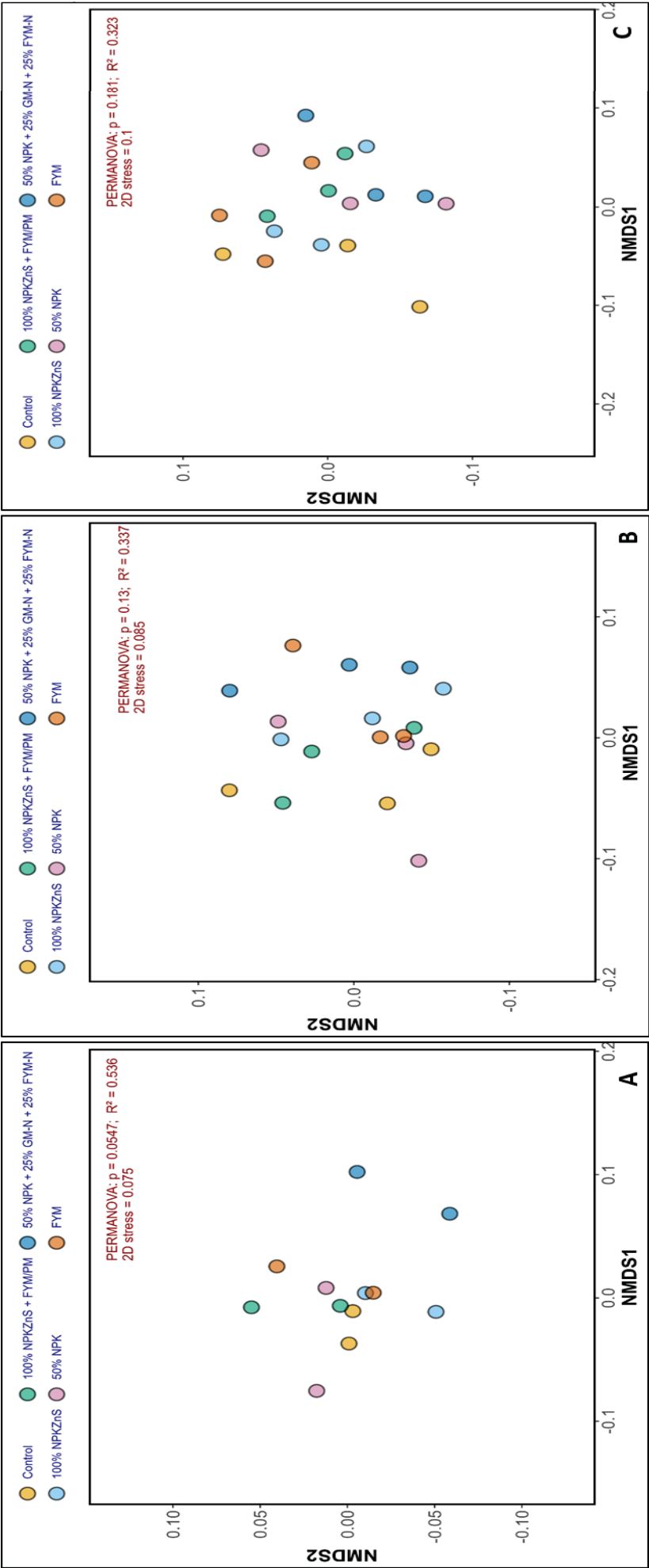


Fig 4. Beta diversity (NMDS) at different locations –A. Mandya, B. Maruteru and C. Titabar



Fig 5. Phylum level relative abundance of bacteria in different treatments at A. Mandya, B. Maruteru and C. Titabar

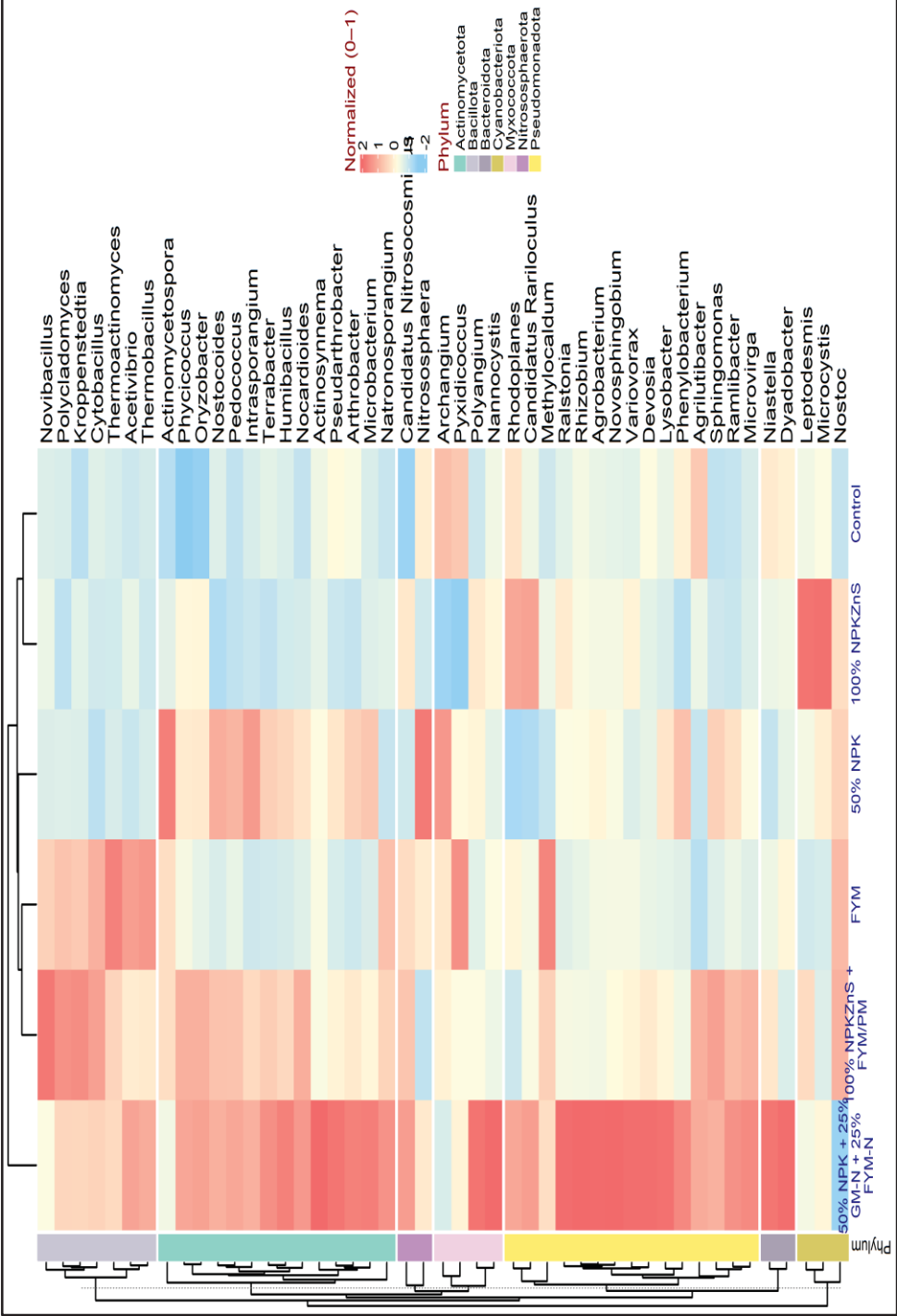


Fig 6. Bacteria community composition (genus level) in different treatments at Mandya

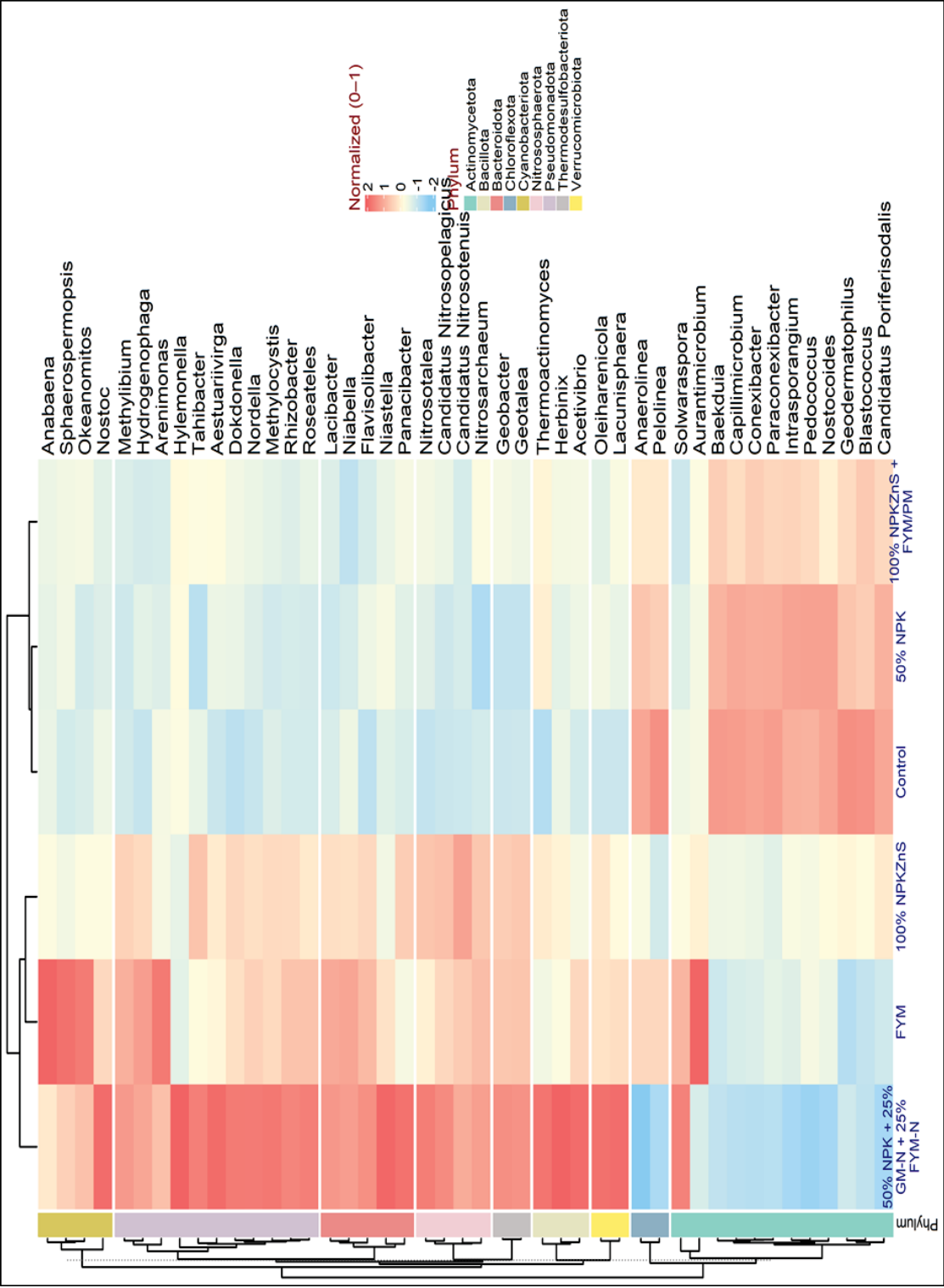


Fig 7. Bacteria community composition (genus level) in different treatments at Maruteru

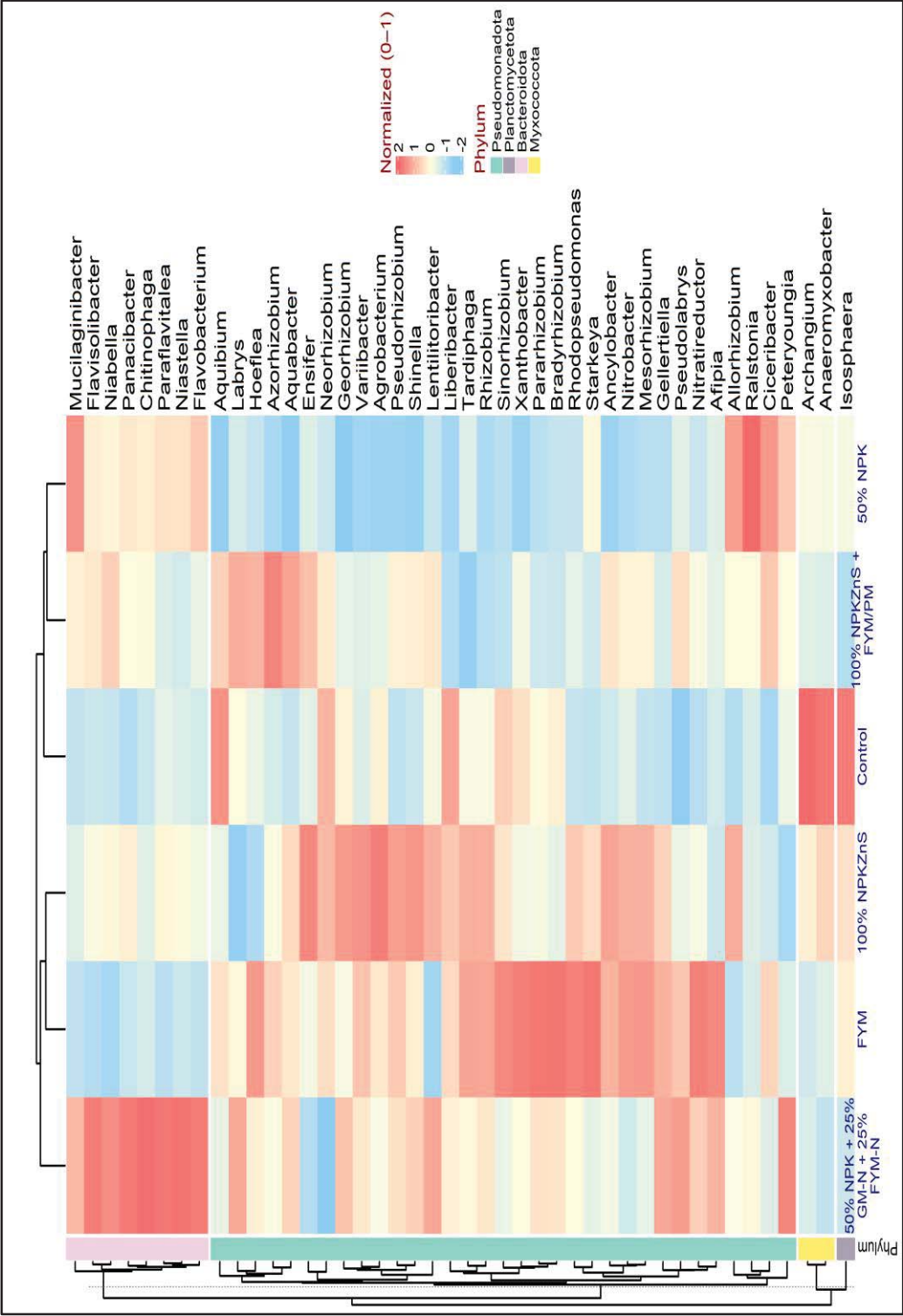


Fig 8. Bacteria community composition (genus level) in different treatments at Titabar

5.2. Management of Sodic Soils Using Nano Zinc Formulations

Sodic soils are characterised by high pH (8.5–11.0), exchangeable sodium percentage (ESP) ≥ 15 , electrical conductivity < 4 dS/m, low organic matter and nutrient content, and a preponderance of sodium carbonates and bicarbonates. These soil characteristics severely restrict micronutrient availability and consequently crop productivity. These soils can be managed by growing tolerant varieties and/or by applying suitable amendments to ameliorate the adverse conditions. Sodic soils are deficient in micronutrients such as Zn, Fe, Mn and Cu, with Zn levels typically below 0.5 ppm. In this context, the present trial was conducted to evaluate nano Zn formulations at various concentrations for enhancing Zn availability to rice in sodic soils. This trial was initiated in *Kharif-2021* with nano Zn formulations at two concentrations (20 and 50 ppm). In the current year, the trial was conducted at four locations, viz., *Kanpur, Mandya, Pusa and Navsari*. The selected genotypes (CSR 23 and DRR Dhan 48) were evaluated under seven nutrient management practices (Control; ZnSO_4 @ 0.5 % foliar spray; Nano Zn @ 20 ppm foliar spray; Nano Zn @ 50 ppm foliar spray; Soil application of ZnSO_4 @ 50 kg/ha; Silicic acid @ 40 ppm and Silicic acid @ 80 ppm). The experimental results are presented in Tables 5.2.1 to 5.2.14 and discussed below.

Yield Parameters

Yield parameters, viz., tiller and panicle numbers per square metre, are presented in Table 5.2.2 and 5.2.3. Significant differences in tiller number due to treatments were observed at all centres except Navsari, while varietal differences were significant at Mandya and Pusa. Among the treatments, foliar application of nano Zn @ 50 ppm at Kanpur (397) and Mandya (440), soil application of ZnSO_4 @ 50 kg/ha at Pusa (314) produced the highest tiller numbers compared to the other treatments. Among the varieties, DRR Dhan 48 recorded higher tiller numbers at Kanpur (362) and Pusa (294), while CSR 23 exhibited higher tiller numbers at Mandya (416) and Navsari (474).

Panicles/m² differed significantly among the treatments at Mandya and Pusa between the varieties at Pusa. Among the treatments, foliar application of nano Zn @ 50 ppm at Kanpur (300), Mandya (313) and Navsari (405); soil application of ZnSO_4 @ 50 kg/ha at Pusa (292) recorded significantly higher panicles per square meter. Among the varieties, CSR 23 registered a higher panicle number at all locations except Pusa.

Grain and Straw yields

Grain and straw yields showed significant differences between the genotypes and treatments and presented in Table 5.2.4 and 5.2.5. At Kanpur, foliar application of nano Zn @ 50 ppm recorded significantly higher grain (4.42 t/ha) and straw (5.45 t/ha) yields while soil application of ZnSO_4 @ 50 kg/ha registered on par grain (4.36 t/ha) and straw yields (5.35 t/ha). Between the two varieties, CSR 23 recorded higher grain (3.88 t/ha) and straw (4.76 t/ha) yields compared to DRR Dhan 48.

At Mandya, foliar application of nano Zn @ 50 ppm recorded significantly higher grain (6.03 t/ha) and straw yields (6.79 t/ha) compared to all other treatments. Regarding varieties, CSR 23 produced higher grain (5.52 t/ha) and straw yields (6.28 t/ha) than DRR Dhan 48.

At Pusa, soil application of ZnSO_4 @ 50 kg/ha produced significantly higher grain yield (4.78 t/ha), which was on par with foliar application of nano Zn @ 50 ppm (4.56 t/ha), and silicic acid spray of 80 ppm (4.39 t/ha). By contrast, foliar application of nano Zn @ 50 ppm has registered higher straw yield (6.00 t/ha), which was on par with silicic acid spray of 80 ppm (5.59 t/ha). Between the two varieties, DRR Dhan 48 recorded significantly higher grain (4.38 t/ha) and straw (5.55 t/ha) yields compared to CSR 23. In Navsari, foliar spray of silicic acid spray @ 80 ppm produced significantly higher grain yield (4.32 t/ha) and straw yield (13.31 t/ha) compared to the other treatments, which was on par with nano Zn @ 50 ppm and silicic acid spray @ 40 ppm. Among the varieties, CSR 23 produced significantly higher grain yield (3.88 t/ha). The interaction between treatments and genotypes was non-significant at all locations.

Nutrient uptake

Significant differences in NPK and Zn uptake were observed at all locations (Table 5.2.6 to 5.2.9). At Kanpur, foliar spray of nano Zn @ 50 ppm recorded higher N (81 kg/ha), P (24.3 kg/ha), Zn (317 g/ha) uptake on par with soil application of ZnSO_4 @ 50 kg/ha. At Mandya, foliar spray of nano Zn @ 50 ppm recorded higher N (122 kg/ha), P (28 kg/ha), K (103 kg/ha) while soil application of ZnSO_4 accumulated more Zn (276 g/ha). At Pusa, higher N (89 kg/ha), P uptake (20 kg/ha) and Zn uptake (435 g/ha) was recorded under soil application of ZnSO_4 @ 50 kg/ha whereas higher K (88 kg/ha) uptake was recorded with nano Zn @ 50 ppm. At Navsari, silicic acid spray of 80 ppm recorded higher N (149 kg/ha) and P uptake (10 kg/ha), K uptake (203 kg/ha) and the maximum Zn uptake (520 g/ha) was recorded under soil application of ZnSO_4 @ 50 kg/ha. Among the varieties, DRR Dhan 48 accumulated higher amounts of NPK and Zn at Pusa and Navsari whereas CSR 23 recorded higher nutrient uptake at Kanpur and Mandya.

Uptake of Zn in Grain and straw:

Zinc accumulation in grain and straw differed significantly among treatments at all locations and among varieties at all locations except Kanpur and Mandya (Table 5.2.10 - 5.2.11). Zinc uptake was higher in straw than in grain at all locations, attributable to the higher Zn concentration and greater straw biomass. Foliar application of nano Zn @ 50 ppm recorded higher Zn uptake in grain (132 g/ha) and straw (185 g/ha) at Kanpur, higher straw Zn uptake (159 g/ha) at Mandya, and higher grain Zn uptake (87 g/ha) at Navsari. By contrast, soil application of ZnSO_4 @ 50 kg/ha resulted in higher grain (183 g/ha) and straw Zn uptake (252 g/ha) at Pusa, higher grain Zn uptake (119 g/ha) at Mandya, and higher straw Zn uptake (453 g/ha) at Navsari.

Post-harvest soil Zn status:

The post-harvest available Zn status in soil differed significantly among treatments but not among varieties, except at Navsari (Table 5.2.12). Soil application of ZnSO_4 @ 50 kg/ha recorded significantly higher Zn status in Kanpur (0.84 mg/kg), Mandya (1.94 mg/kg), Pusa (0.72 mg/kg) and Navsari (6.38 mg/kg) compared to the other treatments.

Summary:

Significant genotypic and location-specific differences in yield parameters and yield were observed across all four locations. Foliar application of nano Zn @ 50 ppm recorded significantly higher grain yields (4.42 and 6.03 t/ha) and straw yields (5.45 and 6.79 t/ha) at Kanpur and Mandya, respectively, and also resulted in higher straw yield at Pusa (6.00 t/ha). By contrast, at Pusa, soil application of ZnSO₄ @ 50 kg/ha produced a significantly higher grain yield (4.78 t/ha). At Navsari, foliar application of silicic acid @ 80 ppm recorded higher grain yield (4.32 t/ha) and straw yields (13.31 t/ha). Between the two varieties, CSR 23 was superior at Kanpur, Mandya, and Navsari, while DRR Dhan 48 performed better at Pusa. Nutrient uptake followed a trend similar to that of grain and straw yields. DRR Dhan 48 accumulated a higher quantity of NPK and Zn at Pusa and Navsari, whereas CSR 23 recorded higher nutrient uptake at Kanpur and Mandya.

**Table 5.2.1: Management of Sodic soil using nano zinc formulations
(Crop and soil characteristics)**

Parameters	Kanpur	Mandya	Pusa	Navsari
Season	<i>Kharif -2025</i>	<i>Kharif -2025</i>	<i>Kharif -2025</i>	<i>Kharif -2025</i>
Varieties	CSR 23, DRR Dhan 48	CSR 23, DRR Dhan 48	CSR 23, DRR Dhan 48	CSR 23, DRR Dhan 48
Fertilizer dose	150:60:60	125:62.5:50	120:60:40:50	
% Clay	21.1	-	16	
% Silt	26.23	-	24	
% Sand	52.7	-	60	
Texture	Sandy Clay Loam	-	Sandy Loam	
Soil pH	9.7	8.23	9.65	
Soil EC (dS/m)	0.25	0.24	0.78	
Organic carbon (%)	0.33	0.65	0.35	
CEC (cmol (P+) / kg)	-	-		
Available N (kg/ha)	155	248.4	162	
Available P (kg/ha)	13.5	19.5	18.5	
Available K (kg/ha)	215	235.2	96.2	
DTPA-Zn (mg/kg)	0.53	0.92	0.46	

Table 5.2.2: Management of Sodic soils using nano Zn formulations, Tillers /m² of rice at different locations

Treatments/ Varieties	Kanpur				Mandya				Pusa				Navsari			
	CSR 23	DRR Dhan 48	Mean		CSR 23	DRR Dhan 48	Mean		CSR 23	DRR Dhan 48	Mean		CSR 23	DRR Dhan 48	Mean	
Control	308	312	310		375	348	362		236	253	245		427	460	443	
ZnSO ₄ @ 0.5 % foliar spray	348	355	352		388	378	383		262	278	270		445	478	462	
Nano Zn @ 20 ppm foliar spray	364	372	368		439	429	434		276	297	287		485	485	485	
Nano Zn @ 50 ppm foliar spray	393	401	397		445	436	440		297	320	309		562	403	482	
Soil application of ZnSO ₄ @ 50 kg/ha	387	395	391		433	408	421		298	330	314		472	477	474	
Silicic acid @ 40 ppm	335	345	340		413	407	410		267	285	276		450	447	448	
Silicic acid @ 80 ppm	340	357	349		419	417	418		282	295	288		479	425	452	
Mean	354	362	358		416	403	410		274	294	284		474	454	464	
CD M	38.76				23.06				32.82				NS			
CD S	NS				7.52				16.01				NS			
M X S	NS				NS				NS				NS			
S X M	NS				NS				NS				NS			
CV (%) M	8.61				4.48				8.51				15.47			
CV (%) S	9.28				2.77				9.18				14.35			

Table 5.2.3: Management of Sodic soils using nano Zn formulations, panicles /m² of rice at different locations

Treatments/ Varieties	Kanpur			Mandya			Pusa			Navsari		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	225	231	228	233	232	232	218	232	225	354	380	367
ZnSO ₄ @ 0.5 % foliar spray	262	268	265	265	254	259	241	254	248	360	394	377
Nano Zn @ 20 ppm foliar spray	271	282	277	285	276	280	255	276	266	405	402	403
Nano Zn @ 50 ppm foliar spray	295	304	300	321	305	313	276	297	286	483	327	405
Soil application of ZnSO ₄ @ 50 kg/ha	289	296	293	290	284	287	277	308	292	378	390	384
Silicic acid @ 40 ppm	258	263	261	277	274	275	245	263	254	367	365	366
Silicic acid @ 80 ppm	266	271	269	284	283	283	260	274	267	395	340	367
Mean	267	238	270	279	272	276	253	272	263	392	371	381
CD M	NS			18.09			29.29			NS		
CD S	NS			NS			15.64			NS		
M X S	NS			NS			NS			NS		
S XM	NS			NS			NS			NS		
CV (%) M	13.67			5.21			8.87			19.53		
CV (%) S	11.2			6.7			9.0			17.39		

Table 5.2.4: Management of Sodic soils using nano Zn formulations, Grain yields (t/ha) of rice at different locations

Treatments/ Varieties	Kanpur			Mandya			Pusa			Navsari		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	3.02	2.86	2.94	4.64	4.57	4.60	3.25	3.51	3.38	3.42	2.71	3.06
ZnSO ₄ @ 0.5 % foliar spray	3.75	3.51	3.63	5.35	5.31	5.33	3.72	4.06	3.89	3.50	3.27	3.38
Nano Zn @ 20 ppm foliar spray	4.08	3.82	3.95	5.69	5.66	5.67	4.16	4.44	4.30	3.82	3.27	3.55
Nano Zn @ 50 ppm foliar spray	4.51	4.33	4.42	6.06	6.00	6.03	4.40	4.71	4.56	4.02	3.99	4.01
Soil application of ZnSO ₄ @ 50 kg/ha	4.46	4.27	4.36	5.77	5.68	5.73	4.60	4.96	4.78	3.99	3.52	3.75
Silicic acid @ 40 ppm	3.58	3.37	3.48	5.48	5.38	5.43	4.14	4.45	4.30	4.03	3.58	3.80
Silicic acid @ 80 ppm	3.80	3.62	3.71	5.68	5.61	5.64	4.25	4.53	4.39	4.35	4.29	4.32
Mean	3.88	3.68	3.78	5.52	5.46	5.49	4.08	4.38	4.23	3.88	3.52	3.70
CD M	0.282			0.263			0.42			0.540		
CD S	0.277			0.134			0.18			0.270		
M X S	NS			NS			NS			NS		
S X M	NS			NS			NS			NS		
CV (%) M	5.93			3.81			7.87			13.92		
CV (%) S	11.08			3.69			6.41			13.15		

Table 5.2.5: Management of Sodic soils using nano Zn formulations, Straw yields (t/ha) of rice at different locations

Treatments/ Varieties	Kanpur			Mandya			Pusa			Navsari		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	3.66	3.45	3.55	5.71	5.28	5.50	4.11	4.46	4.29	9.36	9.48	9.42
ZnSO4 @ 0.5 % foliar spray	4.58	4.25	4.41	5.99	5.94	5.97	4.85	5.29	5.07	9.99	10.63	10.31
Nano Zn @ 20 ppm foliar spray	5.00	4.66	4.83	6.41	6.33	6.37	5.24	5.69	5.47	10.60	11.46	11.03
Nano Zn @ 50 ppm foliar spray	5.57	5.33	5.45	6.88	6.70	6.79	5.82	6.18	6.00	11.42	13.93	12.67
Soil application of ZnSO ₄ @ 50 kg/ha	5.48	5.23	5.35	6.53	6.29	6.41	5.55	5.94	5.75	11.41	12.44	11.93
Silicic acid @ 40 ppm	4.37	4.09	4.23	6.04	5.99	6.02	5.22	5.55	5.38	11.15	12.51	11.83
Silicic acid @ 80 ppm	4.68	4.42	4.55	6.38	6.29	6.34	5.42	5.75	5.59	11.97	14.66	13.31
Mean	4.76	4.49	4.63	6.28	6.12	6.20	5.17	5.55	5.36	10.84	12.16	11.50
CD M	0.35			0.25			0.46			1.66		
CD S	NS			0.12			0.17			0.61		
M X S	NS			NS			NS			NS		
S XM	NS			NS			NS			NS		
CV (%) M	5.96			3.22			6.82			13.75		
CV (%) S	11.1			2.88			4.77			9.49		

Table 5.2.6: Management of Sodic soils using nano Zn formulations, Total nutrient uptake of rice at Kanpur

Treatments/ Varieties	N uptake (kg/ha)			P uptake (kg/ha)			K uptake (kg/ha)			Zn uptake (g/ha)		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	47	45	46	13	13	13	52	50	51	140	137	139
ZnSO ₄ @ 0.5 % foliar spray	62	58	60	19	18	18	71	67	69	219	210	214
Nano Zn @ 20 ppm foliar spray	69	66	68	21	20	20	78	74	76	250	240	245
Nano Zn @ 50 ppm foliar spray	83	79	81	24	24	24	90	90	90	318	315	317
Soil application of ZnSO ₄ @ 50 kg/ha	81	79	80	24	24	24	88	96	92	310	305	308
Silicic acid @ 40 ppm	58	55	56	18	17	17	67	64	65	178	173	176
Silicic acid @ 80 ppm	62	60	61	19	18	18	72	70	71	197	193	195
Mean	66	63	65	20	19	19	74	73	74	230	225	228
CD M	5.76			1.56			7.68			22.51		
CD S	NS			NS			NS			NS		
M X S	NS			NS			NS			NS		
S XM	NS			NS			NS			NS		
CV (%) M	7.1			6.44			8.3			7.86		
CV (%) S	10.66			11.17			12.64			11.64		

Table 5.2.7: Management of Sodic soils using nano Zn formulations, Total nutrient uptake of rice at Mandya

Treatments/ Varieties	N uptake (kg/ha)			P uptake (kg/ha)			K uptake (kg/ha)			Zn uptake (g/ha)		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	80	73	76	13	12	12	63	57	60	129	135	132
ZnSO ₄ @ 0.5 % foliar spray	96	97	97	16	18	17	71	73	72	193	192	192
Nano Zn @ 20 ppm foliar spray	107	108	107	22	23	22	92	90	91	213	220	217
Nano Zn @ 50 ppm foliar spray	124	121	122	28	27	28	106	100	103	263	264	263
Soil application of ZnSO ₄ @ 50 kg/ha	104	100	102	21	21	21	81	78	79	274	278	276
Silicic acid @ 40 ppm	93	93	93	20	21	20	72	70	71	189	191	190
Silicic acid @ 80 ppm	100	100	100	24	22	23	75	75	75	203	207	205
Mean	101	99	100	21	20	21	80	78	79	209	212	211
CD M	4.47			2.71			7.72			7.76		
CD S	NS			NS			2.14			NS		
M X S	NS			2.27			NS			NS		
S XM	NS			1.71			NS			NS		
CV (%) M	3.56			10.5			7.79			2.93		
CV (%) S	2.7			4.77			4.1			3.58		

Table 5.2.8: Management of Sodic soils using nano Zn formulations, Total nutrient uptake of rice at Pusa

Treatments/ Varieties	N uptake (kg/ha)			P uptake (kg/ha)			K uptake (kg/ha)			Zn uptake (g/ha)		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	43	55	49	14	14	14	55	66	60	190	252	221
ZnSO ₄ @ 0.5 % foliar spray	55	70	63	16	16	16	66	78	72	248	309	278
Nano Zn @ 20 ppm foliar spray	71	76	73	18	17	18	73	86	80	304	380	342
Nano Zn @ 50 ppm foliar spray	77	85	81	19	19	19	82	95	88	355	447	401
Soil application of ZnSO ₄ @ 50 kg/ha	85	92	89	20	20	20	80	94	87	381	489	435
Silicic acid @ 40 ppm	70	76	73	18	18	18	72	82	77	247	329	288
Silicic acid @ 80 ppm	78	84	81	18	18	18	77	86	82	279	362	320
Mean	10	11	73	17	17	17	72	84	78	286	367	327
CD M	9.7			1.91			7.03			37.82		
CD S	4.17			NS			4.26			11.43		
M X S	NS			NS			NS			NS		
S XM	NS			NS			NS			NS		
CV (%) M	10.59			8.72			7.17			9.21		
CV (%) S	8.66			7.93			8.25			5.29		

Table 5.2.9: Management of Sodic soils using nano Zn formulations, Total nutrient uptake of rice at Navsari

Treatments/ Varieties	N uptake (kg/ha)			P uptake (kg/ha)			K uptake (kg/ha)			Zn uptake (g/ha)	
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48
Control	122	105	113	9	9	9	129	155	142	192	373
ZnSO ₄ @ 0.5 % foliar spray	132	121	126	10	9	9	139	153	146	247	539
Nano Zn @ 20 ppm foliar spray	137	123	130	9	8	9	154	175	164	358	604
Nano Zn @ 50 ppm foliar spray	149	143	146	10	11	10	175	173	174	266	701
Soil application of ZnSO ₄ @ 50 kg/ha	150	138	144	9	10	9	173	179	176	392	649
Silicic acid @ 40 ppm	150	134	142	9	8	9	174	196	185	332	656
Silicic acid @ 80 ppm	154	145	149	9	11	10	187	218	203	339	694
Mean	142	130	136	9	9	9	162	178	170	304	602
CD M	13.02			NS			13.83			65.91	
CD S	4.68			NS			5.27			24.87	
M X S	NS			NS			13.92			65.97	
S XM	NS			NS			13.95			65.8	
CV (%) M	9.12			11.88			7.74			13.85	
CV (%) S	6.19			11.12			5.58			9.88	

Table 5.2.10: Management of Sodic soils using nano Zn formulations, uptake of Zinc in grain and straw of rice

Treatments/ Varieties	Kanpur						Mandya					
	Grain Zn uptake			Straw Zn uptake			Grain Zn uptake			Straw Zn uptake		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	58	57	57	83	80	81	40	41	41	89	93	91
ZnSO ₄ @ 0.5 % foliar spray	90	87	88	130	122	126	73	74	74	120	117	119
Nano Zn @ 20 ppm foliar spray	101	100	101	148	140	144	81	86	84	132	134	133
Nano Zn @ 50 ppm foliar spray	132	132	132	186	183	185	105	104	105	158	160	159
Soil application of ZnSO ₄ @ 50kg/ha	129	128	129	181	177	179	117	121	119	157	157	157
Silicic acid @ 40 ppm	77	76	76	101	98	100	74	78	76	115	113	114
Silicic acid @ 80 ppm	84	84	84	112	110	111	81	83	82	122	123	122
Mean	96	95	95	134	130	132	82	84	83	127	128	128
CD M	8.42			17.2			4.52			5.2		
CD S	NS			NS			NS			NS		
M X S	NS			NS			NS			NS		
S XM	NS			NS			NS			NS		
CV (%) M	7.03			10.34			4.33			3.23		
CV (%) S	15.52			10.73			5.89			3.23		

Table 5.2.11: Management of Sodic soils using nano Zn formulations, uptake of Zinc in grain and straw of rice

Treatments/ Varieties	Pusa						Navsari					
	Grain Zn uptake			Straw Zn uptake			Grain Zn uptake			Straw Zn uptake		
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean
Control	78	105	91	112	148	130	38	44	41	154	329	242
ZnSO ₄ @ 0.5 % foliar spray	102	128	115	145	181	163	59	61	60	188	477	333
Nano Zn @ 20 ppm foliar spray	130	152	141	174	227	201	55	55	55	303	549	426
Nano Zn @ 50 ppm foliar spray	142	177	160	213	269	241	73	100	87	193	601	397
Soil application of ZnSO ₄ @ 50kg/ha	158	208	183	223	282	252	57	78	67	335	572	453
Silicic acid @ 40 ppm	102	143	122	145	187	166	66	87	76	266	569	417
Silicic acid @ 80 ppm	113	152	133	165	209	187	51	81	66	288	614	451
Mean	118	152	135	168	215	192	57	72	65	247	530	388
CD M	11.54			33.2			10.95			59.42		
CD S	9.85			6.04			4.31			22.01		
M X S	NS			NS			11.2			58.93		
S XM	NS			NS			11.41			58.24		
CV (%) M	6.8			13.78			16.12			14.56		
CV (%) S	11.02			4.77			12.01			10.2		

Table 5.2.12: Management of Sodic soils using nano Zn formulations, Postharvest soil zinc status (mg/kg)

Treatments/ Varieties	Kanpur			Mandya			Pusa			Navsari	
	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48	Mean	CSR 23	DRR Dhan 48
Control	0.55	0.57	0.56	0.84	0.93	0.88	0.55	0.52	0.54	4.11	3.96
ZnSO ₄ @ 0.5 % foliar spray	0.62	0.63	0.62	1.02	0.97	1.00	0.57	0.55	0.56	4.8	3.77
Nano Zn @ 20 ppm foliar spray	0.69	0.7	0.7	1.04	1.04	1.04	0.58	0.56	0.57	4.19	4.01
Nano Zn @ 50 ppm foliar spray	0.74	0.76	0.75	1.08	1.17	1.12	0.57	0.56	0.56	4.78	4.17
Soil application of ZnSO ₄ @ 50 kg/ha	0.83	0.85	0.84	2.00	1.89	1.94	0.73	0.7	0.72	6.09	6.67
Silicic acid @ 40 ppm	0.6	0.61	0.6	0.84	0.94	0.89	0.56	0.55	0.56	4.96	4.25
Silicic acid @ 80 ppm	0.59	0.61	0.6	0.92	0.89	0.9	0.57	0.55	0.56	5.3	3.38
Mean	0.66	0.68	0.67	1.11	1.12	1.11	0.59	0.57	0.58	4.89	4.32
CD M	0.07			0.06			0.06			0.86	
CD S	NS			NS			NS			0.3	
M X S	NS			NS			NS			0.83	
S XM	NS			NS			NS			0.79	
CV (%) M	8.24			3.97			8.62			17.75	
CV (%) S	8.79			5.52			7.72			11.65	

5. 3. Management of Acid soils (*kharij*)

Acid soils are widespread in the eastern, north-eastern and coastal regions of the Indian Peninsula. They are characterised by poor soil fertility, iron toxicity in lowlands, aluminium toxicity in uplands, depletion of Ca, Mg and K, and deficiency of B, Mo and Si. These soils also fix large quantities of soluble P, leading to sub-optimal crop productivity. Management options include liming to correct soil acidity, balanced application of P, K and silicates, and organic manuring. Additionally, identification of genotypes tolerant to soil acidity with high yield potential can help stabilise rice productivity. The trial was therefore conducted at four locations, viz., Moncompu (Kuttanad, Kerala, soil pH 5.2), Hazaribagh (IARI- Jharkhand, soil pH 5.42), Titabar (Assam, soil pH 5.2) and Umam (Meghalaya) under irrigated conditions during *kharij* 2025. The genotypes Uma and Vasundhara (Moncompu) were evaluated under eight nutrient management treatments viz., i) NPK (Recommended Dose of Fertilizer -RDF), ii) NPK (RDF)+ Silixol spray (at vegetative, booting and grain filling stage), iii) NPK (RDF) + Rice husk ash, 250 kg/ha during land preparation, iv) NPK (RDF) + Dolomite 250 kg/ha 30 days after transplanting, v) NPK (RDF) + Silixol spray (at vegetative, booting and grain filling stage) + Dolomite 250 kg/ha, 30 days after transplanting, vi) NPK (RDF)+ Rice husk ash, 250 kg/ha during land preparation + Dolomite 250 kg/ha, 30 days after transplanting, vii) RDF + Potassium Silicate Solution- Four sprays at 15 days interval starting from 15 DAT (days after transplanting) and viii) RDF + Dolomite + Potassium Silicate solution (Four sprays at 15 days' interval starting from 15 DAT). Crop, soil and weather parameters of the experimental sites (Table 5.3.1) revealed variations in soil pH, organic carbon content, texture and available nutrient status. The experimental results are presented in Tables 5.3.2 – 5.3.14 and briefly discussed.

Yield and yield parameters

At Moncompu, nutrient management practices and genotypes significantly influenced yield parameters (tiller m^{-2} and panicle m^{-2}) and yield. Application of dolomite + potassium silicate spray in combination with RDF (Table 5.3.5) produced significantly higher grain yield (5.68 t/ha) followed by the treatments RDF + Dolomite (5.60 t/ha) and RDF + Dolomite + RHA (5.41 t/ha), recording on par yields. The treatment receiving only RDF recorded the lowest grain yield (3.94 t/ha). Straw yield showed a pattern similar to grain yield, with the treatments RDF + dolomite + potassium silicate spray, RDF + dolomite, and RDF + dolomite + RHA recording the highest straw yields (8.48, 7.95, and 7.77 t/ha, respectively), which were statistically comparable. Significant differences were observed for grain yield and straw yield between the two varieties, with Uma producing the highest grain and straw yields (5.05 t/ha, 7.36 t/ha respectively). Similar to grain yield, the application of RDF +dolomite + potassium silicate (Table 5.3.2), resulted in the highest number of tillers/ m^2 (409) and panicles/ m^2 (300). Neither nutrient management treatments nor varieties significantly influenced 1,000-grain weight. No significant interaction effects between nutrient management treatments and varieties were observed at this centre.

At Hazaribagh (IARI—Jharkhand), grain and straw yields (Table 5.3.6) and yield parameters (Table 5.3.3) such as plant height, tillers per hill⁻¹) and panicle length (cm) of the variety Vasundhara did not show a significant response to nutrient management treatments.

Significant differences were observed among the nutrient management treatments and varieties at Titabar for yield and yield parameters (Table 5.3.7 and Table 5.3.4). The highest grain yield was recorded with RDF + dolomite + silixol spray (4.51 t/ha). Statistically on par yields were also obtained with RDF + dolomite + potassium silicate (4.34 t/ha). The other treatments recorded yields ranging from 3.89 t/ha to 4.19 t/ha, while the lowest yield was observed under RDF alone (3.62 t/ha). Straw yields followed trends similar to grain yields, with RDF + dolomite + silixol spray, RDF + dolomite + potassium silicate recording higher straw yields of 4.85 t/ha and 4.74 t/ha, respectively. Between the two varieties, the genotype Uma recorded significantly superior grain and straw yields (4.22 and 4.59 t/ha) compared to Vasundhara (3.94 t/ha and 4.31 t/ha, respectively). RDF + dolomite + silixol spray and RDF + dolomite + potassium silicate application had higher tillers (16 and 15, respectively) and panicles per hill (14 and 13, respectively). Nutrient management practices did not significantly influence 1,000-grain weight (Table 5.3.4). Varietal differences were significant for 1,000-grain weight, with Vasundhara recording the highest value (23 g). A significant interaction between nutrient management and varieties was observed only for 1,000-grain weight.

At Umam, nutrient management treatments significantly influenced the grain yields but not the straw yields (Table 5.3.8). The highest grain yield (4.06 t/ha) was observed in RDF + Rice Husk Ash (RHA) application, and the lowest yield was recorded under the unfertilized control (3.75 t/ha). Varietal differences were significant for both grain and straw yields, with the Uma variety recording the highest grain and straw yields of 4.08 t/ha and 5.34 t/ha, respectively. No significant interaction was observed between nutrient management treatments and varieties.

Total nutrient uptake

Nutrient management treatments significantly influenced total nutrient uptake at Moncompu (Table 5.3.9). The RDF + dolomite + silicate treatment resulted in significantly higher uptake of nitrogen (122.54 kg/ha), phosphorus (56.74 kg/ha), and potassium (133.20 kg/ha) compared to the other treatments. The NPK uptake of Uma variety (97.50 kg/ha, 45.68 kg/ha and 107.59 kg/ha, respectively) was significantly higher than that of Vasundhara (91.81 kg/ha, 39.84 kg/ha and 100.29 kg/ha, respectively). The interaction between nutrient management treatments and varieties was not statistically significant for NPK uptakes.

At Titabar (Table 5.3.10), NPK uptake recorded for the treatments RDF + dolomite + silixol and RDF + dolomite + silicate (74.36 kg/ha, 13.84 kg/ha and 100.74 kg/ha, respectively and 70.36 kg/ha, 12.83 kg/ha and 96.77 kg/ha, respectively) were significantly higher in comparison to other treatments. The varietal differences for nutrient uptakes were significant, with the NPK uptake of Uma (63.51 kg/ha, 11.31 kg/ha and 87.45 kg/ha, respectively), being significantly higher than that of

Vasundhara (57.24 kg/ha, 9.78 kg/ha and 77.40 kg/ha, respectively). No significant interaction between nutrient management treatments and varieties was observed at Titabar.

Post-harvest soil properties

Post-harvest soil characteristics (pH, EC, OC%) were not significantly influenced by nutrient management treatments or varieties (Table 5.3.11) at Moncompu. The application of RDF + dolomite + silicate resulted in significantly higher available N (256.68 kg/ha) and K (171.35 kg/ha) in soil in comparison with other nutrient management treatments (Table 5.3.12). Among varieties, Uma (10.70 kg/ha) variety recorded higher available P in soils than Vasundhara (10.20 kg/ha). At Titabar (Table 5.3.13 and Table 5.3.14), post-harvest soil characteristics (soil pH, OC%, soil available NPK) were significantly influenced by nutrient management treatments. RDF + dolomite + RHA significantly increased organic carbon, soil pH and available N, P and K. Among varieties, Vasundhara (22.21 kg/ha) variety recorded higher available P in soils than Uma (21.12 kg/ha).

Summary

- Nutrient management significantly influenced yield, yield parameters, and nutrient uptake at most locations, with best performance generally from RDF combined with dolomite and silicate/silixol.
- RDF alone consistently recorded the lowest grain yields across locations.
- Variety Uma outperformed Vasundhara in grain yield, straw yield, and nutrient uptake at most sites.
- No significant interaction effects between nutrient management and varieties were observed in most cases (except limited cases like 1000 grain weight at Titabar).
- Post-harvest soil properties were mostly unaffected, though integrated treatments improved available soil nutrients (N, P, K) at certain locations.

Table 5.3.1: Management of acid soils (*Kharif*-2025)**Soil and crop characteristics**

Parameter	Moncompu	IARI-Jharkhand	Titabar	Umam
Cropping system	Rice - Rice		Rice - Rice	
Rice Variety	Vasundhara and Uma	Vasundhara	Vasundhara and Uma	Vasundhara and Uma
RDF (kg NPK/ha)	90:45:45		60:20:40	Nil
Crop growth				
Soil characteristics				
% Clay		18.47		
% Silt		21.0		
% Sand		60.53		
Soil Texture		Sandy Loam		
pH (1:2.5)	5.2	5.42		
Org. carbon (%)	4.71	0.57	0.82	
CEC [c mol (p+)/kg]	0.02			
EC (ds/m)		0.66		
Avail.N (kg/ha)	270.6	282	300	
Avail. P₂O₅ (kg/ha)	12.22	21.39	20	
Avail. K₂O (kg/ha)	179.2	170	60	
Avail S (mg/kg)				
DTPA -Zn (mg/kg)		0.28		
DTPA -Fe (mg/kg)		1.35		
DTPA -Mn (mg/kg)		2.28		
DTPA -Cu (mg/kg)		0.73		

Table 5.3.2: Management of acid soils (*Kharif-2025*)
Yield parameters at Moncompu

Treatments		Tillers (m ⁻²)			Panicles (m ⁻²)			1000 grain wt. (g)		
Nutrient management (M)										
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	
RDF*	263	278	271	186	196	191	24.63	24.77	24.70	
RDF + Silixol	275	289	282	184	206	195	25.23	24.87	25.05	
RDF + RHA**	310	332	321	225	244	235	24.70	24.53	24.62	
RDF + Dolomite	381	398	390	254	284	269	24.60	24.97	24.78	
RDF + Dolomite+ Silixol	321	352	337	215	227	221	24.37	24.70	24.54	
RDF + Dolomite + RHA**	355	379	367	245	258	252	24.83	24.47	24.65	
RDF + K-Silicate	307	321	314	203	218	211	25.20	24.63	24.92	
RDF + Dolomite + Silicate	400	418	409	293	307	300	25.43	25.00	25.22	
CD (0.05)	28.8			32.8			NS			
CV%	6.92			11.31			2.26			
Varieties (S)										
Vasundhara	327			226			24.87			
Uma	346			243			24.74			
CD (0.05)	11.1			7.9			NS			
Experimental Mean	336.27			234.17			24.81			
Interaction -M X S	NS			NS			NS			
Interaction -S X M	NS			NS			NS			
CV%	5.41			5.48			1.37			

*Recommended Dose of Fertilizer, **Rice Husk Ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

5.3.3: Management of acid soils (*Kharif-2025*)
Yield parameters at IARI-Jharkhand (Variety: Vasundhara)

Treatments	Plant height (cm)	Tillers (hill ⁻¹)	Panicle length (cm)
RDF*	96.45	19.44	19.89
RDF + Silixol	101.56	17.44	19.99
RDF + RHA**	97.67	20.22	20.02
RDF + Dolomite	96.21	18.44	20.42
RDF + Dolomite+ Silixol	99.43	22.11	21.04
RDF + Dolomite + RHA**	94.21	17.67	19.77
RDF + K-Silicate	92.34	19.78	18.29
RDF + Dolomite + Silicate	102.61	19.78	19.07
Experimental mean	97.56	19.36	19.81
CD (0.05)	NS	NS	NS
CV%	5.8	10.24	6.31

*Recommended Dose of Fertilizer, **Rice Husk Ash

5.3.4: Management of acid soils (Kharif-2025)

Yield parameters at Titabar

Treatments	Tillers (hill ⁻¹)			Panicles (hill ⁻¹)			1000 grain wt. (g)		
Nutrient management (M)									
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	12	11	11	9	9	9	22.13	21.77	21.95
RDF + Silixol	15	15	15	12	13	12	22.90	21.63	22.26
RDF + RHA**	12	13	13	11	11	11	22.97	21.53	22.25
RDF + Dolomite	13	13	13	11	11	11	23.07	21.00	22.04
RDF + Dolomite+ Silixol	16	16	16	14	14	14	23.10	21.67	22.38
RDF + Dolomite + RHA**	13	14	14	11	12	12	23.03	21.33	22.18
RDF + K-Silicate	13	14	14	12	12	12	23.50	21.37	22.44
RDF + Dolomite + Silicate	15	15	15	13	13	13	23.27	21.43	22.35
CD (0.05)	1.3			1.4			NS		
CV%	7.32			9.56			2.17		
Varieties (S)									
Vasundhara	14			12			23		
Uma	14			12			21		
CD (0.05)	NS			NS			0.24		
Experimental Mean	14			12			22		
Interaction -M X S	NS			NS			0.65		
Interaction -S X M	NS			NS			0.69		
CV%	7.07			6.11			1.8		

*Rice husk ash, M - Main plot (Nutrient management), S - Subplot (Varieties)

5.3.5: Management of acid soils (*Kharif-2025*)

Grain and Straw Yield at Moncompu

Treatments	Grain yield (t/ha)			Straw yield (t/ha)		
Nutrient management (M)						
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	3.72	4.17	3.94	5.52	5.98	5.75
RDF + Silixol	4.20	4.53	4.37	6.17	6.43	6.30
RDF + RHA**	4.82	5.15	4.98	7.27	7.57	7.42
RDF + Dolomite	5.52	5.68	5.60	7.60	8.30	7.95
RDF + Dolomite+ Silixol	4.58	4.95	4.77	6.97	7.25	7.11
RDF + Dolomite + RHA**	5.33	5.48	5.41	7.57	7.97	7.77
RDF + K-Silicate	5.48	4.67	5.08	6.47	6.82	6.64
RDF + Dolomite + Silicate	5.55	5.80	5.68	8.35	8.60	8.48
CD (0.05)	0.52			0.81		
CV%	8.39			9.14		
Varieties (S)						
Vasundhara	4.90			6.99		
Uma	5.05			7.36		
CD (0.05)	0.19			0.20		
Experimental Mean	4.98			7.18		
Interaction -M X S	NS			NS		
Interaction -S X M	NS			NS		
CV%	6.17			4.65		

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

5.3.6: Management of acid soils (*Kharif-2025*)

Grain and Straw Yield at IARI-Jharkhand (Vasundhara)

Treatments	Grain Yield (t/ha)	Straw Yield (t/ha)
RDF*	2.03	2.85
RDF + Silixol	2.25	3.16
RDF + RHA**	2.46	3.25
RDF + Dolomite	2.30	2.94
RDF + Dolomite+ Silixol	2.75	2.80
RDF + Dolomite + RHA**	2.60	3.68
RDF + K-Silicate	2.15	2.96
RDF + Dolomite + Silicate	2.54	3.28
Experimental mean	2.39	3.11
CD (0.05)	NS	NS
CV%	13.22	15.72

*Recommended Dose of Fertilizer, **Rice Husk Ash

5.3.7: Management of acid soils (Kharif-2025)

Grain and Straw Yield at Titabar

Treatments	Grain yield (t/ha)			Straw yield (t/ha)		
Nutrient management (M)						
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	3.46	3.79	3.62	3.77	4.13	3.95
RDF + Silixol	4.11	4.27	4.19	4.51	4.65	4.58
RDF + RHA**	3.73	4.04	3.89	4.07	4.41	4.24
RDF + Dolomite	3.84	4.12	3.98	4.19	4.50	4.34
RDF + Dolomite+ Silixol	4.37	4.64	4.51	4.78	4.92	4.85
RDF + Dolomite + RHA**	3.93	4.24	4.08	4.29	4.65	4.47
RDF + K-Silicate	3.88	4.22	4.05	4.23	4.61	4.42
RDF + Dolomite + Silicate	4.20	4.48	4.34	4.65	4.83	4.74
CD (0.05)	0.27		0.30			
CV%	5.38		5.39			
Varieties (S)						
Vasundhara	3.94		4.31			
Uma	4.22		4.59			
CD (0.05)	0.14		0.16			
Experimental Mean	4.08		4.45			
Interaction -M X S	NS		NS			
Interaction -S X M	NS		NS			
CV%	5.64		6.02			

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

5.3.8: Management of acid soils (Kharif-2025)

Grain and Straw Yield at Umaim

Treatments	Grain yield (t/ha)			Straw yield (t/ha)		
Nutrient management (M)						
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF* (No fertiliser applied)	3.54	3.96	3.75	4.55	5.16	4.85
RDF + Silixol	3.83	4.05	3.94	4.82	5.24	5.03
RDF + RHA**	3.91	4.21	4.06	5.01	5.27	5.14
RDF + Dolomite	3.86	4.06	3.96	5.01	5.47	5.24
RDF + Dolomite+ Silixol	3.73	4.15	3.94	4.77	5.43	5.10
RDF + Dolomite + RHA**	3.83	4.13	3.98	4.86	5.33	5.09
RDF + K-Silicate	3.73	4.06	3.89	4.80	5.34	5.07
RDF + Dolomite + Silicate	3.57	4.01	3.79	4.97	5.46	5.21
CD (0.05)	0.17			NS		
CV%	3.43			3.79		
Varieties (S)						
Vasundhara	3.75			4.85		
Uma	4.08			5.34		
CD (0.05)	0.08			0.14		
Experimental Mean	3.91			5.09		
Interaction -M X S	NS			NS		
Interaction -S X M	NS			NS		
CV%	3.52			4.53		

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

5.3.9: Management of acid soils (Kharif-2025)
Nutrient (NPK) uptake at Moncompu

Treatments	N uptake (kg/ha)			P uptake (kg/ha)			K uptake (kg/ha)		
Nutrient management (M)									
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	63.93	72.68	68.30	27.40	30.11	28.76	70.83	79.46	75.14
RDF + Silixol	74.57	79.47	77.02	28.98	33.80	31.39	82.57	86.86	84.72
RDF + RHA**	90.69	98.87	94.78	38.86	61.39	50.12	103.73	110.88	107.3
RDF + Dolomite	110.31	119.31	114.81	49.66	54.86	52.26	116.76	127.62	122.19
RDF + Dolomite+ Silixol	84.68	89.63	87.16	35.53	38.69	37.11	96.43	103.22	99.82
RDF + Dolomite + RHA**	101.17	110.53	105.85	45.80	50.27	48.04	111.79	120.43	116.11
RDF + K-Silicate	89.29	84.24	86.76	37.05	38.30	37.68	91.61	94.47	93.04
RDF + Dolomite + Silicate	119.85	125.23	122.54	55.47	58.00	56.74	128.58	137.81	133.2
CD (0.05)	7.39			10.81			9.76		
CV%	6.31			20.42			7.58		
Varieties (S)									
Vasundhara	91.81			39.84			100.29		
Uma	97.50			45.68			107.59		
CD (0.05)	3.2			5.05			3.54		
Experimental Mean				42.76			103.94		
Interaction -M X S	NS			NS			NS		
Interaction -S X M	NS			NS			NS		
CV%	5.53			19.32			5.57		

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

5.3.10: Management of acid soils (Kharif-2025)

Nutrient (NPK) uptake at Titabar

Treatments	N uptake (kg/ha)			P uptake (kg/ha)			K uptake (kg/ha)		
Nutrient management (M)									
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	42.95	49.34	46.14	6.95	8.08	7.52	55.99	62.59	59.29
RDF + Silixol	63.44	67.05	65.24	10.48	12.06	11.27	81.11	87.95	84.53
RDF + RHA**	49.01	54.05	51.53	8.21	9.82	9.02	66.80	84.12	75.46
RDF + Dolomite	51.83	57.25	54.54	8.72	9.92	9.32	69.17	80.52	74.84
RDF + Dolomite+ Silixol	70.89	77.84	74.36	13.22	14.47	13.84	96.99	104.48	100.74
RDF + Dolomite + RHA**	55.03	63.58	59.30	8.80	10.63	9.72	75.40	86.25	80.82
RDF + K-Silicate	58.14	64.9	61.52	9.99	11.71	10.85	81.31	92.61	86.96
RDF + Dolomite + Silicate	66.62	74.09	70.36	11.88	13.78	12.83	92.44	101.10	96.77
CD (0.05)	5.69			1.5			7.08		
CV%	7.61			11.46			6.94		
Varieties (S)									
Vasundhara	57.24			9.78			77.40		
Uma	63.51			11.31			87.45		
CD (0.05)	2.17			1.06			4.44		
Experimental Mean	60.38			10.54			82.43		
Interaction -M X S	NS			NS			NS		
Interaction -S X M	NS			NS			NS		
CV%	5.88			16.44			8.81		

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

Table 5.3.11: Management of acid soils (*Kharif-2025*)
Post-harvest soil characteristics at Moncompu (Soil pH, OC% and EC)

Treatments	Soil pH			Soil OC %			Soil EC		
Nutrient management (M)									
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	5.10	5.17	5.14	4.33	4.30	4.32	0.03	0.04	0.04
RDF + Silixol	5.20	5.07	5.14	4.34	4.36	4.35	0.03	0.04	0.04
RDF + RHA**	5.23	5.17	5.20	4.57	4.51	4.54	0.04	0.02	0.03
RDF + Dolomite	5.23	5.20	5.22	4.64	4.58	4.61	0.03	0.03	0.03
RDF + Dolomite+ Silixol	5.13	5.23	5.18	4.49	4.44	4.46	0.04	0.03	0.04
RDF + Dolomite + RHA**	5.20	5.17	5.18	4.54	4.54	4.54	0.02	0.03	0.02
RDF + K-Silicate	5.10	5.13	5.12	4.45	4.41	4.43	0.04	0.03	0.04
RDF + Dolomite + Silicate	5.2	5.23	5.22	4.59	4.62	4.60	0.03	0.03	0.03
CD (0.05)	NS			NS			NS		
CV%	3.16			52.17			4.43		
Varieties (S)									
Vasundhara	5.17			0.03			4.49		
Uma	5.17			0.03			4.47		
CD (0.05)	NS			NS			NS		
Experimental Mean	5.17			0.03			4.48		
Interaction -M X S	NS			NS			NS		
Interaction -S X M	NS			NS			NS		
CV%	1.95			25.62			8.58		

*Rice husk ash, M - Main plot (Nutrient management), S - Subplot (Varieties)

**Table 5.3.12: Management of acid soils (*Kharif-2025*)
Post-harvest soil available nutrients (NPK) at Moncompu**

Treatments	Available N (kg/ha)			Available P (kg/ha)			Available K (kg/ha)		
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
Nutrient management (M)									
RDF*	228.83	231.80	230.32	9.10	9.23	9.16	146.20	148.90	147.55
RDF + Silixol	231.97	234.80	233.38	9.27	11.33	10.30	150.63	152.93	151.78
RDF + RHA**	244.40	246.67	245.54	10.07	10.67	10.37	157.90	162.07	159.98
RDF + Dolomite	250.63	253.87	252.25	10.93	11.40	11.16	166.37	169.77	168.07
RDF + Dolomite+ Silixol	239.83	244.97	242.40	10.13	10.23	10.18	154.60	157.87	156.24
RDF + Dolomite + RHA**	248.20	256.10	252.15	11.03	11.13	11.08	162.60	160.57	161.58
RDF + K-Silicate	235.47	239.53	237.50	9.67	9.90	9.78	152.07	154.43	153.25
RDF + Dolomite + Silicate	254.33	259.03	256.68	11.40	11.67	11.54	170.73	171.97	171.35
CD (0.05)	16.42			NS				11.16	
CV%	5.44			12.74				5.68	
Varieties (S)									
Vasundhara	241.71			10.20			157.64		
Uma	245.85			10.70			159.81		
CD (0.05)	NS			0.46			NS		
Experimental Mean	243.78			10.45			158.73		
Interaction -M X S	NS			NS			NS		
Interaction -S X M	NS			NS			NS		
CV%	3.23			7.27			5.59		

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

Table 5.3.13: Management of acid soils (*Kharif-2025*)

Post-harvest soil characteristics at Titabar

Treatments	Soil pH			Soil OC %		
Nutrient management (M)						
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	5.00	5.03	5.02	0.84	0.83	0.84
RDF + Silixol	5.00	5.07	5.04	0.85	0.84	0.84
RDF + RHA**	5.03	4.90	4.96	0.87	0.90	0.88
RDF + Dolomite	5.80	5.87	5.84	0.85	0.85	0.85
RDF + Dolomite+ Silixol	5.87	5.93	5.90	0.85	0.84	0.84
RDF + Dolomite + RHA**	5.93	5.97	5.95	0.90	0.87	0.88
RDF + K-Silicate	5.07	5.17	5.12	0.84	0.85	0.84
RDF + Dolomite + Silicate	5.90	5.93	5.92	0.85	0.84	0.84
CD (0.05)	0.17			0.03		
CV%	2.56			2.69		
Varieties (S)						
Vasundhara	5.45			0.86		
Uma	5.48			0.85		
CD (0.05)	NS			NS		
Experimental Mean	5.47			0.85		
Interaction -M X S	NS			NS		
Interaction -S X M	NS			NS		
CV%	2.87			2.52		

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

Table 5.3.14: Management of acid soils (*Kharif-2025*)

Post-harvest soil available nutrients at Titabar

Treatments	Available N (kg/ha)			Available P (kg/ha)			Available K (kg/ha)		
Nutrient management (M)									
	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean	Vasundhara	Uma	Mean
RDF*	310.00	312.67	311.34	20.67	20.00	20.34	160.00	159.33	159.66
RDF + Silixol	310.00	311.00	310.5	20.33	20.00	20.16	161.00	160.33	160.66
RDF + RHA**	313.33	312.00	312.66	22.33	21.67	22.00	163.33	162.00	162.66
RDF + Dolomite	315.33	314.67	315.00	22.00	21.33	21.66	160.33	161.00	160.66
RDF + Dolomite+ Silixol	316.67	317.33	317.00	23.00	21.67	22.34	161.33	161.67	161.50
RDF + Dolomite + RHA**	321.67	318.00	319.84	23.33	22.00	22.66	165.00	164.33	164.66
RDF + K-Silicate	312.00	311.67	311.84	22.00	20.33	21.16	162.33	161.33	161.83
RDF + Dolomite + Silicate	313.33	316.33	314.83	24.00	22.00	23.00	162.00	162.00	162.00
CD (0.05)	4.04			1.53			2.71		
CV%	1.04			5.71			1.35		
Varieties (S)									
Vasundhara	314.04			22.21			161.92		
Uma	314.21			21.12			161.50		
CD (0.05)	NS			0.83			NS		
Experimental Mean	314.13			21.67			161.71		
Interaction -M X S	NS			NS			NS		
Interaction -S X M	NS			NS			NS		
CV%	1.43			6.25			0.73		

*Rice husk ash, M – Main plot (Nutrient management), S – Subplot (Varieties)

Trial 5.4: Residue Management in Rice-Based Cropping Systems (RBCS)

India *generates* approximately 500 million tonnes of crop residues annually, of which paddy straw constitutes nearly one-third (~160 million tonnes). The large-scale adoption of combine harvesters in rice cultivation has dramatically increased the volume of loose straw left in the field after harvest. Compounding this is the extremely narrow time window — often as little as one to three weeks — between rice harvest and the sowing of the subsequent wheat crop RBCS. This severely constrains a farmer's ability to manage residue through any means other than the quickest and cheapest option i.e., burning. From an environmental standpoint, open-field burning of rice straw contributes significantly to greenhouse gas (GHG) emissions and carbon monoxide (CO), and volatile organic compounds (VOCs) that severely degrade ambient air quality. From a soil health perspective, burning destroys the surface organic matter layer and eliminates the beneficial soil microflora and microfauna, leading to long-term deterioration in soil biological activity and aggregate stability.

Paradoxically, rice straw represents a considerable repository of plant nutrients: a tonne of rice straw contains approximately 5–8 kg N, 1.0–1.5 kg P, 12–16 kg K and 50–70 kg Si. Burning dissipates virtually all the nitrogen and sulphur as gases and a significant portion of the other nutrients is rendered unavailable through volatilisation or ash run-off. *In-situ* incorporation of residue, when managed correctly, can therefore serve as a supplement to chemical fertilisers, improving soil organic carbon and water retention capacity. The key challenge that has historically limited residue incorporation has been the slow decomposition rate under field conditions, particularly for recalcitrant components such as cellulose, hemicellulose and lignin.

In light of the above, the present trial initiated during *Kharif* 2023 was taken up with the following objectives:

- To evaluate the effect of crop residue incorporation, with and without Pusa Decomposer, on the grain and straw yield of rice.
- To determine the extent to which residue-derived nitrogen can substitute for chemical fertiliser nitrogen without yield penalty.
- To assess the influence of residue management practices on NPK uptake, nutrient use efficiency (NUE) and post-harvest soil nutrient status.

Experimental Centres, Locations and Cropping Systems

During *Kharif* 2025, the trial was conducted at nine centres spread across multiple states, encompassing a diverse spectrum of soil types, agro-climatic zones, rainfall regimes and prevalent cropping systems. The nine centres, their locations and the cropping systems being followed are summarized below:

Code	Centre / Location	State	Agro-climatic Zone	Cropping System
CHP	Chiplima, OUAT	Odisha	E. Coastal Plains & Hills	Rice – Rice
KNP	Kanpur, NDUA&T	Uttar Pradesh	Upper Gangetic Plain	Rice – Wheat
KRK	Karaikal, TNAU	Tamil Nadu / Puducherry	Coastal Agro-climatic Zone	Rice – Wheat
KUL	Kaul, HAU	Haryana	Trans-Gangetic Plain	Rice – Wheat
KHD	Khudwani, SKUAST-K	Jammu & Kashmir	Himalayan Mid-altitude	Rice – Brown Sarson
MTU	Maruteru, ANGRAU	Andhra Pradesh	Krishna-Godavari Delta	Rice – Rice
MCU	Moncompu, KAU	Kerala	Kuttanad Wetland	Rice – Rice
PNT	Pantnagar, GBPUAT	Uttarakhand	Tarai & Bhabhar	Rice – Wheat
PSA	Pusa, RAU	Bihar	Middle Gangetic Plain	Rice – Wheat

The Rice–Wheat rotation, prevalent across five centres (KNP, KRK, KUL, PNT, PSA), is the dominant cropping system of the IGP area. The Rice–Rice double-cropped system (CHP, MTU, MCU) represents the coastal and deltaic rice bowls of eastern and southern India. Khudwani (KHD) is unique in being situated in the temperate Himalayan zone with the Rice–Brown Sarson system, a shorter and climatically constrained rotation. The diversity of centres thus provides a robust multi-environment test for the treatments.

Experimental Design and Treatments

The experiment was laid out in a Randomised Block Design (RBD) with three replications at each centre. Six treatments were evaluated (Table 5.4.1), representing a gradient of mineral fertiliser substitution by organic residue-based nitrogen sources:

In T 2 and 3, 50% of the Recommended Dose of Nitrogen (RDN) was supplied through crop residues incorporated into the soil, while the remaining 50% was applied as chemical fertiliser. T 4 replaced the RDF component with green manure (GM) or green leaf manure (GLM) to supply an equivalent quantum of nitrogen on a 50:50 bases, providing comparison with a biologically-fixed N source. T 5 applied 75% of the chemical fertiliser N and supplemented the remaining 25% through crop residues with Pusa Decomposer. T 3 and T 5 differed from T 2 and 4 by the addition of Pusa Decomposer to catalyse residue decomposition. Phosphorus and Potassium were applied as per the recommended dose in all fertiliser treatments.

Soil and Crop Characteristics

The soil and crop parameters of the experimental sites are presented in Table 5.4.2. Pronounced variability in soil characteristics was observed across centres — a feature that lends ecological validity to the multi-location design and allows generalisation of treatment effects across diverse soil orders and fertility classes. Soil texture ranged from sandy loam (KNP, KRK, PSA) through loam (KUL), silty clay loam (KHD, PNT), clay loam (MTU) to sandy clay (MCU). Organic carbon was generally low across most centres (0.47–0.95%), except at Moncompu (MCU) where the Kuttanad wetland conditions yielded an exceptionally high OC of 4.86%. Soil pH varied from mildly acidic at KRK (5.8), KHD (6.5) and MTU (5.89) to alkaline at PSA (8.59). Available nitrogen was lowest at MTU (138 kg/ha) and PNT (160 kg/ha) and highest at KUL and KHD (301 kg/ha each). Available K₂O was particularly high at MTU (342 kg/ha) owing to clay loam texture, while KRK had very low available K (33.52 kg/ha), likely attributable to sandy loam texture and high leaching under coastal rainfall conditions.

Rice productivity (*Kharif* 2025)

The grain yield data presented in Table 5.4.3 reveal a consistent and readily interpretable pattern across the nine centres, with most showing a clear response to nutrient management source and rate. The mean grain yield across all centres ranged from 3,696 kg/ha at Pantnagar (PNT) to 6,609 kg/ha at Khudwani (KHD), reflecting the expected productivity variation driven by variety, solar radiation, and agro-climatic conditions rather than treatment alone.

100% RDF registered the highest numerical yield at all nine centres, ranging from 4,117 kg/ha (KRK) to 7,310 kg/ha (KHD). However, statistically superior was observed over residue-based treatments only at certain centres. At Pantnagar (PNT), 100% RDF (4,833 kg/ha) was statistically superior to all residue treatments, including T5 (4,473 kg/ha).

The most agronomically significant finding from the grain yield data is the performance of T5 (75% RDF + 25% Residue + Pusa Decomposer). At seven of the nine centres i.e., CHP, KNP, KUL, KHD, MTU, MCU and PSA — T 5 was statistically on par with the 100% RDF. This result has demonstrated that up to 25% of the chemical

fertiliser nitrogen can be replaced by residue-incorporated nitrogen, when supported by microbial decomposition catalysed by Pusa Decomposer, without yield penalty. The biological mechanism underlying this equivalence lies in the temporal synchrony between the mineralization of Residue-N (accelerated by Pusa Decomposer) and the active N-uptake phase of rice, thereby ensuring that residue-derived nitrogen becomes plant-available at the critical tillering and panicle initiation stages.

T 3 (50% Residue + 50% RDF + Pusa Decomposer) performed better than T2 (50% Residue + 50% RDF) at most centres, confirming the positive contribution of microbial culture to residue decomposition and nutrient release. At CHP (4,925 vs 4,588 kg/ha) and KNP (5,250 vs 4,981 kg/ha) for instance, the addition of Pusa Decomposer in T3 recovered a substantial portion of the yield gap caused by the 50% reduction in chemical fertiliser N.

T4 (50% Residue + 50% GM/GLM) showed variable performance. At KRK (4,033 kg/ha), T 4 was actually numerically higher than 100% RDF (4,117 kg/ha), though the differences were non-significant. At KUL, however, the GM/GLM treatment (3,464 kg/ha) showed a dramatic shortfall relative to 100% RDF (6,091 kg/ha). This variability likely reflects the difficulty in sourcing and applying sufficient GM/GLM biomass to meet the target 50% RDN in all sites, and the differential C: N ratios and decomposition dynamics of the green manure species used. In regions where high-nitrogen green manure species (e.g., *Sesbania aculeata*, *Gliricidia sepium*) are available and can be incorporated early, the treatment performs competitively; where this condition is not met, nutrient immobilization during decomposition of High-C materials can temporarily deplete mineral N.

The absolute control (no fertiliser or residue) confirmed the basal productivity of rice under inherent soil fertility alone. Its yields ranged from 1,414 kg/ha (PNT) — reflecting the inherently low available N soil of the Tarai at 160 kg N/ha — to 5,584 kg/ha (KHD), where the high available N status (301 kg/ha), favourable soil moisture and the cool temperate climate collectively support reasonable productivity even without fertiliser inputs. Straw yield data presented in Table 5.4.4 largely followed the trends observed for grain yield, confirming that treatment effects were consistent across the entire plant biomass and not restricted to the harvestable grain fraction. The Harvest Index (HI) across treatments was broadly stable within each centre, suggesting that nitrogen source did not significantly alter the partitioning of assimilates between grain and straw. Straw yields were particularly high at KRK (8,588 kg/ha) and KHD (7,927 kg/ha), reflecting high vegetative biomass accumulation associated with CO 51 variety (KRK) and Shalimar Rice 4 (KHD). The lowest straw yields were observed at PNT (4,185 kg/ha), consistent with the lower grain yield and a semi-dwarf variety at that location. The pattern that T5 (75% RDF + 25% Residue + PD) produced straw yields on par with 100% RDF at most centres reaffirms its merit as a balanced production option.

Higher straw yields, particularly in the Rice–Rice double-cropped systems (CHP, MTU, MCU), mean a larger residue quantum must be managed, making Pusa Decomposer application progressively more important for those systems to prevent immobilisation-associated yield penalties.

Rabi (2024–25)

Rabi season yield data were available from four centres — CHP, KNP, KRK and MTU — where either a second rice crop or a wheat crop follows the *Kharif* rice. The data demonstrate that the residue management strategies adopted in *Kharif* did not adversely affect the succeeding *Rabi* crop and, in many cases, showed numerical trends toward higher yields under the residue incorporation treatments, particularly when Pusa Decomposer was applied (Table 5.4.4a). At Maruteru (MTU, Rice–Rice system), T5 (75% RDF + 25% Residue + PD) recorded the highest straw yield of 9,423 kg/ha, and T2 (50% Residue + 50% RDF) produced the highest grain yield (5,870 kg/ha), indicating a carryover benefit of residue incorporation on the second rice crop — likely mediated by improved soil aggregation, moisture retention and enhanced microbial N mineralization from the partially decomposed *Kharif* residue. At Kanpur (KNP), under the Rice–Wheat system, *Rabi* wheat grain yields showed a modest but consistent advantage for residue incorporation treatments over the absolute control. T5 (5,108 kg/ha) and T1 (5,097 kg/ha) were on par, again confirming the equivalence of 75% chemical N + 25% residue N in maintaining crop productivity across seasons.

Nutrient Uptake (*Kharif* 2025)

The nitrogen uptake data confirm that 100% RDF consistently maintained the highest N uptake at most centres, with values ranging from 73.3 kg N/ha (KRK – control) to 153.0 kg N/ha (KHD – 100% RDF). The absolute control recorded the lowest N uptake values across all centres, with PNT showing an extremely low uptake of only 18.3 kg N/ha — consistent with its low grain yield and soil N availability. Among the residue treatments, T5 (75% RDF + 25% Residue + PD) recorded nutrient uptake values on par with or close to 100% RDF at most centres (CHP: 83.5 vs 94.7; KNP: 119.9 vs 122.4; KHD: 144.6 vs 153.0 kg N/ha), with statistically significant differences observed only at centres. This pattern is consistent with the grain yield data and validates the agronomic sufficiency of the 75:25 RDF: Residue-N ratio. T3 (50% Residue + 50% RDF + PD) showed intermediate uptake, consistently higher than T2 (without PD), reinforcing the role of microbial inoculation in accelerating N release from residue.

The N uptake under T4 (50% GM/GLM) was variable, tracking its yield performance. At centres where GM/GLM was incorporated (KRK, MTU), N uptake under T4 was comparable to T3, but at KUL — where yield under T4 was severely depressed — N uptake was correspondingly the lowest among fertilized treatments (52.8 kg N/ha vs 127.4 for 100% RDF), pointing to inadequate or poorly timed N availability from the GM source. Potassium uptake values were consistently high across centres (159 kg K/ha under 100% RDF), particularly at Karaikal (KRK) — a coastal location with

calcareous sandy loam soils of very low available K. Residue incorporation is particularly valuable for K cycling, since rice straw is an exceptionally rich K source (~12–16 kg K per tonne), and its return to the field can cumulatively replenish the K pool that is otherwise mined by grain + straw export under non-residue systems.

Nutrient Use Efficiency (*Kharif 2025*)

A key agronomic indicator often overlooked in favour of absolute yield is nutrient use efficiency (NUE), defined here as kilograms of grain produced per kilogram of nutrient taken up. The NUE data reveal a striking and consistent pattern: the absolute control (no fertiliser, no residue) invariably recorded the highest NUE for N across nearly all centres (e.g., 76.5 at CHP; 73.3 at KUL; 75.0 at MCU) (Table 5.4.6 & 6a). Among fertilized treatments, the residue-based treatments (T2, T3, T4, T5) generally exhibited higher NUE-N than 100% RDF (T1). At CHP, NUE-N for 100% RDF was 53.5 kg grain/kg N, compared to 61.2 for T2, 56.1 for T3, 68.0 kg grain/kg N for T4 and 56.7 kg grain/kg N for T5. Residue-derived N, is released more slowly and progressively through microbial mineralisation, thereby better synchronising with crop demand phases and reducing luxury uptake and N losses. The result is lower total N uptake per unit grain produced, i.e., higher NUE under residue treatments.

Phosphorus use efficiency (PUE), expressed as kg grain / kg P uptake, was exceptionally high across all centres (range: ~100–940 kg grain/kg P), the plant takes up relatively small amounts of P (2–20 kg P/ha), partly because most soil P and applied P is rapidly fixed. The absolute control recorded the highest PUE at most centres, again due to the dilution effect, while 100% RDF showed the lowest PUE, because the additional fertiliser P applied beyond crop requirements accumulated in the soil or was taken up without proportional yield gain. T4 (50% GM/GLM) showed competitive PUE at several centres (578.6 at CHP), possibly because GM/GLM contributes P through organic matter decomposition without adding excess inorganic P.

Post-Harvest Soil Nutrient Status (*Kharif 2025*)

Post-harvest available soil nutrient data (Tables 5.4.8 & 5.4.8a) reveal that residue incorporation treatments maintained soil N status on par with or slightly below 100% RDF at most centres. The absolute control consistently recorded the lowest post-harvest available N — for instance, 245.5 kg N/ha at CHP, 207.0 kg N/ha at KNP and 259.6 kg N/ha at KHD — compared to 265.3, 242.0 and 302.7 kg N/ha, respectively under 100% RDF, differences that were statistically significant at several centres. Notably, T4 (50% Residue + 50% GM/GLM) recorded numerically higher post-harvest available N at some centres (199.9 kg N/ha at KRK vs 167.0 under 100% RDF), suggesting that the green manure treatment, ultimately contributed net N to the soil post-harvest through organic matter decomposition.

Post-harvest soil available K data showed relatively minor treatment differences at most centres. At MTU (Maruteru), post-harvest K was consistently high (270–322

kg/ha) despite the high in-crop K uptake, reflecting the substantial non-exchangeable K pool in the clay loam soils that equilibrates with the solution and exchangeable K pool during the fallow period. The overall message from the soil nutrient data is reassuring for the sustainability of residue incorporation practices: the treatments did not lead to soil nutrient mining (depletion below the 100% RDF benchmark) over the course of the season, and in some instances the organic residue treatments contributed to an improved post-harvest soil N status.

Summary

Incorporation of 25% residue along with 75% RDF + Pusa Decomposer) produced grain yields statistically on par with 100% RDF at seven of nine *Kharif* centres (CHP, KNP, KUL, KHD, MTU, MCU, PSA), demonstrating that 25% of the recommended chemical fertiliser nitrogen can be replaced by residue-derived nitrogen without a yield penalty. The addition of Pusa Decomposer consistently improved the performance of residue treatments by accelerating cellulose degradation and synchronizing Residue-N mineralisation with crop uptake demand. NPK uptake was highest under 100% RDF, followed by T5 (75% RDF + 25% Residue + Pusa Decomposer), with residue treatments on par with each other in most cases and the absolute control recording the lowest uptake. Total N uptake ranged from 17–153 kg/ha, P from 2.5–73.8 kg/ha and K from 14–165 kg/ha across centres and treatments. Residue-based treatments consistently exhibited higher nitrogen use efficiency (NUE-N) than 100% RDF, owing to better synchrony between residue N mineralisation and crop N demand, reducing luxury uptake and N loss pathways. Post-harvest soil nutrient status was maintained at par across treatments at most centres, with the absolute control showing marginally depleted soil N. This confirms that residue incorporation does not mine soil fertility relative to pure chemical fertilization in the short term. *Rabi* season data from four centres indicate that carryover effects of *Kharif* residue incorporation were neutral to mildly positive for the succeeding crop, with residue treatments performing on par with or above 100% RDF at several centres.

**Table 5.4.1: Treatment Details – Residue Management Trial (RBCS)
(*Kharif 2025*)**

Sl.No	Treatments
1	100% RDF (Recommended Dose Fertilizer)
2	50% Residue + 50% RDF
3	50% Residue + 50% RDF + Pusa decomposer
4	50% Residue + 50% GM/GLM
5	75% RDF + 25% residue + Pusa Decomposer
6	Absolute control

Table 5.4.2: Soil and Crop Characteristics at Experimental Centres (*Kharif* 2025)

Parameter	CPM	KNP	KRK	KUL	KHD	MTU	MCU	PNT	PSA
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Cropping system	Rice - Rice	Rice - Wheat	Rice - Wheat	Rice - Wheat	Rice - Brown-sarson	Rice - Rice	Rice - Rice	Rice - Wheat	Rice-Wheat
Variety									
<i>Kharif</i>	MTU 1156	Sarjoo-52	CO 51	HKR 47	Shalimar rice	MTU 1061	Uma	Dhan - 18	Rajendra
<i>Rabi</i>	-	-	BPT	-	-	MTU 1121	-	-	-
RFD (Kg NPK/ha)									
<i>Kharif</i>	80:40:40	120:60:60	150:50:50	150:60:60	120:60:30	90:60:60	90:45:45	120:60:30	120:60:40
<i>Rabi</i>	-	-	150:50:50	-	-	180:90:60	-	-	-
Crop growth									
<i>Kharif</i>	Good	Good	Good	Good	Good	Good	Good	Good	Good
<i>Rabi</i>	Good	Good	Good	-	-	Good	-	-	Good
Soil data									
% clay	21	17.83	16.2	37	37	38	30.1	25.9	15
% silt	15	22.77	4.5	45	45	28	24.3	61.4	26
% sand	64	59.40	72.76	18	18	34	45.6	12.9	59
Soil Texture	sandy clay	sandy loam	sandy loam	Loam	Silty clay	clay loam	Sandy clay	Silty clay	Sandy loam
pH (1:1)	6.58	7.6	5.8	6.5	6.5	5.89	5.23	7.2	8.59
Org. carbon	0.47	0.58	0.676	0.95	0.95	0.69	4.86	0.62	0.51
CEC [cmol(p+)]	-	-	9.2	-	-	48.6	-	23.2	-
EC (ds/m)	0.11	0.58	0.157	0.21	0.21	0.99	0.04	0.36	0.19
Avail.N (kg/ha)	251	224	247.7	301	301	138	285.6	160	239.8
Avail. P ₂ O ₅	19.2	23.9	28.14	15.38	15.8	56.7	18.04	10.2	19.2
Avail. K ₂ O (kg/ha)	161	212	33.52	218	218	342	224	210	208.2

Table 5.4.3: Grain Yield (kg/ha) of Rice in RBCS as influenced by Residue Management (Kharif 2025)

Treatments	Grain Yield (Kg/ha)									
	CHP	KNP	KRK	KUL	KHD	MTU	MCU	PNT	PSA	
100% RDF	5064	5481	4117	6091	7310	6373	5763	4833	5015	
50% Residue + 50% RDF	4588	4981	3650	5154	6401	5150	4275	3725	4545	
50% Residue + 50% RDF + Pusa decomposer	4925	5250	3692	5386	6668	5523	4825	3923	4680	
50% Residue + 50% GM/GLM	4494	4844	4033	3464	6536	5383	4513	3808	4328	
75% RDF + 25% residue + Pusa decomposer	4981	5389	3792	5704	7158	6367	5488	4473	4800	
Absolute control	3981	2475	3375	2375	5584	3567	2988	1414	2753	
Exp. Mean	4672	4737	3776	4696	6609	5394	4642	3696	4353	
CD (0.05)	517.5	517.9	NS	411.2	552.8	465.4	667.3	74.2	530.0	
CV (%)	7.3	7.2	16.4	4.8	5.5	5.7	9.5	1.3	8.0	

Table: 5.4.4 Straw Yield (*Kharif* 2025) in RBCS as influenced by Residue Management

Treatments	Straw Yield (Kg/ha)								
	CHP	KNP	KRK	KUL	KHD	MTU	MCU	PNT	PSA
100% RDF	5351	7236	8800	8539	8762	7352	7613	5140	7230
50% Residue + 50% RDF	4905	6536	8633	7446	7726	8176	5725	4344	6343
50% Residue + 50% RDF + Pusa decomposer	5215	6909	9383	7483	7869	8440	6375	4645	6533
50% Residue + 50% GM/GLM	4751	6272	9083	5020	7904	7856	6063	4395	5900
75% RDF + 25% residue + Pusa decomposer	5150	7061	8292	8046	8607	8108	7238	4870	6825
Absolute control	4185	3144	7333	3987	6692	4739	4088	1714	4215
Exp. Mean	4926	6193	8588	6753	7927	7445	6183	4185	6174
CD (0.05)	509.9	624.2	NS	399.5	664.3	638.2	855.9	78.7	752.4
CV (%)	6.8	6.6	16.6	3.2	5.5	5.6	9.1	1.2	8.0

Table: 5.4.4a Grain and Straw Yields (*Rabi* 2024-2025) in RBCS as influenced by Residue Management

Treatments	Grain Yield (Kg/ha)				Straw Yield (Kg/ha)			
	CHP	KNP	KRK	MTU	CHP	KNP	KRK	MTU
100% RDF	5097	4537	3364	5636	6813	6606	4011	7397
50% Residue + 50% RDF	4982	4114	3636	5870	6035	5809	4455	9160
50% Residue + 50% RDF + Pusa decomposer	5037	4328	3686	5996	6163	6277	5220	8933
50% Residue + 50% GM/GLM	4865	3842	4320	5470	6140	5380	4338	8797
75% RDF + 25% residue + Pusa decomposer	5108	4435	4085	5796	6425	6455	4398	9423
Absolute control	4052	1823	3170	3543	5500	2478	3847	6807
Exp. Mean	4857	3846	3710	5385	6179	5501	4378	8419
CD (0.05)	469.0	417.8	738.8	516.0	632.3	595.8	NS	514.4
CV (%)	6.4	7.1	13.1	6.3	6.7	7.1	17.8	4.0

Table 5.4.5 Total Nutrient Uptake (kg/ha) by Rice Crop as influenced by Residue Management – Kharif 2025

Treatments	CHP [1]			KNP [2]			K RK [3]			K UL [4]			K HD [5]		
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
100% RDF	94.7	13.5	109.1	122.4	37.6	125.1	73.3	11.0	159.4	127.4	31.5	145.5	153.0	30.6	143.5
50% Residue + 50% RDF	74.9	8.5	87.8	109.0	31.4	108.8	71.7	16.8	160.7	90.6	21.7	99.1	125.9	24.3	121.7
50% Residue + 50% RDF + Pusa decomposer	88.0	11.6	99.9	116.5	34.4	116.7	108.4	13.0	181.0	98.1	22.7	102.0	129.4	25.2	124.7
50% Residue + 50% GM/ GLM	66.1	7.8	74.1	102.4	29.2	102.2	106.1	12.7	174.6	52.8	12.3	55.1	127.4	25.1	124.0
75% RDF + 25% residue + Pusa decomposer	83.5	9.3	95.6	119.9	36.4	121.9	89.1	12.1	160.0	115.2	29.0	130.9	144.6	28.1	137.0
Absolute control	52.2	4.4	59.1	44.6	13.0	44.6	76.2	14.9	150.8	32.4	7.4	37.7	102.8	18.6	101.5
Exp. Mean	76.6	9.2	87.6	102.5	30.3	103.2	87.5	13.4	164.4	86.1	20.8	95.1	130.5	25.3	125.4
CD (0.05)	9.2	1.1	8.3	10.2	4.8	11.4	23.3	NS	NS	7.0	2.0	6.0	10.1	3.3	10.6
CV (%)	7.9	7.7	6.2	6.5	10.4	7.3	17.5	45.6	17.0	4.4	5.2	6.4	5.1	8.6	5.5

Table 5.4.5a Total Nutrient Uptake (kg/ha) by Rice Crop as influenced by Residue Management – Kharif 2025

Treatments	MTU [6]			MCU [7]			PNT [8]			PSA [9]		
	N	P	K	N	P	K	N	P	K	N	P	K
100% RDF	88.2	42.5	94.7	115.4	55.8	119.4	89.2	16.1	84.9	109.5	24.9	116.8
50% Residue + 50% RDF	72.2	36.0	74.9	68.7	30.4	76.7	56.5	11.4	56.5	95.4	20.2	94.6
50% Residue + 50% RDF + Pusa decomposer	79.1	30.5	88.0	88.4	40.2	93.4	55.1	12.1	55.1	98.7	21.3	99.5
50% Residue + 50% GM/GLM	75.0	32.8	66.1	76.1	33.5	84.8	58.6	12.0	58.6	86.0	18.3	84.7
75% RDF + 25% residue + Pusa decomposer	84.1	37.9	83.5	103.9	52.2	110.1	74.9	15.0	74.9	104.9	23.0	107.6
Absolute control	50.8	21.6	52.2	39.7	18.3	50.4	18.3	3.6	18.3	54.5	11.7	59.1
Exp. Mean	74.9	33.5	76.6	82.0	38.4	89.1	58.1	11.7	58.1	91.5	19.9	93.7
CD (0.05)	13.3	8.0	16.3	13.4	8.5	10.8	4.0	1.4	4.0	11.3	2.0	12.3
CV (%)	11.7	15.7	7.6	10.7	14.5	7.9	4.6	7.7	4.6	8.2	6.5	8.6

Table: 5.4.6 Nutrient use efficiency (Kg grain /kg uptake) in rice crop as influenced by Residue Management (*Kharif 2025*)

Treatments	CHP [1]			KNP [2]			KRRK [3]			KUL [4]			KHD [5]		
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
100% RDF	53.5	375.5	46.4	44.8	146.7	43.8	56.2	397.3	25.8	47.8	193.7	41.9	47.8	239.3	51.0
50% Residue + 50% RDF	61.2	542.0	52.2	45.7	158.8	45.8	52.3	232.7	23.2	56.9	237.8	52.1	50.8	264.5	52.6
50% Residue + 50% RDF + Pusa decomposer	56.1	423.7	49.3	45.1	152.6	45.0	34.2	365.3	20.6	54.9	237.4	52.8	51.6	265.2	53.6
50% Residue + 50% GM/GLM	68.0	578.6	60.6	47.4	166.0	47.4	38.9	441.1	23.4	65.6	283.9	62.8	51.4	261.7	52.9
75% RDF + 25% residue + Pusa decomposer	56.7	532.7	52.1	45.0	148.9	44.2	44.0	332.4	23.8	49.6	196.7	43.6	49.5	256.6	52.3
Absolute control	76.5	915.6	67.4	55.5	191.0	55.6	45.5	280.5	22.9	73.3	325.4	63.0	54.3	301.3	55.1
Exp. Mean	62.5	561.3	54.7	47.2	160.6	47.0	45.2	341.6	23.3	58.0	245.8	52.7	50.9	267.8	52.9
CD (0.05)	1.9	52.8	2.1	1.3	14.5	1.5	13.1	NS	NS	4.6	34.9	4.9	1.6	25.3	NS
CV (%)	2.0	6.2	2.5	1.8	5.9	2.2	19.1	48.2	11.6	4.3	7.7	5.1	2.0	264.8	5.1

Table: 5.4.6a Nutrient use efficiency (Kg grain /kg uptake) in rice crop as influenced by Residue Management (Kharif 2025)

Treatments	MTU [6]			MCU [7]			PNT [8]			PSA [9]		
	N	P	K	N	P	K	N	P	K	N	P	K
100% RDF	73.5	150.4	51.4	50.2	104.3	48.2	54.4	304.3	57.0	45.9	201.1	43.2
50% Residue + 50% RDF	72.8	145.8	37.8	62.7	141.6	56.0	56.6	330.2	66.1	47.7	224.9	48.5
50% Residue + 50% RDF + Pusa decomposer	70.6	205.1	38.5	54.7	120.4	51.6	54.7	328.0	71.2	74.7	219.9	47.3
50% Residue + 50% GM/GLM	72.1	168.9	39.5	59.5	138.1	53.5	54.2	323.2	65.1	50.4	236.6	51.3
75% RDF + 25% residue + Pusa decomposer	75.7	168.8	34.1	5.0	107.5	50.0	51.3	299.4	59.7	45.7	209.1	44.6
Absolute control	70.2	165.8	32.4	75.0	166.2	59.5	58.1	394.3	77.9	50.6	235.1	47.2
Exp. Mean	72.5	167.5	39.0	59.2	129.7	53.1	54.9	329.9	66.2	48.0	221.1	47.0
CD (0.05)	NS	NS	5.7	8.7	23.3	6.1	NS	33.5	5.9	NS	17.2	NS
CV (%)	10.9	23.9	9.6	9.6	11.8	7.6	7.4	6.7	5.8	5.4	5.1	13.2

Table: 5.4.7 Total Nutrient uptake (kg/ha) and Nutrient Use Efficiency (kg grain /kg uptake) in Rice Crop as influenced by Residue Management (*Rabi* 2024 - 2025)

Treatments	Total nutrient uptake (kg/ha)						Nutrient Use Efficiency (kg grain/kg uptake)					
	KRR			MTU			KRR			MTU		
	N	P	N	P	N	P	N	P	N	P	N	P
100% RDF	45.5	9.8	94.7	80.1	30.9	125.6	76.2	358.7	36.9	70.7	183.9	45.8
50% Residue + 50% RDF	54.4	12.0	115.5	82.2	31.7	136.4	67.1	310.8	31.6	72.5	186.6	44.0
50% Residue + 50% RDF + Pusa decomposer	57.1	13.8	143.0	79.8	33.2	144.5	66.0	322.9	26.9	75.8	182.1	42.5
50% Residue + 50% GM/GLM	60.1	16.3	118.9	80.1	27.0	130.6	74.2	277.2	37.4	70.5	206.2	42.6
75% RDF + 25% residue + Pusa decomposer	57.2	14.7	113.4	82.6	34.5	140.2	71.5	281.7	37.6	70.8	171.8	42.0
Absolute control	40.1	8.6	96.5	54.2	19.7	114.7	87.1	421.3	33.5	65.6	181.5	31.6
Exp. Mean	52.4	12.5	113.7	76.5	29.5	132.0	73.7	328.8	34.0	71.0	185.3	41.4
CD (0.05)	NS	NS	NS	16.3	6.8	NS	NS	NS	NS	NS	NS	NS
CV (%)	21.4	32.2	23.6	14.0	15.1	13.8	25.7	39.9	24.0	9.0	12.1	15.7

Table: 5.4.8 Available soil nutrient status (kg/ha) after Harvest as influenced by Residue Management (*Kharif*2025)

Treatments	Chiplima [1]			Kanpur [2]			Karikal [3]			Kaul [4]			Khudwani [5]		
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
100% RDF	265.3	24.0	179.2	242.0	32.4	232.0	167.0	27.4	93.4	138.0	18.1	254.0	302.7	16.1	241.2
50% Residue + 50% RDF	260.8	21.8	166.9	233.0	29.2	224.0	174.1	31.2	196.5	141.3	14.4	226.7	304.8	15.7	220.7
50% Residue + 50% RDF + Pusa decomposer	256.5	22.2	171.8	239.0	29.5	226.0	174.1	27.7	239.8	144.3	16.0	223.7	310.6	15.8	214.0
50% Residue + 50% GM/GLM	252.5	20.8	168.8	225.0	27.3	217.0	199.9	26.3	193.6	147.3	14.6	208.3	308.6	15.5	220.7
75% RDF + 25% residue + Pusa decomposer	258.5	23.1	172.8	241.0	31.8	229.0	192.1	28.3	170.5	141.3	17.8	246.7	325.5	16.0	232.6
Absolute control	245.5	18.9	159.9	207.0	23.9	210.0	185.8	25.7	147.4	120.3	11.5	202.3	259.6	13.3	166.4
Exp. Mean	256.5	21.8	169.9	231.2	29.0	223.0	182.2	27.8	173.5	138.8	15.4	226.9	302.0	15.4	215.9
CD (0.05)	12.3	2.3	NS	22.2	2.4	NS	19.9	NS	77.7	10.0	2.7	12.7	25.1	1.2	12.5
CV (%)	3.1	6.8	4.6	6.3	5.4	6.3	7.2	23.5	29.5	3.9	9.5	3.0	5.5	5.3	3.8

Table: 5.4.8a Post-harvest soil nutrient status (kg/ha) (Kharif 2025) in RBCS as influenced by Residue Management

Treatments	Maruteru [6]			Moncompu [7]			Pantnagar [8]			Pusa [9]	
	N	P	K	N	P	K	N	P	K	N	P
100% RDF	161.9	64.9	288.5	285.7	18.2	220.0	180.5	13.1	191.3	274.1	22.4
50% Residue + 50% RDF	142.7	65.2	303.9	257.1	16.5	234.1	165.5	11.7	160.0	263.3	20.2
50% Residue + 50% RDF + Pusa decomposer	168.1	63.0	322.7	269.6	16.3	226.8	162.0	11.3	157.0	268.7	19.4
50% Residue + 50% GM/GLM	131.0	63.8	274.7	281.7	15.8	224.4	166.5	11.4	170.0	255.2	17.9
75% RDF + 25% residue + Pusa decomposer	140.7	61.4	291.4	290.9	19.1	220.9	176.8	13.5	172.5	272.7	21.7
Absolute control	159.5	60.9	312.2	229.2	14.7	189.5	133.8	9.0	145.0	229.5	15.5
Exp. Mean	150.6	63.2	298.9	269.0	16.8	219.3	164.2	11.7	166.0	260.6	19.5
CD (0.05)	NS	NS	NS	35.7	NS	26.2	9.9	0.8	10.7	24.8	3.1
CV (%)	15.8	7.6	9.6	8.7	15.9	7.9	4.0	4.3	4.2	6.2	8.1

Trial 5.5. Nano-fertilisers for increasing nutrient use efficiency, yield, and economic returns in transplanted rice

The nitrogen use efficiency (NUE) in agricultural systems remains low, with more than 50% of the nitrogen applied to agricultural soils potentially lost to the environment on a global scale. To improve the current NUE, it is essential to enhance the efficiency of farming systems, adopt environmentally sound agronomic practices, and explore disruptive technologies. Nano-fertilisers offer distinct advantages that improve plant performance, including enhanced absorption, increased production, higher photosynthesis rates, and a significant expansion of the leaf surface area. Utilising nano-fertilisers for specific crops, such as rice, could help reduce the negative impacts of excessive chemical input use while maintaining production levels and nutritional benefits. In this background, we formulated a study with following objectives 1. *To study the efficiency of nano-fertilisers in increasing the growth and yield of rice crops*, and 2. *To find out the nutrient use efficiency of nano-fertilisers in rice crops*.

A total of six treatments namely, T1: RDN (*Recommended dose of nitrogen (RDN) through urea (recommended P and K)*), T2: T1 + Two foliar sprays of Nano-Urea plus (16% N w/w or 20% N w/v) (4ml/L of water) at AT & PI, T3: 75 % of RDN (66% Basal + 17 % active tillering (AT) + 17 % at Panicle initiation (PI)), T4: 75% RDN+2 sprays of Nano-Urea plus (No reduction in basal nitrogen (66% Basal). Top dressing of Urea at Active Tillering Stage (34 %) + 2 sprays of NUP at PI and Heading stage), T5: 75% of RDN + 3 sprays of Nano-Urea plus (No reduction in basal nitrogen (66%). Top dressing of urea at Active Tillering Stage (34%); NUP to be applied 10 Days after Split Urea Application; 3 sprays of NUP at AT, PI and Heading Stage) and T6: Control (no application of N). Treatment T5 was included at the last ARGM, by replacing 50% RDN + 2 sprays of NU, to evaluate the effect of a higher frequency of nano urea sprays on rice. The trial was laid out in a randomised block design (RBD) with three replications.

Experimental Centres, Locations and Cropping Systems

During *Kharif* 2025, the trial was conducted at 25 centres across multiple states, encompassing a diverse range of soil types, agro-climatic zones, rainfall regimes and cropping systems: ARI-Hyderabad, BNK-Bankura, CHT-Chatha, CHP-Chiplima, CBT-Coimbatore, GNG-Gangavati, JDP-Jagadapur, KNP-Kanpur, KRK-Karaikal, KUL-Kaul, KHD-Khudwani, LUD-Ludhiana, MND-Mandya, MTU – Maruteru, MCP – Moncompu, NGN-Nagina, NVS-Navasari, NLR-Nellore, PNT – Pantnagar, PTB-Pattambi, PDU-Puducherry, PSA-Pusa, RCI-Ranchi, WGL – Warangal and CRRI-Cuttack.

The results of the experiment carried out in *kharif* 2025 were summarised and presented in Tables 5.5.2 to 5.5.7, and the salient findings are as follows.

Yield parameters, viz., tiller and panicle numbers per square metre, are presented in Table 5.5.2. Significant differences were observed in the yield parameters due to variations with treatments at all locations except Karaikal, Mandya, Maruteru, Moncompu, Nagina, CRRI and ARI. Application of 100 % RDN along with two sprays of nano urea at active tillering and panicle initiation stage (T2) registered the significantly higher tiller and panicle numbers (per m²) at Chatha (253, 229), Chiplima (405, 331), Gangavati (224, 218), Jagdalpur (346, 331), Kanpur (487, 416), Khudwani (527, 445), Nellore (800, 571) and Pantnagar (295, 296), respectively, which was on par with 100% recommended dose of N treated plots alone at Chiplima, Kanpur. However, application of 75% RDN and three sprays of nano urea (T5) at Gangavati (214, 197), Jagadalpur (306, 293), Khudwani (521, 428), Pantnagar (289, 290) and CRRI (260, 230) registered on-par results with 100% RDN, 100% RDN + 2 sprays of nano urea. At Pattambi, T4 (75% RDN and administration of two sprays of nano urea) recorded higher tiller (341) and higher panicles at 100% RDN (330), which is statistically on par with other treatments except control. Application of 75% RDN and three sprays of nano urea exhibited significantly higher tiller and panicle number at Puducherry (355, 329) and Pusa (303, 292) during *kharif* 2025.

Grain and straw yields at all locations showed significant differences with the addition of nano urea treatments (Table 5.5.3). Similar to yield attributes, the application of 100% RDN and two sprays of nano urea at two critical stages of rice crop recorded the highest grain and straw yields at a majority of the locations *i.e.*, ARI (6933 and 17186 kg/ha), Coimbatore (6480 and 7846 kg/ha), Jagdalpur (6873 and 8586 kg/ha), Kanpur (5783 and 5857 kg/ha), Kaul (6920 and 8930 kg/ha), Khudwani (6918 and 8093 kg/ha), Ludhiana (6477 and 9917 kg/ha), Mandya (6610 and 8547 kg/ha), Maruteru (5446 and 8784 kg/ha), Navasari (4602 and 6717 kg/ha), Pusa (4743 and 6206 kg/ha), Pantnagar (5008 and 5383 kg/ha), Moncompu (3966 and 4744 kg/ha), Ranchi (5806 and 8350 kg/ha), and CRRI (5836 and 5856 kg/ha), Chatha (3153 and 7096 kg/ha), Gangavati (5186 and 5992 kg/ha), Nagina (3966 and 4744 kg/ha), respectively., which was on par with the 100% RDF in their respective locations. By contrast, 75% RDN + 3 sprays of nano urea during critical stages stood on par with the 100% RDN+ nano urea and 100% RDN at a few locations, *i.e.*, Nellore, Pantnagar, Pusa, Ranchi, Warangal, Maruteru, Khudwani, Kaul, Kanpur and Rajendranagar. However, 75% RDN + 3 sprays of nano urea exhibited higher yield at Puducherry (7221 and 10156 kg/ha), followed by 100% RDN + 2 sprays of nano urea and 100% RDN. The absolute control registered the lowest yield across all locations.

Supplementary nano urea spray with 100% RDN conferred a yield advantage ranging from 1% (Kaul and Pantnagar) to 23% (Pusa) over 100% RDN alone. Similarly, replacement of 25% RDN with three sprays of RDN showed a yield advantage with an improvement at Pattambi (16.4%), Rajendranagar (9.5%), Puducherry (6.1%), Maruteru (5.0%), Nagina (1.2%), and Khudwani (1.0%), respectively. In comparison, 25% replacement with dual

spray of nano urea recorded a penalty between -0.6% (Khudwani) and -23.3% (Pantnagar) in *kharif* 2025. By contrast, it recorded 35.4%, 4.2% and 3.3% improvement over 100% RDN at PTB, ARI and PDU.

The total N uptake of rice plants was documented and presented in Table 5.5.4. An additional two sprays of nano urea along with RDN (T2) registered the significantly higher N uptake in rice plants grown at Chiplima (107.4 kg/ha), Coimbatore (127.4 kg/ha), Jagdalpur (158.6 kg/ha), Kanpur (127.4 kg/ha), Khudwani (147.2 kg/ha), Kaul (135.9 kg/ha), Ludhiana (154.0 kg/ha), Mandya (130.6 kg/ha), Maruteru (114.6 kg/ha), Puducherry (121.5 kg/ha), ARI (174.3 kg/ha), Navasari (85.1 kg/ha), Pantnagar (95.8 kg/ha), and CRRI (107.5 kg/ha), respectively, followed by 100% RDN at majority of locations except, Khudwani, ARI, where 75% RDN + 3 sprays of nano urea accumulated more N than 100% RDN. Surprisingly, Pusa and Moncompu centres exhibited higher N uptake with 75% RDN + 3 sprays of nano urea treatment (85.3 and 179.3 kg/ha). The lowest N uptake was observed with the control treatment across locations.

The effect of nitrogen application through conventional fertiliser and nano urea on post-harvest soil available N is presented in Table 5.5.5. Both 100% RDN and 100% RDN + nano urea sprays positively improved post-harvest soil available N over the absolute control at the majority of locations. Significant available N changes observed at CHP, JDP, KUL, LUD, KRK, MCP, PNT, PSA and CRRI. Treatments, namely T4 (75% RDN+2 spray) and T5 (75% RDN + 3 sprays of nano urea) recorded on-par value across locations, suggesting that additional sprays of nano urea did not confer a significant benefit in improving post-harvest soil N status. With regard to soil OC, significant changes were observed with Khudwani, Karaikal, Maruteru, Ludhiana, and Pantnagar centres only (Table 5.5.6). 100% RDN + nano urea spray registered the highest OC content at the majority of the locations, while 75% RDN + 3 sprays of nano urea exhibited higher organic carbon at Maruteru (1.09%).

The use of nano urea in rice crops did not significantly improve the BC ratio (economic returns) across locations (Table 5.5.7). The highest benefit and returns were observed with T2 at Chiplima (2.44), Kanpur (2.29), Maruteru (1.93), Pantnagar (2.94), Coimbatore (2.24), Gangavati (1.72), Pusa (2.12), Ranchi (3.03) and Warangal (2.13). By contrast, the next best economic return was recorded with 100% RDN treatment, and other treatments registered a lower BC ratio than T2. However, at Puducherry, 75% RDN + 3 sprays of nano urea exhibited a higher return as their BC ratio value was 2.32. Overall, the additional application of nano urea along with 100% RDN was on par with 100% RDN alone and did not confer significant monetary advantage in irrigated rice crops.

Nano urea application improved nutrient use efficiency (NUE; kg grain/kg nutrient uptake) at a few locations (Figures 1). The highest NUE was exhibited in T4 (75% RDN + 2 sprays of NU) at Chiplima (68.4), Kanpur (47.0), Karaikal (44.9), Moncompu (56.5), Pant Nagar (75.4)

and CRRI (59.5). While at Maruteru, 75% RDN + 3 sprays of Nano urea recorded highest NUE, i.e., 56.6.

Summary:

Application of nano urea along with recommended dose of nitrogen (RDN) improved growth parameters, grain yield, and nitrogen uptake in rice across most locations compared to the control. The treatment 100% RDN + two sprays of nano urea (T2) was the most consistent, recording yield advantage at a majority of centers with gains ranging from 1% to 23% over RDN, indicating stable performance across agro-ecologies. Replacement of 25% RDN with three sprays of nano urea (T5) resulted in yield improvement at 6 centres (Pattambi, Rajendranagar, Puducherry, Maruteru, Nagina, Khudwani) with gains ranging from 1.0% to 16.4%, but responses were location-specific and not consistently superior to RDN. In contrast, two sprays under reduced nitrogen (T4) showed inconsistent performance, with yield penalties observed at several locations (up to ~23%), indicating inadequate compensation for nitrogen reduction. The benefit: cost (B:C) ratio was highest with T2 at several centres, but remained largely comparable to 100% RDN, indicating that nano urea application did not confer a significant economic advantage over the recommended fertilizer practice.

Table 5.5.1: List of centres with trial details (Zone wise)

S. No	Centre name	Variety	Soil Type	Soil values (Initial)	Fertiliser Dose
1	ARI, Rajendranagar				
2	Bankura				
3	Chatha	Basmati 370	Sandy Clay Loam	245:14:146	30:20:10
4	Chiplima	Swarna		261:17.6:121	80:40:40
5	Coimbatore	CO 55	Clay Loam	228:18.2:436	150:50:50
6	Gangavati		Black Soil		150:75:75
7	Jagdapur		Alfisols	232:11:341	100:60:30
8	Kanpur	Sarjoo-52	Sandy Loam	17.72:21.89:60.39	90:60:60
9	Karaikal	CO 51	Sandy Loam	288:39:286	150:50:50
10	Kaul	HKR 127	Loam	15:26:322	150:60:60:25
11	Khudwani	Shalimar Rice-4	Silty Clay Loam	329:18.3:240	120:60:30
12	Ludhiana	PR 126	Sandy Loam	269:21.4:180	105:30:30
13	Mandya	RNR - 15048		7.98:80.3: 220.6	125:62:62
14	Maruteru				
15	Moncompu				
16	Nagina				
17	Navsari		Clayey		100:30:0
18	Nellore				
19	Pantnagar	Pant Dhan - 18	Silty Clay Loam	175:9.25:215	120:60:30
20	Pattambi				
21	Puducherry		Clayey Loam	134:37.4:180	120:40:40
22	Pusa				
23	Ranchi				
24	Warangal				
25	CRRI				

Table 5.5.2: Effect of nano urea application on growth parameters of Rice (Tiller (T) and Panicle (P) Numbers per m²)

Treatments	CHT		CHP		GNG		JDP		KNP		KRK	
	T	P	T	P	T	P	T	P	T	P	T	P
T1: Recommended dose of N (RDN)	229	204	361	313	208	192	318	313	456	397	238	221
T2: T1+ Two sprays of Nano-Urea	253	229	405	331	224	218	346	331	487	416	254	237
T3: 75% RDN	198	176	294	235	201	183	250	235	422	369	240	224
T4: 75% RDN + Two sprays of Nano-Urea	202	181	316	281	221	203	293	281	441	382	268	257
T5: 75% RDN + Three sprays of Nano-Urea	217	194	328	293	214	197	306	293	445	386	230	222
T6: Control (no N)	163	138	237	102	164	145	113	102	318	241	281	268
Mean	210.8	187	323	259	205	190	271	259	429	365	252	238
CD (p=0.05)	7.0	5.0	49	47	26	37	47	47	36	25	NS	NS
CV (%)	1.9	1.5	8.4	9.9	7.2	10.7	9.8	9.9	5.6	4.7	18.0	23.7

T = Tiller numbers per m², P = Panicle number per m²**Table 5.5.2a: Effect of nano urea application on growth parameters of Rice (Tiller (T) and Panicle (P) Numbers per m²)**

Treatments	KHD		LUD		MND		MTU		MCP		NGN	
	T	P	T	P	T	P	T	P	T	P	T	P
T1: Recommended dose of N (RDN)	511	426	306	260	392	349	276	252	462	436	462	102
T2: T1+ Two sprays of Nano-Urea	527	445	341	294	402	351	294	259	421	410	421	373
T3: 75% RDN	460	390	374	230	379	331	261	219	465	409	465	409
T4: 75% RDN + Two sprays of Nano-Urea	512	419	296	251	380	328	268	199	439	409	439	409
T5: 75% RDN + Three sprays of Nano-Urea	521	428	321	276	391	343	286	252	448	448	448	416
T6: Control (no N)	391	302	204	169	348	308	248	210	360	328	360	338
Mean	487	401	291	247	382	335	272	237	432	411	432	341
CD (p=0.05)	40	15	15	13	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	3.1	2.8	2.8	2.9	5.4	5.4	14.8	15.5	9.4	12.7	10.2	8.4

T = Tiller numbers per m², P = Panicle number per m²

Table 5.5.2b: Effect of nano urea application on growth parameters of Rice (Tiller (T) and Panicle (P) Numbers per m²)

Treatments	NVS		NLR		PNT		PTB		PDU		Pusa	
	T	P	T	P	T	P	T	P	T	P	T	T
T1: Recommended dose of N (RDN)	335	325	729	553	293	291	297	330	338	305	287	280
T2: T1+ Two sprays of Nano-Urea	318	321	800	571	295	296	308	264	349	321	299	291
T3: 75% RDN	298	283	724	489	258	258	330	264	311	281	250	242
T4: 75% RDN + Two sprays of Nano-Urea	306	296	782	530	277	275	341	264	342	314	281	277
T5: 75% RDN + Three sprays of Nano-Urea	303	292	752	529	289	290	275	242	355	329	303	292
T6: Control (no N)	264	257	650	474	166	190	247	230	284	256	206	195
	Mean	304	740	525	263	266	299	282	330	301	271	262
CD (p=0.05)	39	42	66	NS	19	5	74	NS	7	6	21	19
CV (%)	7.1	7.9	4.9	7.2	4.2	1.1	12.7	24.6	1.2	1.2	4.3	4.2

Table 5.5.2c: Effect of nano urea application on growth parameters of Rice (Tiller (T) and Panicle (P) Numbers per m²)

Treatments	WGL			CRRl			RNR	
	P	P	P	T	P	T	T	T
T1: Recommended dose of N (RDN)	322	320	320	262	225	284	262	262
T2: T1+ Two sprays of Nano-Urea	318	316	316	264	231	296	287	287
T3: 75% RDN	334	334	334	257	231	263	222	222
T4: 75% RDN + Two sprays of Nano-Urea	327	327	327	259	228	300	288	288
T5: 75% RDN + Three sprays of Nano-Urea	340	340	340	260	230	289	271	271
T6: Control (no N)	295	291	291	241	226	233	223	223
	Mean	323	322	257	229	277	256	256
CD (p=0.05)	NS	NS	NS	4.7	NS	NS	37	37
CV (%)	5.4	5.6	5.6	1.0	2.1	9.9	7.8	7.8

Table 5.5.3: Effect of nano urea application growth parameters of Rice (Grain (kg/ha) and straw yield (kg/ha)) – Kharif 2025

Treatments	ARI		CHT		CHP		CBT		GNG		JDP		KNP	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T1: Recommended dose of N (RDN)	6233	15657	2920	6542	6109	6930	6070	7786	4654	5667	6618	8946	5350	5843
T2: T1+ Two sprays of Nano-Urea	6933	17186	3153	7096	6423	7340	6480	7846	5186	5992	6873	8586	5783	5857
T3: 75% RDN	5506	12106	1935	5913	5700	6467	5503	6530	4071	4958	4906	6450	4725	5487
T4: 75% RDN + Two sprays of Nano-Urea	6492	13740	2813	6310	5920	6560	6023	7180	4391	5321	5700	7274	5142	5393
T5: 75% RDN + Three sprays of Nano-Urea	6823	16128	2840	6383	5967	6683	6083	7250	4304	5338	5873	8304	5317	5637
T6: Control (no N)	4086	8939	2153	4320	4317	5133	2536	4160	2701	3450	2332	4244	2519	4907
Mean	6012	13959	2635	6094	5739	6519	5449	4150	4216	5121	5467	7300	4806	5479
CD (p=0.05)	1014	1655	NS	87	NS	737	222	300	NS	988	827	866	580	573
CV (%)	9.3	6.6	22.2	8.0	11.2	6.1	2.3	2.5	30.2	10.5	5.8	6.5	8.1	6.2

Table 5.5.3 a: Effect of nano urea application on growth parameters of Rice (Grain (kg/ha) and straw yield (kg/ha)) - Kharif 2025

Treatments	KRR		KUL		KHD		LUD		MND		MTU		MCP	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T1: Recommended dose of N (RDN)	3500	6188	6839	8747	6683	7829	6167	9253	6457	8023	4795	7304	3644	4599
T2: T1+ Two sprays of Nano-Urea	2863	6350	6920	8930	6918	8093	6477	9917	6610	8547	5446	8784	3966	4744
T3: 75% RDN	3300	6550	5791	7458	6048	7148	5550	8123	5380	6720	4147	6688	3255	4144
T4: 75% RDN + Two sprays of Nano-Urea	3113	5813	6327	7950	6649	7799	5850	8683	5493	7213	4619	7451	3400	4444
T5: 75% RDN + Three sprays of Nano-Urea	2800	5738	6548	8285	6748	7869	6050	9063	5650	7663	5033	8118	3688	4644
T6: Control (no N)	3100	5925	3198	5424	4817	5746	3700	5420	3707	4383	3660	5903	2533	3344
Mean	3113	6094	5937	7799	6311	7414	5632	8410	5549	7092	4617	7375	3414	4319
CD (p=0.05)	NS	NS	702	624	755	562	66	667	491	824	749	1254	795	NS
CV (%)	18.0	12	6.2	4.5	6.1	4.2	1.5	4.2	5.1	6.3	9.2	9.2	12.8	12.6

Table 5.5.3 b: Effect of nano urea application growth parameters of Rice (Grain (kg/ha) and straw yield (kg/ha)) – Kharif 2025

Treatments	NVS		NLR		PNT		PDU		Pusa		RCI		WGL	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T1: Recommended dose of N (RDN)	4381	6552	5356	8803	4977	5360	6803	9660	3850	4803	5506	7933	3760	5282
T2: T1+ Two sprays of Nano-Urea	4602	6717	5296	8930	5008	5383	7111	10121	4743	6206	5806	8350	3585	5867
T3: 75% RDN	3463	5442	4920	7880	3780	5077	6310	8880	2356	2990	4090	6183	3453	5414
T4: 75% RDN + Two sprays of Nano-Urea	3739	5577	5326	8406	3817	5173	7029	9930	3143	4033	5013	7053	3380	4943
T5: 75% RDN + Three sprays of Nano-Urea	3743	5581	5256	8710	4213	5230	7221	10156	3616	4500	5480	7580	3746	5589
T6: Control (no N)	3380	5046	2820	6950	1527	1820	5875	8185	1410	1923	2276	3650	2195	3075
Mean	3195	5819	4773	8279	3887	4674	6724	9488	3186	4075	4695	7108	3353	5028
CD (p=0.05)	576	868	446	964	60	98	70	218	932	1261	665	1249	556	845
CV (%)	8.1	8.2	5.1	6.40	1.2	1.3	0.5	1.3	16.0	17.0	7.8	10.1	9.2	9.2

Table 5.5.3 b: Effect of nano urea application on growth parameters of Rice (Grain (kg/ha) and straw yield (kg/ha)) – Kharif 2025

Treatments	CRR1		BNK		NGN		PTB	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T1: Recommended dose of N (RDN)	5496	5843	5463	7869	3644	4599	2683	4033
T2: T1+ Two sprays of Nano-Urea	5836	5856	5440	7823	3966	4744	2850	5043
T3: 75% RDN	4813	5486	3975	6741	3255	4144	2390	2726
T4: 75% RDN + Two sprays of Nano-Urea	5090	5393	4855	7267	3400	4444	3633	5396
T5: 75% RDN + Three sprays of Nano-Urea	5280	5636	4861	7490	3688	4644	3123	5796
T6: Control (no N)	4213	4906	2654	4282	2533	3344	1573	3763
Mean	5121	5520	4540	6912	3414	4319	2709	4459
CD (p=0.05)	263	528	98	91	795	NS	929	1427
CV (%)	2.83	5.3	1.5	1.7	12.8	12.6	18.8	17.5

Table 5.5.4: Effect of nano urea application on Total N uptake (kg/ha) in rice

Treatments	CHP	CBT	JDP	KNP	KRK	KHD	KUL	LUD	MND	MTU
T1: Recommended dose of N (RDN)	93.6	118.6	150.1	115.2	96.6	136.8	127.8	139.5	121.2	98.2
T2: T1+ Two sprays of Nano-Urea	107.4	127.4	158.6	127.4	67.4	147.2	135.9	154.0	130.6	114.6
T3: 75% RDN	77.4	108.6	100.7	98.7	82.1	121.7	80.3	115.6	85.7	84.7
T4: 75% RDN + Two sprays of Nano-Urea	86.6	115.3	122.6	109.4	69.3	137.1	112.3	127.9	95.1	92.4
T5: 75% RDN + Three sprays of Nano-Urea	93.9	121.3	130.4	113.6	68.0	140.4	118.9	136.5	111.0	88.9
T6: Control (no N)	51.2	79.4	52.7	39.9	61.8	90.7	50.8	60.9	50.6	68.1
Mean	85.1	111.7	119.1	100.7	74.2	128.9	104.3	122.4	99.0	91.1
CD (p=0.05)	9.6	5.5	10.6	12.9	NS	8.9	30.8	6.0	7.2	14.6
CV (%)	6.2	2.7	4.9	8.6	28.8	3.8	16.2	2.3	3.9	8.8

Table 5.5.4 a: Effect of nano urea application on Total N uptake (kg/ha) in rice

Treatments	PDU	PSA	ARI	PDU	MCP	NVS	PNT	CRRI
T1: Recommended dose of N (RDN)	112.0	75.8	153.6	112.0	176.6	77.1	89.3	99.0
T2: T1+ Two sprays of Nano-Urea	121.5	82.3	174.3	121.5	170.6	85.1	95.8	107.5
T3: 75% RDN	94.5	60.3	125.3	94.5	149.0	60.8	65.6	80.6
T4: 75% RDN + Two sprays of Nano-Urea	108.6	73.7	144.3	108.6	151.0	66.9	70.6	85.6
T5: 75% RDN + Three sprays of Nano-Urea	112.6	85.3	157.6	112.6	179.3	70.2	78.1	93.1
T6: Control (no N)	78.4	30.8	73.8	78.3	139.3	51.4	25.6	61.3
Mean	104.6	68.03	138.1	104.5	160.9	68.5	70.8	88
CD (p=0.05)	1.5	14.9	20.5	1.5	NS	11.6	5.2	6.1
CV (%)	0.8	12.1	8.2	3.0	18.0	9.3	4.0	3.9

Table 5.5.5: Effect of nano urea application on available N (kg/ha) in soil

Treatments	ARI	CBT	CHP	CHT	JDP	KNP	KHD	KRK	KUL	LUD
T1: Recommended dose of N (RDN)	150	213	269	235	157	230	342	157	165	277
T2: T1+ Two sprays of Nano-Urea	143	220	276	239	222	233	339	222	167	283
T3: 75% RDN	145	208	263	266	248	222	318	248	160	264
T4: 75% RDN + Two sprays of Nano-Urea	147	243	264	228	201	227	325	201	161	270
T5: 75% RDN + Three sprays of Nano-Urea	148	216	271	230	243	228	332	243	162	274
T6: Control (no N)	131	186	252	202	255	212	291	255	141	230
Mean	144	209	265	233	221	225	326	221	159	266
CD (p=0.05)	NS	NS	8	NS	35	NS	NS	35	12.5	1.0
CV (%)	5.6	10.7	1.6	10.3	10.5	5.8	5.9	10.5	4.3	0.3

Table 5.5.5 a: Effect of nano urea application on available N (kg/ha) in soil

Treatments	MND	MTU	MNC	NVS	PNT	PSA	RCI	CRR1
T1: Recommended dose of N (RDN)	236	150	217	250	199	200	211	345
T2: T1+ Two sprays of Nano-Urea	241	162	202	246	198	197	204	408
T3: 75% RDN	243	148	200	238	177	189	221	345
T4: 75% RDN + Two sprays of Nano-Urea	239	158	170	243	185	209	218	346
T5: 75% RDN + Three sprays of Nano-Urea	231	149	177	252	189	222	245	351
T6: Control (no N)	242	115	166	226	136	155	228	245
Mean	238	147	189	242	180	195	216	340
CD (p=0.05)	NS	NS	26	NS	10	256	NS	34
CV (%)	3.3	12.9	7.7	6.3	3.1	7.2	8.7	5.6

Table 5.5.6: Effect of nano urea application on soil organic carbon (%) in soil

Treatments	CHP	KHD	KRK	KUL	MND	MTU	LUD	PNT	CRR1
T1: Recommended dose of N (RDN)	0.57	0.78	0.42	0.56	1.01	0.87	0.48	0.67	0.51
T2: T1+ Two sprays of Nano-Urea	0.56	0.81	0.18	0.56	1.06	0.96	0.50	0.71	0.54
T3: 75% RDN	0.53	0.80	0.28	0.53	1.02	0.98	0.46	0.52	0.47
T4: 75% RDN + Two sprays of Nano-Urea	0.53	0.79	0.19	0.55	1.05	0.88	0.47	0.58	0.53
T5: 75% RDN + Three sprays of Nano-Urea	0.54	0.79	0.19	0.55	1.01	1.09	0.49	0.61	0.54
T6: Control (no N)	0.50	0.69	0.23	0.54	0.82	0.82	0.41	0.44	0.52
Mean	0.54	0.77	0.25	0.55	1.00	0.93	0.47	0.59	0.52
CD (p=0.05)	NS	0.04	0.10	NS	NS	0.07	0.06	0.07	NS
CV (%)	6.4	2.9	0.23	5.9	2.7	5.1	1.4	7.0	16.2

Table 5.5.7: Effect of nano urea application on Benefit: Cost Ratio (B:C) in rice

Treatments	CHP	KNP	KUL	MND	LUD	MTU	PNT	CBT	GNG	KHD
T1: Recommended dose of N (RDN)	2.41	2.18	2.19	2.75	1.22	1.66	2.90	2.17	1.57	2.13
T2: T1+ Two sprays of Nano-Urea	2.44	2.29	2.11	2.70	1.22	1.93	2.94	2.24	1.72	2.13
T3: 75% RDN	2.24	1.98	1.89	2.28	1.17	1.59	2.32	2.02	1.38	1.90
T4: 75% RDN + Two sprays of Nano-Urea	2.28	2.08	1.95	2.42	1.16	1.74	2.30	2.15	1.47	2.03
T5: 75% RDN + Three sprays of Nano-Urea	2.28	2.10	1.99	2.38	1.17	1.84	2.55	2.10	1.43	1.96
T6: Control (no N)	1.94	1.22	1.10	1.72	0.83	1.53	1.14	1.07	1.04	1.00
Mean	2.27	1.98	3.54	2.38	1.13	1.72	2.36	1.96	1.44	1.86
CD (p=0.05)	0.09	0.15	0.22	0.17	0.01	0.25	0.09	0.11	0.36	0.31
CV (%)	2.2	4.8	6.7	4.0	0.66	8.2	2.2	5.6	14.0	9.0

Table 5.5.7 a: Effect of nano urea application on Benefit: Cost Ratio (B:C) in rice

Treatments	MNC	NLR	PTB	PUD	PSA	ARI	RCI	WGL
T1: Recommended dose of N (RDN)	1.77	1.54	1.26	2.28	1.77	3.07	3.03	2.00
T2: T1+ Two sprays of Nano-Urea	1.77	1.47	1.30	2.29	2.12	3.18	3.03	2.13
T3: 75% RDN	1.47	1.42	1.13	2.16	1.08	2.73	2.18	2.00
T4: 75% RDN + Two sprays of Nano-Urea	1.63	1.50	1.66	2.29	1.60	3.00	2.78	1.86
T5: 75% RDN + Three sprays of Nano-Urea	1.63	1.45	1.43	2.32	2.01	3.08	2.89	2.03
T6: Control (no N)	1.06	0.92	1.13	2.32	0.71	2.07	1.30	1.23
Mean	1.56	1.38	1.32	2.28	1.55	2.86	2.54	1.88
CD (p=0.05)	0.36	0.13	0.13	0.01	0.48	0.40	0.34	0.33
CV (%)	12.8	5.2	5.6	0.27	17.5	7.8	7.4	9.8

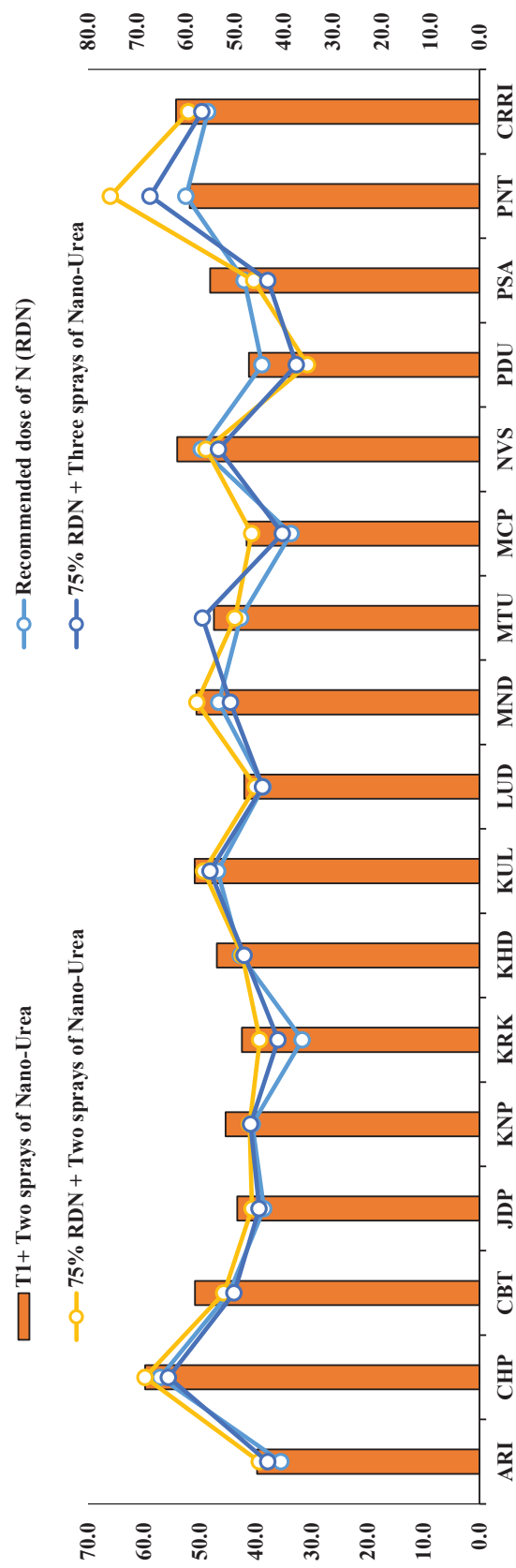


Figure 1: Effect of nano urea application on Nutrient Use Efficiency (NUE) in rice

Effect of nano urea on grain yield improvement

S. NO	Centres	100 % RDN	Grain Yield (kg/ha) (% change over RDN in parentheses)		OC (%)	N	P	K	Soil Type
			25% N Replacement + 2 sprays of NU	25 % N Replacement + 3 sprays of NU					
								kg/ha	
Zone I (Hilly Areas)									
1	Khudwani	6683	6649 (-0.5)	6748 (1.0)	0.84	329	18.3	240	Silty clay loam
Zone II (Northern)									
2	Chatha	2920	2813 (-3.3)	2840 (-2.3)	-	245	14	146	Sandy loam
3	Kanpur	5350	5142 (-3.9)	5317(-0.6)	0.57	226	22.5	222	Sandy loam
4	Kaul	6839	6327 (-7.5)	6548 (-4.3)	0.54	158	26	322	Loam
5	Ludhiana	6167	5850 (-5.1)	6050 (-1.9)	0.45	269	21.9	180	Sandy loam
6	Pantnagar	4977	3817 (-23.3)	4213 (-15.4)	0.74	175	9.25	215	Silty clay loam
Zone III (Eastern)									
7	Bankura	54653	4855 (-11.1)	4862 (-11.0)					
8	Chiplima	6109	5920 (-3.1)	5967 (-2.4)	0.51	261	17.6	121	Sandy clay loam
9	Cuttack	5496	5090 (-12.4)	5280 (-7.4)	-	-	-	-	-
10	Nagina	3644	3400 (-6.7)	3688 (1.2)	-	21	18.3	209	Clay loam
11	Pusa	3850	3143 (-18.4)	3616 (-6.1)	-	-	--	-	-
12	Ranchi	5507	5013 (-9.0)	5480 (-0.5)	-	250	43	157	-
Zone V (Central)									
13	Jagdalpur	6619	5700 (-13.9)	5873 (-11.3)	0.42	232	11.4	341	-
Zone VI (Western)									
14	Navasari	4381	3739 (-14.7)	3774 (-14.6)	-	-	-	-	Clayey
Zone VII (Southern)									
15	Coimbatore	6070	6023 (-0.77)	6083 (0.21)	-	228	18.2	436	Clay loam
16	Gangavati	4654	4392 (-5.7)	4304 (-7.5)	-	-	-	-	Black soil
17	Hyderabad	6233	6492 (4.2)	6823 (9.5)	-	-	-	-	-
18	Karaikal	3500	3113 (-11.1)	2800 (-20.0)	0.210	288.5	39.89	286.8	Sandy loam
19	Mandya	6457	5493 (-14.9)	5650 (-12.5)		7.98	80.3	220.6	-
20	Maruteru	4795	4619 (-3.7)	5033 (5.0)	-	-	-	-	-
21	Moncompu	3644	3400 (-10.7)	3689 (-6.7)	-	-	-	-	Clay loam
22	Nellore	5357	5327 (-0.6)	5257 (-1.9)	-	-	-	-	-
23	Pattambi	2683	3633 (35.4)	3123 (16.4)	-	-	-	-	-
24	Warangal	3760	3380 (-10.1)	3746 (-0.4)	-	129	55	423	Clay
25	Puducherry	6803	7030 (3.3)	7221 (6.1)	-	134	37.4	180	Clay loam

Trial 5.7. Evaluation of Organic fertilisers and Natural farming practices for enhancing Productivity and soil health

The trial was conducted during *Rabi*2024-25 and *kharif*-2025 in collaboration with Agronomy to “Evaluate the organic fertilisers and natural farming practices for enhancing the productivity and soil health” and its influence on productivity, grain quality, soil health and environmental sustainability. Currently, organic produce including organic rice is in huge demand owing to its potential to fetch premium prices in the global market. There were mainly five treatments viz T₁:Control (No addition of any inputs except labours for operations including weeding) T₂: Complete Natural Farming (NF), T₃: AI-NPOF package (All India Network Programme on Organic Farming), T₄: Integrated Crop Management (50% nutrient through organic and 50% nutrient through inorganic source), T₅: Integrated Crop Management (50% nutrient through organic and 50% nutrient through inorganic source with application of need based pest management) and T₆: Recommended Dose of Fertilizers (RDF). All farming practices starting from seed treatment to harvest were practiced as per the technical programme; observations were recorded on grain yields, straw yields and other yield parameters. Soil samples were collected before start of an experiment and after harvest and were analysed for important soil properties. The trial was conducted at sixteen locations viz., (Chinsurah-CHN, Chiplima-CHP, Khudwani-KHD, Kaul-KUL, Moncompu-MNC, Mandya-MND, Maruteru- MTU, Pantnagar-PNT, Pusa-PUSA, Puducherry-PUD, Titabar-TTB, Chatha-CHT, Gangavati-GNV, Ghaghraghat-GHT, Karaikal-KRK Navsari-NVS, Pattambi-PTB and Raipur-RAI) during *Kharif*- 2025 and at Chinsurah-CHN, Maruteru- MTU and Pattambi-PTB during *rabi* 2024-25. The results are presented in Tables 7.1 to 7.24.

***Kharif*-2025**

Grain, straw yield and yield parameters

Among the eighteen locations, grain yield during *Kharif*-2025 was significantly superior in (T₆) Recommended dose of fertiliser [4.42, 5.36, 5.21, 4.87, 4.42, 4.74, 5.05, 7.40, 5.20, 5.04 t/ha] treatment compared to complete Natural Farming recording 35.5, 68.4, 22.4, 59.7, 35.5, 28.4, 15.8, 24.3, 24.23, 41 % higher yield in KUL, MND, MNC, PNT, PUSA, GHT, KRK, KHD, NVS, RAI respectively. And Integrated Crop Management (inclusive of pest management) shown high grain yield recording 5.99, 4.04, 5.07, 5.13, 4.83 t/ha which is 26.04, 31.4, 2.76, 38.5, 30.6 % increase compared to complete natural farming in, MTU, TTB, CHN, CHP and PTB respectively. Whereas at PUD (6.42 t/ha), GNV (6.98 t/ha) recorded higher grain yield, which was 16.04 and 49.5 % higher in T₄: Integrated Crop Management compared to complete natural farming. At CHT (3.23 t/ha), T₃: AI-NPOF package recorded higher grain yield, which was 19.6% higher compared to complete natural farming.

Straw yield followed an almost similar trend as that of grain yield at most of the locations recording 29.9, 60.9, 16.2, 58, 30, 38.8, 13.3, 9.02, 20.8, 23.8 and 38.9 % higher straw yields in T₆: Recommended dose of fertiliser over complete natural farming at KUL, MND, MNC, PNT,

PUSA, CHP, GHT, KRK, KHD, NVS and RAI respectively. Whereas at MTU, TTB, CHT, and GNV T₅: Integrated Crop Management (inclusive of pest management) recorded 24.7, 28 and 16.3 % higher over complete natural farming. The T₄: Integrated Crop Management recorded higher grain yield at PUD (8.59 t/ha), and GNV (7.61 t/ha) which was 19.6 and 29.3 % higher compared to complete natural farming. Whereas at PTB natural farming has shown the highest straw yield with 14.2 t/h as compare other treatments. (Table 7.2 to 7.3).

With regard to yield parameters (tillers/m², panicles/m², 1000 grain weight), the treatment integrated crop management (need based pesticides) recorded significantly higher values compared to other treatments at CHN, CHP, KUL, MTU, MND and TTB. Whereas (tillers/m², panicles/m², 1000 grain weight) the treatment RDF recorded significantly higher values compared to other treatments at MNC, PNT, PUSA, CHT, KHD, GHT, RAI, PTB and NVS. However, at GNV, PUD and KRK the integrated crop management treatment recorded significantly higher compared to other treatments. (Table 7.4 to 7.21).

With regard to nutrient uptake values the treatment recommended dose of fertiliser recorded significantly higher values compared to other treatments at KUL, PNT, MNC, PUSA, KUD and NVS, whereas treatment Integrated Crop Management (inclusive of pest management) recorded significantly higher values compared to other treatments at CHP and MND. But at TTB and KRK the integrated crop management treatment recorded significantly higher values compared to other treatments. At MTU and CHT shown higher values of nutrient uptake in the treatment AI-NPOF Package. (Table 7.4 to 7.21).

Rabi2024-25

At MTU during *Rabi2024-25* (Table 7.22) grain yield (6.54 t/ha) and straw yields (9.52 t/ha) were significantly superior in T₅: Integrated crop management (inclusive of pest management) compared to other treatments with an improvement of 7.49 and 21.53 % in grain and straw yields over complete NF treatment respectively. Similarly, at CHN (Table 7.23) T₅: Integrated crop management (inclusive of pest management) showed 6.2 % increase in grain yield from 4.8 to 5.12 t/ha. At PTB, the highest straw yield was recorded in T₄ (Integrated Crop Management), showing a 36.1% increase over natural farming. Meanwhile, grain yield was 30.5% higher under T₅ (Integrated crop management (inclusive of pest management) compared to natural farming (Table 7.24)

With regard to yield, attributes at MTU recorded significantly higher number of tillers/m² (411), panicle/m² (334), 1000-grain weight (21) and at CHN (*Boro*), tillers/m² (371) panicles/m² (302), panicle weight (3.18 g) improved in T₅: Integrated crop management (inclusive of pest management) treatment compared to other treatments. At PTB, the highest values for tiller number per m² (384), panicles per m² (371), and filled grains per panicle (117) and highest nutrient uptake were recorded under T₅: Integrated crop management (inclusive of pest management) performed better than other treatments (Table 7.22)

Soil properties after harvest

At MND, PNT, PUSA, KUL most of the soil properties improved with recommended dose of fertilisers and at CHP, CHN, KRK, Integrated Crop Management (inclusive of pest management) recorded the highest values. While, AI-NPOF treatment gave highest Soil N, P, K values at MTU, CHT, and KHD. PUD, NVS recorded highest soil N, P, K values with Natural farming compared to other treatments. At MNC, soil N, P, K values are highest with T3, T6, T4 treatments, respectively. Similarly, TTB also shown highest in soil N, P, K values with T3, T4, T2 treatments, respectively.

Summary

In the fourth year of study (except CHP, KUL and MTU, second year) on “Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health”, out of six treatments, the recommended dose of fertiliser treatment was significantly superior compared to other treatments at KUL, MND, MNC, PNT, PUSA, GHT, KRK, KHD, NVS and RAI in terms of grain yield and MNC, PNT, PUSA, CHT, KHD, GHT and NVS in terms of yield parameters. Recommended dose of fertilisers at MND, PNT, PUSA and KUL recorded the highest soil nutrient values and many of the soil properties improved with Integrated Crop Management (inclusive of pest management) at CHP, CHN, KRK locations.

Table 5.7.1 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health

Soil and crop characteristic

Locations	Soil type	Initial soil status (N:P:K) Kg/ha	Fertilizer dose N:P:K(Kg/ha)	Variety	Sowing date	Duration
CHP	Clay Loam	263:18.17:155.4	80:40:40	Pratikshya	19/07/2025	-
KRK	Sandy loam	163:34.7	150:50:50	KKLR-2	06-09-2024	135 Days
KUL	Loam	152:25	60:30:0:25	HKR 15-488	10-6-2025	approx 150
MND	-	258.6: 28.3:179.6 OC-0.56%	100:50:50	KMP-175	20-07-2025	110-115 days
MTU	-	147:11.5	90:60:60	-	-	-
MNC	-	303.6: 11.35: 235.2 OC- 4.28%	90 : 45 : 45	Uma	05-07-2025	125
PNT	Silty clay loam	235:19:110	120:60:30	Pant Dhan-24	-	-
PUSA	Sandy loam	254:31.5:0	120:60:40	Rajendra Nilam	-	-
TTB	-	284:22.5:0	-	Ketekijoha	-	-
KHD	Silty clay loam	346.4:16.8:176.6	120:60:30	Shalimar Rice- 4	02-05-2025	139
PUD	Clay loam	156:41:0	150:50:50	Co R43 Sub 1	12-10-2025	Medium duration
CHT	Sandy clay loam	245.15:14.34:146.31	30:20:10	Basmati 370	-	-
CHN	Clay loam	525:125:0	80:40:40	Manisha	-	-
GNV	Black soil	150:75:75	150:75:75	RNR 15048	-	-
GHT	Sandy loam	205.4:23.5:232.5	120:60:60:25	-	-	-
NVS	-	-	100:30:0	-	-	-
CHN (Boro)	Clay loam	-	130:65:65	Sukumar	-	-

Table 5.7.2 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health- Grain yield of *khariif*

Treatments	KUL	MND	MTU	MNC	PNT	PUSA	TTB	PUD	CHT	CHN	CHP	GNV	GHT	KRK	KHD	NVS	PTB	RAI
Control (No addition of any inputs)	2.58	1.39	3.85	2.69	1.01	2.58	2.42	3.05	2.17	3.70	2.85	2.16	2.44	3.81	5.40	3.40	1.93	2.05
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	2.85	1.69	4.43	4.04	1.96	2.85	2.77	5.39	2.60	4.93	3.15	3.52	3.39	4.25	5.60	3.94	3.35	2.97
AI-NPOF package	3.13	2.35	4.37	3.94	2.18	3.13	3.50	5.21	3.23	5.02	3.43	4.13	4.23	4.27	6.48	4.05	4.50	3.87
Integrated Crop management	3.58	3.08	5.33	4.32	2.51	3.58	3.87	6.42	2.96	4.93	4.90	6.98	4.49	4.62	6.83	4.35	4.38	4.54
Integrated Crop management (inclusive of pest management)	3.72	3.14	5.99	4.56	2.69	3.72	4.04	6.29	3.15	5.07	5.13	7.19	4.50	4.58	6.95	4.46	4.83	4.76
Recommended Dose of Fertiliser	4.42	5.36	5.56	5.21	4.87	4.42	3.31	6.15	-	4.97	4.70	6.30	4.74	5.05	7.40	5.20	4.43	5.04
MEAN	3.38	2.84	4.92	4.12	2.54	3.38	3.32	5.42	2.82	4.77	4.03	5.05	3.97	4.43	6.44	4.23	3.90	3.87
C.D (0.05)	0.39	0.28	0.69	0.64	0.64	0.387	0.41	0.69	0.52	0.84	0.25	1.30	0.53	0.64	0.72	0.53	0.29	0.65
C.V	7.52	6.0	9.0	10.0	1.7	7.528	8.12	7	11.9	11.71	4.12	17.15	8.94	9.65	7.4	8.28	4.85	11.13

T1: Absolute Control (No NPK) (Non-addition of any inputs).

T2: Natural farming (Beejamrit + Ghanjeevamrit + Jeevamrit + Residue mulching + intercropping)

T3: AI-NPOF package (Vermicompost 4.5 t/ha + Panchagavya 3.0% Spray 125 L/ha + Improved Pest management).

T4: Integrated Crop Management (50% nutrients through organic manures + 50% nutrients through inorganic sources + Non-chemical pest management)

T5: Integrated Crop Management (50% nutrients through organic manures + 50% nutrients through inorganic sources + Need-based chemical pest management)

T6: Recommended dose of fertiliser (RDF)

Table 5.7.3 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Straw yield of *kharif*

Treatments	KUL	MND	MTU	MNC	PNT	PUSA	TTB	PUD	CHT	CHP	GNV	GHT	KRK	KHD	NVS	PTB	RAI
Control (No addition of any inputs)	3.69	1.89	6.22	3.96	1.25	3.69	7.29	4.13	4.33	3.55	5.13	3.11	5.43	6.71	4.11	8.78	2.71
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	4.19	2.37	7.15	6.31	2.28	4.19	7.9	6.90	5.82	3.78	5.38	4.36	6.15	6.86	4.75	14.20	3.92
AI-NPOF package	4.57	2.98	7.05	6.15	2.60	4.57	9.0	6.67	7.24	3.95	5.03	4.38	5.84	7.79	4.88	13.78	4.98
Integrated Crop management	5.11	3.89	8.60	6.33	2.83	5.11	10	8.59	6.53	5.30	7.61	4.87	6.16	8.22	5.24	13.85	5.81
Integrated Crop management (inclusive of pest management)	5.24	3.90	9.50	6.73	2.94	5.24	11	8.39	6.96	5.78	7.56	4.88	6.05	8.43	5.37	11.10	6.07
Recommended Dose of Fertiliser	5.98	6.07	8.73	7.53	5.45	5.98	9.3	8.28	-	6.18	6.46	5.03	6.76	8.67	6.24	8.50	6.42
MEAN	4.79	3.52	7.88	6.17	2.89	4.79	9.0	7.16	6.18	4.76	6.20	4.44	6.07	7.78	5.10	11.70	4.99
C.D (0.05)	0.53	0.35	0.97	0.99	0.91	0.53	1.6	1.29	1.37	0.32	1.79	0.53	0.63	0.71	0.62	3.06	0.85
C.V	7.29	6	8	10	91	7.29	12	10	14.45	4.51	19.12	7.92	6.95	6.06	8.04	17.38	11.3

Table 5.7.4 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *khariif* (Locations: KUL)

Treatments	Tiller number/ m ²	Panicle number/m ²	1000 grain wt (g)	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)	Grain Zn (mg/kg)	DTPA Zn (mg/kg)
Control (No addition of any inputs)	210	191	27.2	0.34	8.38	0.44	220	26	120	1.33	0.26	0.21	22.2	0.68
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	233	213	27.5	0.29	8.31	0.48	231	28.5	129	1.386	0.28	0.22	22.7	0.69
AI-NPOF package	240	220	28.2	0.26	8.27	0.56	247	29.6	132	1.4	0.28	0.23	23.6	0.70
Integrated Crop management	269	246	28.3	0.32	8.34	0.52	267	34.2	145.2	1.442	0.29	0.25	24.1	0.72
Integrated Crop management (inclusive of pest management)	271	247	28.5	0.30	8.31	0.53	271	34.3	146.5	1.449	0.29	0.26	24.5	0.73
Recommended Dose of Fertiliser	294	276	28.2	0.32	8.43	0.54	281	36.4	156.3	1.498	0.33	0.27	25.8	0.75
MEAN	252.8	232.1	27.9	0.30	8.3	0.50	252	31.5	138	1.41	0.28	0.03	23	0.70
C.D (0.05)	31.01	29.62	NS	0.05	NS	0.05	32.8	5.12	19.74	NS	0.04	8.50	NS	NS
C.V	8.074	8.394	3.705	11.30	3.08	6.03	8.52	10.69	9.39	1.33	8.05	0.21	7.58	7.20

**Table 5.7.5 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: MND)**

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)	Grain Zn (mg/kg)	DTPA Zn (mg/kg)
Control (No addition of any inputs)	208	172	19.35	0.12	7.58	0.54	229	21	165	0.84	0.088	0.35	6.74	0.71
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	209	179	20.26	0.13	7.51	0.58	236	23	163	0.90	0.100	0.37	6.61	0.71
AI-NPOF package	209	181	20.44	0.13	7.50	0.58	241	22	159	0.93	0.108	0.39	6.82	1.00
Integrated Crop management	232	190	20.53	0.14	7.36	0.57	257	26	184	1.01	0.130	0.44	8.34	1.22
Integrated Crop management (inclusive of pest management)	238	199	21.33	0.13	7.44	0.55	251	26	183	1.05	0.145	0.46	9.11	1.25
Recommended Dose of Fertiliser	310	221	23.77	0.13	7.40	0.54	259	29	205	1.13	0.165	0.57	13.03	1.28
MEAN	234	190	20.94	0.13	7.46	0.56	246	25	177	0.98	0.123	0.43	8.44	1.03
C.D (0.05)	18.5	6.6	1.0	NS	0.1	0.0	7.8	2.2	8.9	0.0	0.0	7.9	0.8	0.1
C.V	5.2	2.3	3.1	6.6	1.0	2.7	2.1	6.0	3.3	2.7	7.9	4.0	6.5	6.2

Table 5.7.6 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *khariif* (Locations: MTU)

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)
Control (No addition of any inputs)	241	292	17	0.96	162	72	292	1.06	0.33	0.34
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	401	327	19	0.83	148	68	305	1.02	0.29	0.38
AI-NPOF package	395	336	19	0.88	158	81	329	1.04	0.30	0.35
Integrated Crop management	460	386	20	1.10	137	65	299	0.94	0.31	0.36
Integrated Crop management (inclusive of pest management)	503	428	20	0.81	115	55	305	0.94	0.28	0.28
Recommended Dose of Fertiliser	474	398	20	0.92	144	68	306	1.00	0.30	0.34
MEAN	412	361	19	0.92	144	68.1	305.9	1.00	0.30	0.34
C.D (0.05)	52.187	55.08	0.661	2.4	5.09	3.49	NS	0.07	0.02	0.05
C.V	8.326	10.03	2.276	1.0	2.272	3.287	8.108	4.392	4.222	8.628

Table 5.7.7 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: MNC)

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)
Control (No addition of any inputs)	280	131	24	0.04	4.7	4.14	246	7.5	185.6	1.03	0.32	0.29
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	368	170	26	0.04	4.55	4.54	319	11.75	206.0	1.19	0.44	0.36
AI-NPOF package	398	165	25	0.06	4.45	4.63	331	11.18	204.7	1.17	0.41	0.34
Integrated Crop management	375	176	26	0.07	4.6	4.3	312	10.9	231.0	1.18	0.45	0.39
Integrated Crop management (inclusive of pest management)	385	181	26	0.06	4.78	4.28	308	11.08	223.5	1.13	0.48	0.37
Recommended Dose of Fertiliser	444	210	27	0.05	4.85	4.35	314	13.73	227.7	1.29	0.49	0.45
MEAN	375	172	25.66	0.05	4.65	4.37	305	11.02	213.1	1.17	0.43	0.37
C.D (0.05)	55.34	27.28	NS	NS	NS	NS	32.09	1.96	16.6	0.15	0.07	0.07
C.V	9.70	10.42	4.47	32.68	11.16	6.42	6.92	11.73	5.14	8.48	11.26	12.77

Table5. 7.8 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: PNT)

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Soil Zn (mg/kg)	Grain N (%)	Grain P (%)	Grain K (%)	Grain Zn (mg/kg)	DtPA Zn (mg/kg)
Control (No addition of any inputs)	118	108	17	0.27	7.17	0.44	125	8	129	9	0.97	0.07	0.71	7.98	0.29
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping AI-NPOF package	194	115	19	0.28	7.2	0.55	133	8	144	9	1.01	0.09	0.79	9.23	0.40
Integrated Crop management	188	130	20	0.33	7.2	0.64	137	9	198	9	1.02	0.09	0.85	10.05	0.47
Integrated Crop management (inclusive of pest management)	213	135	22	0.39	7.2	0.65	144	9	197	11	0.97	0.11	0.83	10.63	0.58
Recommended Dose of Fertiliser	214	188	24	0.46	7.33	0.81	203	15	198	15	1.08	0.14	1.01	16.13	0.61
MEAN	191	140	21	0.35	7.24	0.64	193	9	177	11	1.01	0.10	0.84	11.01	0.49
C.D (0.05)	11.0	18.0	1.0	0.1	NS	0.1	NS	1.0	17.0	0.0	0.1	0.0	0.1	0.4	0.1
C.V	4.0	8.0	4.0	11.5	1.5	10.6	131.0	4.0	6.0	3.0	4.3	12.1	4.4	2.4	7.0

Table 5.7.9 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: PUSA)

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)	Grain Zn (mg/kg)	DtPA Zn (mg/kg)
Control (No addition of any inputs)	210	191	27.2	0.343	8.38	0.44	220	26	120	1.33	0.26	0.206	22.2	0.672
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	233	213	27.5	0.293	8.31	0.48	231	28.5	129	1.39	0.271	0.218	22.7	0.686
AI-NPOF package	240	220	28.2	0.255	8.27	0.56	247	29.6	132	1.4	0.274	0.226	23.6	0.693
Integrated Crop management	269	246	28.3	0.315	8.34	0.52	267	34.2	145.2	1.44	0.286	0.247	24.1	0.728
Integrated Crop management (inclusive of pest management)	271	247	28.5	0.298	8.31	0.53	271	34.3	146.5	1.45	0.29	0.256	24.5	0.733
Recommended Dose of Fertiliser	294	276	28.2	0.32	8.43	0.54	281	36.4	156.3	1.50	0.323	0.268	25.8	0.746
MEAN	252	232	27.9	0.30	8.34	0.51	252	31.5	138.1	1.4	0.28	0.23	23.81	0.709
C.D (0.05)	31.03	29.62	29.62	0.05	NS	0.05	32.8	5.12	19.75	NS	0.04	0.03	NS	NS
C.V	8.074	8.394	8.394	11.30	3.08	6.03	8.52	10.69	9.39	8.16	8.05	8.49	7.58	7.20

Table 5.7.10 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: TTB)

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil available K (kg/ha)	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)
Control (No addition of any inputs)	249	241	18	5.22	0.50	238	19	106	89	15	93
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	267	260	18	5.66	0.53	243	18	115	104	17	101
AI-NPOF package	286	277	18	5.51	0.49	255	18	111	130	22	118
Integrated Crop management	293	285	17	5.17	0.52	240	19	106	145	29	172
Integrated Crop management (inclusive of pest management)	313	305	17	5.12	0.52	241	18	116	160	34	143
Recommended Dose of Fertiliser	278	271	17	5.08	0.49	238	17	111	121	21	121
MEAN	281	273	17.58	5.29	0.51	242.46	18.22	110.71	124.86	22.97	124.69
C.D (0.05)	13.06	11.94	NS	0.18	NS	9.16	NS	NS	21.29	NS	NS
C.V	3.06	2.87	4.11	2.28	4.06	2.05	8.58	9.53	9.25	29.58	25.58

**Table 5.7.11 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: PUD)**

Treatments	Tiller number/m ²	Panicle number/m ²	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)
Control (No addition of any inputs)	260	202	0.27	5.68	0.28	112	39	154
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	383	323	0.29	5.76	0.39	157	43	171
AI-NPOF package	363	306	0.27	5.95	0.40	157	37	162
Integrated Crop management	474	417	0.32	5.81	0.36	149	41	176
Integrated Crop management (inclusive of pest management)	451	404	0.27	5.62	0.37	153	39	179
Recommended Dose of Fertiliser	442	395	0.29	5.68	0.31	134	40	171
MEAN	396	341	0.28	5.75	0.35	143.73	40.06	168.83
C.D (0.05)	49.3	43.7	NS	NS	0.0	23.5	NS	NS
C.V	6.8	7.0	18.7	4.0	7.1	8.9	18.8	6.8

**Table 5.7.12 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: CHT)**

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil OC (%)	Soil available N (kg/ha)	Soil available P (kg/ha)	Soil available K (kg/ha)	N uptake in palnts (kg/ha)	P uptake in palnts (kg/ha)	K uptake in palnts (kg/ha)
Control (No addition of any inputs)	173	139	19.15	0.48	221.23	12.67	128.40	33.96	9.16	51.20
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	209	190	20.41	0.52	228.23	13.03	132.60	37.42	10.58	58.66
AI-NPOF package	243	233	21.40	0.51	242.27	14.11	136.77	47.96	13.04	74.18
Integrated Crop management	224	207	20.92	0.51	233.97	13.40	134.17	41.85	11.55	61.29
Integrated Crop management (inclusive of pest management)	234	219	21.31	0.50	237.40	13.91	135.23	44.40	12.25	63.94
MEAN	2.82	198	20.64	0.50	232.62	13.42	133.43	41.12	11.32	61.85
C.D (0.05)	0.52	42.59	1.09	0.02	9.66	0.71	3.81	6.55	1.78	9.85
C.V	11.9	13.99	3.42	2.51	2.7	3.44	1.85	10.34	10.2	10.34

Table 5.7.13 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: CHP)

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)
Control (No addition of any inputs)	216	190	21	0.11	5.84	0.48	293	17	150	0.78	0.06	0.43
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	200	176	21	0.13	5.96	0.5	310	18	159	0.85	0.09	0.51
AI-NPOF package	232	196	22	0.12	6.01	0.52	319	18	167	0.93	0.1	0.62
Integrated Crop management	270	222	23	0.12	6.01	0.51	329	20	176	1.05	0.14	0.83
Integrated Crop management (inclusive of pest management)	276	230	24	0.13	6.14	0.52	331	19	180	1.07	0.15	0.86
Recommended Dose of Fertiliser	261	218	22	0.12	6.06	0.5	323	19	181	1.02	0.12	0.77
MEAN	242	205	22	0.1	6.0	0.5	317	19	169	0.95	0.11	0.67
C.D (0.05)	23	31	1	NS	NS	NS	17	1	11	0.041	0.011	0.027
C.V	6	10	3	10	2.6	5.3	4	5	4	2.9	6.9	2.7

**Table 5.7.14 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: GNV)**

Treatments	Tiller number/m ²	Panicle number/m ²	Test wt (g)	Filled grains/panicle	Unfilled grains/panicle
Control (No addition of any inputs)	153	112	12.25	167	7
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	169	118	14.25	190	7
AI-NPOF package	174	136	14.50	213	5
Integrated Crop management	220	176	15.75	242	5
Integrated Crop management (inclusive of pest management)	209	163	15.50	264	6
Recommended Dose of Fertiliser	197	149	15.00	233	6
MEAN	187	142	14.54	218	6
C.D (0.05)	74.95	52.17	1.37	75.67	1.89
C.V	26.6	24.32	6.27	23.03	20.58

**Table 5.7.15 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: GHT)**

Treatments	Tiller number/m ²	Panicle number/m ²	Test wt (g)	Filled grains/panicle	Unfilled grains/panicle
Control (No addition of any inputs)	147	95	21.44	155	31
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	175	114	23.19	193	25
AI-NPOF package	185	122	24.12	198	20
Integrated Crop management	214	137	24.13	216	16
Integrated Crop management (inclusive of pest management)	213	138	24.21	214	17
Recommended Dose of Fertiliser	217	138	24.31	210	15
MEAN	192	124	23.57	197	21
C.D (0.05)	11.91	7.16	1.13	10.97	4.56
C.V	4.13	3.84	3.18	3.68	14.71

Table 5.7.16 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: KRK)

Treatments	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Soil S (ppm)	Grain N (%)	Grain P (%)	Grain K (%)
Control (No addition of any inputs)	0.034	5.2	0.259	177	30	105	54	0.69	0.06	0.55
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	0.029	5.1	0.384	202	35	114	97	0.87	0.11	0.58
AI-NPOF package	0.033	5.0	0.384	209	34	146	83	0.91	0.14	0.60
Integrated Crop management	0.036	5.0	0.340	221	34	117	82	1.02	0.17	0.68
Integrated Crop management (inclusive of pest management)	0.038	5.0	0.436	213	27	181	72	0.90	0.12	0.71
Recommended Dose of Fertiliser	0.034	5.1	0.361	205	32	133	77	0.88	0.12	0.62
MEAN	0.034	5.12	0.361	204.6	32.01	132.7	77.48	0.88	0.12	0.62
C.D (0.05)	NS	NS	NS	NS	NS	49.70	19.88	NS	NS	0.10
C.V	13.61	3.63	24.10	19.78	34.51	24.05	16.47	17.19	47.29	10.39

Table 5.7.17 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *khairif* (Locations: KHD)

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil EC (dS/m)	Soil pH	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)
Control (No addition of any inputs)	304	258	28	0.26	6.0	0.59	274	12	122	1.22	0.23	0.27
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	320	269	28	0.27	6.2	0.73	286	13	145	1.24	0.24	0.27
AI-NPOF package	395	314	29	0.28	6.4	0.99	368	18	185	1.27	0.25	0.30
Integrated Crop management	435	357	29	0.27	6.1	0.87	328	17	194	1.32	0.24	0.31
Integrated Crop management (inclusive of pest management)	425	350	29	0.27	6.3	0.84	321	17	200	1.30	0.25	0.32
Recommended Dose of Fertiliser	448	369	29	0.28	6.1	0.80	356	17	194	1.37	0.27	0.35
MEAN	387	320	28.6	0.27	6.2	0.80	322	15.8	173.2	1.28	0.25	0.30
C.D (0.05)	35.0	29.7	NS	NS	NS	0.1	25.5	1.4	14.9	0.1	NS	0.0
C.V	5.9	6.1	2.9	10.1	4.9	6.6	5.2	5.7	5.6	2.7	9.2	9.8

**Table 5.7.18 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: NVS)**

Treatments	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil OC (%)	Soil available N (kg/ha)	Soil available P (kg/ha)	Soil available K (kg/ha)	N uptake in palnts (kg/ha)	P uptake in palnts (kg/ha)	K uptake in palnts (kg/ha)
Control (No addition of any inputs)	258	249	26.40	0.42	218.10	32.65	588.08	45.20	15.69	59.03
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	286	276	27.97	0.53	260.43	43.95	724.18	70.83	21.23	71.50
AI-NPOF package	290	279	28.99	0.52	252.08	40.78	689.53	71.21	21.45	72.69
Integrated Crop management	291	279	30.22	0.47	233.18	38.26	680.37	67.58	22.13	77.54
Integrated Crop management (inclusive of pest management)	292	282	30.29	0.46	230.28	37.60	675.48	68.36	22.43	78.32
Recommended Dose of Fertiliser	336	327	30.70	0.45	233.02	35.64	672.18	77.20	26.43	92.17
MEAN	292	282	29.10	0.48	237.85	38.15	671.64	66.73	21.56	75.21
C.D (0.05)	36.48	34.16	2.68	0.05	27.02	5.46	76.42	9.5	3.38	9.91
C.V	8.29	8.03	6.11	7.51	7.54	9.5	7.55	9.45	10.4	8.74

Table 5.7.19 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: CHN)

Treatments	Tiller number/m ²	Panicle number/m ²	Panicle wt (g)	Soil OC (%)	Soil available N (kg/ha)	Soil available P (kg/ha)	Soil available K (kg/ha)
Control (No addition of any inputs)	280	243	2.25	1.20	438.47	92.13	285.04
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	372	323	2.98	1.19	440.24	89.37	291.04
AI-NPOF package	379	329	3.04	1.21	512.19	93.11	297.67
Integrated Crop management	372	323	2.99	1.12	455.47	96.12	294.39
Integrated Crop management (inclusive of pest management)	384	333	3.08		508.20	96.11	297.67
Recommended Dose of Fertiliser	376	326	3.01	1.24	459.80	93.23	296.75
MEAN	360	313	2.89	1.192	469.062	93.345	293.76
C.D (0.05)	63.29	54.88	0.51	0.04	18.39	7.75	7.99
C.V	11.65	11.64	11.6	1.93	2.6	5.51	1.8

Table 5.7.20 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *khariif* (Locations: PTB)

Treatments	Tillers/m ² (No.)	Panicle/m ² (No.)	Filled grains/panicle	Unfilled grains/panicle
Control (No addition of any inputs)	247	247	174	19
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	265	263	159	22
AI-NPOF package	322	322	183	26
Integrated Crop management	388	386	190	23
Integrated Crop management (inclusive of pest management)	322	322	188	27
Recommended Dose of Fertiliser	388	388	160	29
MEAN	322	321	176	24
C.D (0.05)	78.97	78.61	44.5	8.14
C.V	16.28	16.24	16.82	22.35

**Table 5.7.21 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *kharif* (Locations: RAI)**

Treatments	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Unfilled grains/panicle
Control (No addition of any inputs)	218	193	18.70	91	45
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	265	236	19.00	101	45
AI-NPOF package	289	251	19.23	125	43
Integrated Crop management	319	286	19.63	148	42
Integrated Crop management (inclusive of pest management)	335	290	19.73	161	42
Recommended Dose of Fertiliser	355	296	19.83	172	41
MEAN	297	258	19.35	133	43
C.D (0.05)	45.22	40.83	0.62	22.18	7.05
C.V	10.11	10.48	2.14	11.06	10.96

Table 5.7.22 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield parameters and nutrients uptake of *Rabi* (Locations: MTU)

Treatments	Grain yield (t/ha)	Straw yield (t/ha)	Tiller number/m ²	Panicle number/m ²	1000 grain wt (g)	Soil OC (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)	Grain N (%)	Grain P (%)	Grain K (%)
Control (No addition of any inputs)	4.60	7.05	315	233	19	0.96	115	54	290	0.97	0.31	0.28
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	6.05	7.47	389	311	19	0.92	162	68	305	0.96	0.30	0.38
AI-NPOF package	5.66	7.72	350	336	20	1.03	158	65	329	0.96	0.30	0.35
Integrated Crop management	6.14	8.83	398	332	19	1.08	137	72	299	0.99	0.30	0.34
Integrated Crop management (inclusive of pest management)	6.54	9.52	411	334	21	0.81	148	81	298	1.00	0.29	0.36
MEAN	5.79	8.118	373	309	19.3	0.96	144	68	304	0.97	0.30	0.34
C.D (0.05)	0.10	0.70	61.293	67.90	1.6	0.08	5.28	3.49	NS	NS	NS	0.05
C.V	4.60	7.475	10.56	14.11	5.3	5.27	2.36	3.29	7.17	4.16	3.272	8.63

**Table 5.7.23 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield and yield parameters and nutrients uptake of *Boro* (Locations: CHN)**

Treatments	Grain yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Panicle wt (g)	Soil OC (%)	Soil available N	Soil available P	Soil available K
Control (No addition of any inputs)	3.03	215	178	1.89	1.11	409.41	90.32	290.75
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping	4.8	341	281	2.97	1.16	422.31	92.72	294.72
AI-NPOF package	5.08	362	296	3.15	1.22	496.21	96.55	303.87
Integrated Crop management	4.96	352	287	3.1	1.17	448.08	94.19	297.97
Integrated Crop management (inclusive of pest management)	5.12	372	303	3.18	1.23	502.00	99.74	308.87
MEAN	4.6	328	269	2.86	1.18	455.6	94.7	299.23
C.D (0.05)	0.27	20.55	15.32	0.2	0.09	28.83	8.25	14.05
C.V	3.77	4.06	3.7	4.44	4.85	4.11	5.66	3.05

**Table 5.7.24 Evaluation of Organic fertilisers and Natural farming practices for enhancing the productivity and soil health
Yield and yield parameters and nutrients uptake of *Rabi* (Locations: PTB)**

Treatments	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m ² (No.)	Panicle/m ² (No.)	Test wt (g)	Filled grains/panicle	Unfilled grains/panicle
Control (No addition of any inputs)	2.81	3.43	119	117	22.98	62	18
Natural Farming (Beejamrit, Ghanjeevamrit, Jeevamrit + residue + intercropping)	4.48	6.28	255	241	22.48	62	19
AI-NPOF package	4.80	9.68	300	281	22.50	60	18
Integrated Crop management	5.80	9.83	305	305	22.63	91	18
Integrated Crop management (inclusive of pest management)	6.45	8.00	384	371	22.60	117	16
MEAN	4.87	7.44	272	263	22.64	78	18
C.D (0.05)	0.39	1.16	18.68	32.74	2.4	11.1	2.45
C.V	5.22	10.11	4.45	8.09	6.89	9.2	9.02

Among the sucking pests of rice, BPH incidence was high in T1-control (83.7/5 hills) while it was low in T6-RDF (30/5 hills). In all the other treatments, the population varied from 36.1 to 38.8/ 5 hills (**Figure 5.7.1**). Low WBPH incidence was reported across treatments, varying from 2.9 to 39.2/ 5 hills. Low GLH incidence (1.9 – 2.7/ 5 hills) was reported from different treatments.

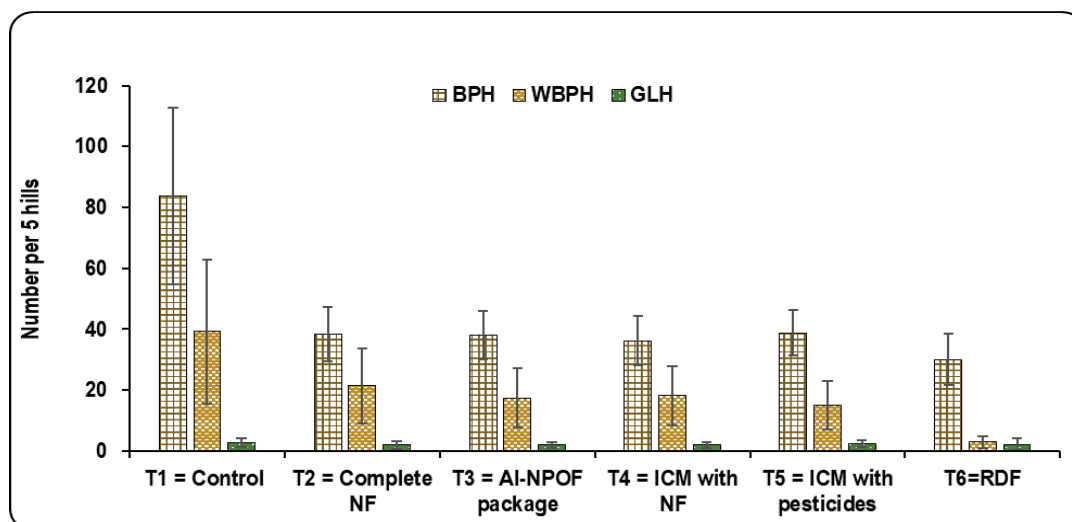


Figure 5.7.1. Incidence of sucking pests in different treatments across locations

Across locations, the incidence of stem borer, gall midge, leaf folder, whorl maggot, hispa, thrips, caseworm, grasshopper, rice skipper, BPH, WBPH and GLH was observed in all the treatments. The incidence of thrips was observed only at Titabar, the incidence of grasshopper and rice skipper was observed only at Khudwani. Overall, the incidence of pests was low in T5-Integrated crop management with need-based pesticides and high in T1-control. However, in majority of the locations the incidence in T2- Complete natural farming, T3 – AI-NPOF package and T4- Integrated crop management with NF was between T1-control and T5-Integrated crop management with need-based pesticides and needs to be studied in depth in relation to the inputs used and the time and frequency of application.

Trial 5.8. Assessment of biofortified rice genotypes' response to Zn application and assessing agronomic biofortification potential

Biofortification, also known as biological fortification, involves the development and cultivation of nutritionally enriched food crops using modern biotechnology methods, traditional plant breeding, and agricultural techniques to enhance their bioavailability and address nutritional deficiencies in the human population. It is a burgeoning and cost-effective method, addressing the inadequacy of micronutrients in staple crops like rice, a consequence of agricultural systems prioritizing yield over human health, by enhancing the nutrient content to alleviate micronutrient deficiencies in populations with limited dietary diversity. Recent zinc-enriched varieties and newly developed genotypes necessitate evaluation of their reaction to applied zinc fertilisers to devise nutrient management strategies and determine their potential for agronomic biofortification.

Keeping this in view, the trial was conducted during rabi- 2024-2025 and Kharif-2025 with objectives

- To evaluate the response of the fortified rice genotypes/varieties to the zinc application
- To study the agronomic biofortification potential of the rice varieties.

The experiments were laid out in factorial RBD, consisting of two factors, viz., I) Rice genotypes/varieties (5); II) Zn doses (3). The treatment details are represented in Table 5.8.1. From the beginning of farming until harvest, all practices were carried out in accordance with the technical programme; observations regarding grain and straw yields as well as other yield metrics, were noted. Before starting the experiment and during harvest, soil samples were collected, and significant soil characteristics were examined. Following harvesting, plant samples were also obtained, and their zinc accumulation was evaluated. The trial was conducted viz. Cuttack, Maruteru during Rabi 2024-2025, and during, it was conducted at eight locations viz., Cuttack, Maruteru, Pusa, Titabar, Varanasi, Ludhiana, Kaul and Karaikal during Kharif- 2025. Soil, crop characteristics and results are presented in Table 5.8.2 to 5.8.12.

Yields and yield attribute

Grain and straw yields and yield attributes (panicle numbers per square meter) showed significant differences between the genotypes and treatments and are depicted in tables 5.8.3 to 5.8.6.

At Cuttack, application of T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment registered higher mean grain (5.23 t/ha and 4.99 t/ha) and straw (6.72 t/ha and 6.40 t/ha) yields as compared to control grain (4.44 t/ha and 3.86 t/ha) and straw (6.21 t/ha and 5.75 t/ha) yields during both rabi and kharif 2025, respectively. Between the varieties, V2: CR Dhan 315 has recorded a higher mean grain yield (5.67 t/ha) during rabi 2025, whereas V1: Swarna produced higher grain yield (5.11 t/ha) which is significantly at par with V2: CR Dhan 315 during kharif 2025. V2: CR Dhan 315 registered maximum straw yield (7.65 t/ha and 7.30 t/ha), whereas CG Zinc Rice-1 recorded minimum grain (3.92 t/ha and 3.29 t/ha) and straw (5.04 t/ha and 4.56 t/ha) yields during both rabi and kharif seasons 2025, respectively. Application of T3: FS of 0.5%

Zn at AT stage, PI stage and 1 WAF treatment recorded significantly higher harvest index (43.8) as compared to control (41.7 and 40.0) during both rabi and kharif season 2025, respectively. In case of Varieties, V1: Swarna recorded significantly higher harvest index (45.9 and 47.1) as compared to all other varieties, whereas V4: DR Dhan 48 registered minimum harvest index (40.6 and 39.1) during both rabi and kharif 2025, respectively. Interaction between treatments and genotypes was found to be significant in the case of grain yield during rabi 2025, straw yield during kharif season 2025 and harvest index of both rabi and kharif season 2025.

In case of Maruteru, there was no significant difference found between Zn treatments in grain yield during both rabi and kharif 2025 and straw yield in rabi season 2025. Application of T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment resulted in higher straw yield (8.73 t/ha) in kharif 2025. However, there was significant variation in grain and straw yields with respect to interaction of both Zn treatments and rice varieties only in both rabi and kharif 2025. In terms of varieties, V1: Swarna recorded significantly higher grain (7.21 t/ha and 5.82 t/ha) during both rabi and kharif 2025 respectively, whereas higher straw yield (9.61 t/ha) was produced by V4: DR Dhan 48 as compared to all other varieties during kharif 2025. Straw yield during rabi 2025 was found to be non-significant in terms of varieties. Harvest index was found to be non-significant in case of treatments whereas V1: Swarna showed higher (42.6 and 39.7, respectively) harvest index between the varieties in both rabi and kharif 2025.

During kharif season 2025, at Pusa, the grain and straw yields were significantly higher (4.29 t/ha and 5.95 t/ha) under application of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF. However, there was no significant difference among the treatments as well as varieties in case of harvest index. Between the varieties, V1: Swarna produced significantly higher grain yield and straw yield (4.62 t/ha and 6.37 t/ha) across the varieties. There was no significant difference between interaction of Zn treatments and genotypes in case of grain and straw yields and harvest index.

In Titabar, the grain yield was observed higher in T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment (3.34 t/ha) whereas the straw yield was found to be higher in case of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF treatment (5.27 t/ha) during kharif 2025. The harvest index was also found to be higher in T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment (40.0). There is no significant difference among the varieties in terms of grain yield, the straw yield and harvest index were significantly influenced by varieties. V5: CG Zinc Rice-1 produced a higher straw yield (5.44 t/ha), whereas V1: Swarna produced a harvest index (38.7), which is significantly at par with V5: CG Zinc Rice-1 (37.9) and V2: CR Dhan 315 (36.3). Interaction between treatments and genotypes was found to be significant in case of straw yield and harvest index. The straw yield was found to be higher in interaction between V1: Swarna and T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF treatment (6.46 t/ha), conversely the harvest index was higher (52.3) with interaction of V1: Swarna and T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment.

In case of Varanasi, among Zn treatments, the application of T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment registered significantly higher grain yield (4.92 t/ha) and higher

straw yield (12.34 t/ha). Among the varieties, significantly higher grain and straw yields were produced by V3: DRR Dhan 45 (5.34 t/ha and 13.57 t/ha). Harvest index was found to be non-significant in case of both treatments. The harvest index was found to be higher in V4: DRR Dhan 48 (29.2). There was no significant difference found between the interaction of treatments and genotypes.

At Ludhiana, significantly higher grain yield (2.77 t/ha) was found with application of T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment, whereas higher straw yield (3.99 t/ha) was observed under T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF treatment. Among the varieties, significantly higher grain yield and straw yields were produced by V2: CR Dhan 315 (3.23 t/ha and 4.25 t/ha). Harvest index was found to be significant in case of both treatments and varieties. The higher harvest index was observed in T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF treatment (41.1), and it was higher in V2: CR Dhan 315 (43.3). Significant differences were found between the interaction of treatments and genotypes in case of grain and straw yields and harvest index.

In case of Karaikal, there was no significant difference found between treatments in terms of both grain and straw yields and harvest index. Among varieties, V1: Swarna produced higher grain yield (4.28 t/ha), which is statistically at par with V4: DR Dhan 48 (4.18 t/ha) and V3: DR Dhan 45 (4.15 t/ha), whereas V4: DR Dhan 48 achieved significantly higher straw yield (12.10 t/ha). Harvest index was found to be non-significant in terms of both genotypes. There was no significant difference found between the interaction of treatments and genotypes.

Yield parameter like panicle number per m² was represented in the table 5.8.6.1 to 5.8.6.3. There were significant differences in the number of panicles per square meter among the Zn treatments at Cuttack during rabi 2025. During kharif 2025, a significant difference was recorded at Cuttack, Maruteru, Titabar, Varanasi, Ludhiana, and Kaul. Whereas it was non-significant at Maruteru during rabi 2025 and at Pusa and Karaikal during kharif 2025. Within the treatments, T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF produced higher number of panicles per m² at Cuttack (351.7 and 341.3, respectively) during both rabi and kharif 2025, Titabar (387.2), Varanasi (304.9), and Ludhiana (281.1) except at Maruteru during kharif 2025 and Kaul, application of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF produced higher (261.4 and 299.3) panicle number per m² respectively.

Regarding varieties, panicle number per m² was observed higher in V2: CR Dhan 315 at Cuttack during both rabi and kharif 2025, Ludhiana in kharif 2025 whereas V4: DRR Dhan 48 produced higher panicle number per square meter at Maruteru during both rabi and kharif season 2025, and at Titabar in kharif 2025. V5: CG Zinc Rice-1 produced higher panicle number per square meter at Varanasi and Karaikal, and at Kaul, it was found to be higher in V3: DRR Dhan 45. The interaction between treatments and genotypes was found non-significant at all centres except at Cuttack during rabi 2025 and at Maruteru and Ludhiana during kharif 2025.

Plant Zinc Content

Significant differences in grain Zn content were observed at all the locations with respect to Zn treatments except Titabar (Table 5.8.7). Among the treatments, the application of T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF, resulted in higher grain Zn content at Cuttack (36.8 mg/kg and 34.9 mg/kg, respectively) which is on par with application of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF during rabi 2025 and Maruteru (34.3 mg/kg and 33.0 mg/kg) during both rabi and kharif season 2025, Varanasi (44.8 mg/kg) and Kaul (34.6 mg/kg). Conversely, at Pusa, Ludhiana and Karaikal, the significantly higher grain Zn content (34.8 mg/kg, 30.9 mg/kg and 36.4 mg/kg, respectively) was observed with the application of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF treatment. Varietal differences were observed in grain Zn content at all locations except Karaikal. Between varieties, V5: CG Zinc Rice-1 exhibited higher grain Zn content at Cuttack (38.7 mg/kg and 36.9 mg/kg), Maruteru (38.7 mg/kg), during both rabi and kharif season 2025, respectively, Pusa (35.0 mg/kg), Titabar (41.3 mg/kg), and Kaul (34.2 mg/kg). In case of Varanasi, higher grain Zn content was found in V4: DRR Dhan 48 (40.2 mg/kg), which was significantly at par with both V1: Swarna and V2: CR Dhan 315. At Ludhiana, significantly higher grain Zn content was observed in V2: CR Dhan 315 (31.6 mg/kg).

The Zn content in the straw was significantly impacted by the zinc treatments at all locations except Maruteru during kharif 2025, conversely, varietal differences were observed across all locations except at Titabar and Karaikal (Table 5.8.8). Application of T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF registered higher straw Zn content at Cuttack (50.3 mg/kg and 49.4 mg/kg) during both rabi and kharif season 2025 and Maruteru (37.7 mg/kg) during rabi 2025, Titabar (66.0 mg/kg), Varanasi (96.0 mg/kg), Kaul (48.8 mg/kg) and Karaikal (51.3 mg/kg). Conversely, at Cuttack, it was significantly at par with the application of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF during both rabi and kharif season 2025. In case of Pusa, Ludhiana, the higher straw Zn content was recorded under the application of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF treatment (47.9 mg/kg and 66.5 mg/kg, respectively). Regarding varieties, V5: CG Zinc Rice-1 displayed higher straw Zn content at Cuttack (50.7 mg/kg) during rabi 2025, Maruteru (41.0 mg/kg and 38.8 mg/kg) during both rabi and kharif -2025, Pusa (49.3 mg/kg), Titabar (66.5 mg/kg) and Kaul (48.7 mg/kg), however at Cuttack and Ludhiana during kharif 2025, it was higher in V2: CR Dhan 315 (48.9 mg/kg and 63.0 mg/kg, respectively). In case of Varanasi, V4: DRR Dhan 48 exhibited higher straw Zn content (75.2 mg/kg). Interaction between treatments and varieties was found to be non-significant across all locations except at Varanasi and Ludhiana in case of both grain and straw Zn contents.

Post-harvest soil zinc status

Following harvest, the available Zn status in soil significantly varied among the treatments at all locations (Table 5.8.9). The application of T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF treatment exhibited higher post-harvest Zn status in soil at Cuttack (1.31 mg/kg and 1.23 mg/kg), Maruteru (1.42 mg/kg and 1.51 mg/kg) during both rabi and kharif 2025, respectively. Similar response recorded at Pusa (0.69 mg/kg), Titabar (1.61 mg/kg), Varanasi (0.68 mg/kg), Ludhiana (0.85 mg/kg), Kaul (0.84 mg/kg) and Karaikal (1.19 mg/kg). Varietal differences are found to be

non-significant across all the locations except at Ludhiana. V1: Swarna exhibited higher post-harvest soil Zn status (0.72 mg/kg) at Ludhiana. Interaction between treatments and varieties was found to be non-significant across all locations except at Cuttack during kharif 2025.

Summary

The multilocation field trial was conducted during Rabi 2024-25 and Kharif 2025 to evaluate the response of biofortified rice genotypes to zinc (Zn) application and to assess their agronomic biofortification potential. The experiment followed a factorial randomized block design involving five rice varieties **and** three zinc management practices, and was carried out across multiple locations, including Cuttack, Maruteru, Pusa, Titabar, Varanasi, Ludhiana, Kaul, and Karaikal. Results showed that zinc application significantly influenced grain yield, yield attributes, zinc accumulation, and post-harvest soil Zn status, though responses varied across locations and genotypes. Foliar application of 0.5% Zn at active tillering, panicle initiation, and one week after flowering (T3) generally produced higher grain and straw yields, improved harvest index, and enhanced yield attributes such as tiller number, panicle density, spikelet fertility, and thousand-grain weight. Among varieties, CR Dhan 315 and Swarna consistently recorded superior yields, while CG Zinc Rice-1 exhibited higher grain zinc concentration, confirming strong biofortification potential. Zinc treatments significantly increased grain and straw Zn content across most locations, demonstrating the effectiveness of agronomic zinc management in improving nutritional quality. Additionally, seed treatment combined with foliar Zn spray (T2) improved post-harvest soil zinc availability.

Treatments Details

Varieties		Zn Doses/Rates	
V1	Swarna/ Naveen	T1	Control with no Zinc
V2	CR Dhan 315	T2	Soil test-based Zinc application (STBZ)+ Foliar spray of 0.5% Zinc at PI stage and 1 week after flowering
V3	DRR Dhan 45		
V4	DRR Dhan 48	T3	Foliar spray of 0.5% Zinc at active tillering (AT) stage, panicle initiation (PI) stage and 1 week after flowering
V5	CG Zinc Rice-1		

Table: 5.8.2 Assessment of biofortified rice genotypes response to Zn application and assessing agronomic biofortification potential- Soil and crop characteristics

Parameters	Cuttack		Maruteru		Pusa	Titabar	Varanasi	Ludhiana	Kaul	Kariakal
	Rice	Rice	Rice	Rice						
Cropping system	Rice	Rice	Rice	Rice	Rice	Rice	Rice	Rice	Rice	Rice
Season	Rabi	Kharif	Rabi	Kharif	Kharif	Kharif	Kharif	Kharif	Kharif	Kharif
RDF (kg NPK/ha)	100:50:50	80:40:40	180:90:90	90:60:60	120:60:40	60:20:40	150:60:40	105:30:30	150:60:60	150:50:50
Soil characteristic										
Clay (%)	27.2	33.5	38	37	14	40.5	23.66	15.1	-	14.4
Silt (%)	56.8	51.2	28	27	31	29.5	26.13	20.2	-	4.0
Sand (%)	16.0	15.3	34	36	55	30	50.21	64.7	-	80.16
Texture	Sandy clay loam	Sandy clay loam	Clay loam	Clay loam	Sandy loam	Silty clay	Sandy clay loam	Sandy loam	-	Sandy loam
CEC (cmol (P ⁺) / kg	16.1	15.7	48.9	48.9	-	11.5	-	14.0	-	10.2
pH (1:2)	5.8	5.7	6.63	6.45	8.24	5.2	7.13	7.2	8.24	5.86
EC (dS/m)	0.48	0.61	0.89	0.89	0.28	0.11	0.19	0.19	0.17	0.071
Organic carbon (%)	0.56	0.62	1.18	1.12	0.48	0.85	0.28	0.50	0.54	0.21
Avail. N (kg/ha)	310.2	298.7	184	164	232	235	190.0	238	158	325
Avail. P ₂ O ₅ (kg/ha)	33.1	35.8	53.9	43.9	32.6	22.1	40.3	22.5	26	40.5
Avail. K ₂ O (kg/ha)	245.2	231.5	348	328	140.5	159	240.0	155	322	267.7
DTPA -Zn (mg/kg)	0.84	0.87	1.16	1.18	0.54	0.70	0.60	0.62	0.51	0.91

Table: 5.8.3.1 Effect of biofortified rice genotypes response to Zn application on Grain yield (t/ha) of rice at different locations during rabi 2025

Treatments/ Varieties	Cuttack				Treatments/ Varieties	Maruteru			
	T1	T2	T3	Mean		T1	T2	T3	Mean
V1: Naveen	4.84	4.99	5.07	4.97	V1: Swarna	6.46	7.59	7.57	7.21
V2: CR Dhan 315	5.16	5.85	6.00	5.67	V2: CR Dhan 315	6.29	6.03	5.33	5.88
V3: DRR Dhan 45	4.93	5.36	5.74	5.34	V3: DR Dhan 45	5.88	5.82	6.18	5.96
V4: DRR Dhan 48	3.83	4.73	5.04	4.54	V4: DR Dhan 48	6.18	5.58	4.83	5.53
V5: CG Zinc Rice-1	3.44	4.04	4.29	3.92	V5: CG Zinc Rice-1	4.67	5.92	6.37	5.65
Mean	4.44	4.99	5.23		Mean	5.90	6.19	6.06	
CD (0.05) T	0.09				CD (0.05) T	NS			
CD (0.05) V	0.12				CD (0.05) V	0.83			
T*V	0.21				T*V	NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.3.2 Effect of biofortified rice genotypes response to Zn application on Grain yield (t/ha) of rice at different locations during kharif 2025

Treatments/ Varieties	Cuttack				Maruteru				Pusa				Titabar			
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	4.52	5.18	5.62	5.11	5.73	5.83	5.89	5.82	4.12	5.09	4.64	4.62	2.43	2.66	3.54	2.88
V2: CR Dhan 315	4.34	5.34	5.62	5.10	5.35	5.37	5.43	5.38	3.85	4.56	4.39	4.27	1.84	2.93	3.88	2.89
V3: DRR Dhan 45	4.35	4.65	5.45	4.82	3.63	4.06	5.66	4.45	3.55	4.39	4.13	4.02	2.30	2.59	2.90	2.60
V4: DRR Dhan 48	3.29	3.93	4.51	3.91	4.81	4.98	5.07	4.95	3.49	4.35	4.03	3.95	2.61	2.85	3.00	2.82
V5: CG Zinc Rice-1	2.80	3.32	3.74	3.29	2.33	2.92	2.97	2.74	2.46	3.07	2.87	2.80	2.87	3.51	3.38	3.25
Mean	3.86	4.48	4.99		4.37	4.63	5.01		3.49	4.29	4.01		2.41	2.91	3.34	
CD (0.05) T	0.16				NS				0.23				0.56			
CD (0.05) V	0.20				0.73				0.30				NS			
T*V	NS				NS				NS				NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.3.3 Effect of biofortified rice genotypes response to Zn application on Grain yield (t/ha) of rice at different locations during kharif 2025

Treatments/ Varieties	Varanasi			Ludhiana			Kaul			Karaikal		
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	4.21	5.11	5.45	4.92	2.48	2.72	3.02	2.74	3.39	2.84	3.25	3.16
V2: CR Dhan 315	4.41	5.32	5.51	5.08	2.78	3.12	3.79	3.23	3.15	2.30	2.45	2.63
V3: DRR Dhan 45	4.64	5.23	6.16	5.34	2.12	2.56	2.51	2.40	3.90	3.57	2.92	3.46
V4: DRR Dhan 48	4.75	5.11	5.28	5.04	2.17	2.51	2.46	2.38	1.84	2.73	1.47	2.01
V5: CG Zinc Rice-1	1.58	1.82	2.18	1.86	1.84	2.11	2.06	2.00	2.97	2.79	2.26	2.68
Mean	3.92	4.52	4.92		2.28	2.60	2.77		3.05	2.85	2.47	
CD (0.05) T	0.26				0.01				0.06			NS
CD (0.05) V	0.34				0.01				0.07			0.61
T*V	NS				0.02				0.12			NS

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.4.1 Effect of biofortified rice genotypes response to Zn application on Straw yield (t/ha) of rice at different locations during rabi 2025

Treatments/ Varieties	Cutback				Treatments/ Varieties	Maruteru			
	T1	T2	T3	Mean		T1	T2	T3	Mean
V1: Naveen	5.57	5.85	6.17	5.86	V1: Swarna	8.95	9.75	10.27	9.66
V2: CR Dhan 315	7.33	7.63	7.98	7.65	V2: CR Dhan 315	9.67	8.95	9.40	9.34
V3: DRR Dhan 45	6.88	7.20	7.33	7.14	V3: DR Dhan 45	9.37	8.38	9.02	8.92
V4: DRR Dhan 48	6.39	6.55	6.86	6.60	V4: DR Dhan 48	9.41	8.74	9.13	9.09
V5: CG Zinc Rice-1	4.86	5.00	5.27	5.04	V5: CG Zinc Rice-1	7.49	8.14	8.74	8.12
Mean	6.21	6.45	6.72		Mean	8.98	8.79	9.31	
CD (0.05) T	0.09				CD (0.05) T	NS			
CD (0.05) V	0.12				CD (0.05) V	NS			
T*V	NS				T*V	NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.4.2 Effect of biofortified rice genotypes response to Zn application on Straw yield (t/ha) of rice at different locations during kharif 2025

Treatments/ Varieties	Cutback				Maruteru				Pusa				Titabar			
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	5.39	5.81	5.97	5.73	8.38	8.53	9.59	8.83	5.57	7.08	6.38	6.34	4.59	6.46	3.23	4.76
V2: CR Dhan 315	6.72	7.23	7.94	7.30	8.27	8.22	8.86	8.45	5.21	6.27	6.05	5.84	4.78	5.22	4.82	4.94
V3: DRR Dhan 45	6.45	6.82	6.78	6.69	7.75	8.29	8.53	8.19	4.79	6.08	5.99	5.62	5.44	5.08	5.50	5.34
V4: DRR Dhan 48	5.78	5.81	6.56	6.05	9.22	9.69	9.91	9.61	4.72	6.03	5.53	5.43	4.89	5.24	5.52	5.22
V5: CG Zinc Rice-1	4.42	4.48	4.77	4.56	5.13	5.31	6.77	5.74	3.33	4.28	3.98	3.86	6.04	4.37	5.90	5.44
Mean	5.75	6.03	6.40		7.75	8.01	8.73		4.72	5.95	5.58		5.15	5.27	4.99	
CD (0.05) T	0.12				0.68				0.28				0.16			
CD (0.05) V	0.15				0.88				0.36				0.21			
T*V	0.27				NS				NS				0.36			

Table: 5.8.4.3 Effect of biofortified rice genotypes response to Zn application on Straw yield (t/ha) of rice at different locations

Treatments/ Varieties	Varanasi				Ludhiana				Kaul				Karaikal			
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	11.27	12.30	12.75	12.11	3.79	4.26	4.19	4.08	6.79	5.84	6.56	6.39	9.43	9.72	9.08	9.41
V2: CR Dhan 315	12.16	13.58	14.76	13.50	3.36	4.78	4.60	4.25	5.33	4.96	5.09	5.12	8.32	7.42	7.75	7.83
V3: DRR Dhan 45	13.02	13.54	14.14	13.57	3.22	3.89	3.79	3.63	7.28	7.13	5.85	6.75	8.75	10.27	11.18	10.07
V4: DRR Dhan 48	11.65	11.99	13.06	12.23	3.25	3.79	3.85	3.63	4.06	5.83	4.02	4.64	11.93	12.37	12.00	12.10
V5: CG Zinc Rice-1	5.45	6.58	6.97	6.33	2.86	3.25	3.12	3.08	6.63	6.25	4.94	5.94	8.08	7.00	8.78	7.96
Mean	10.71	11.60	12.34		3.30	3.99	3.91		6.02	6.00	5.29		9.30	9.35	9.76	
CD (0.05) T	0.37				0.02				0.14				NS			
CD (0.05) V	0.47				0.02				0.19				1.54			
T*V	NS				0.04				0.32				NS			

Table: 5.8.5.1 Effect of biofortified rice genotypes response to Zn application on Harvest index of rice at different locations during rabi 2025

Treatments/ Varieties	Cuttack				T1	T2	T3	Mean
	T1	T2	T3	Mean				
V1: Naveen	46.5	46.0	45.1	45.9				
V2: CR Dhan 315	41.3	43.4	42.9	42.5				
V3: DRR Dhan 45	41.7	42.7	43.9	42.8				
V4: DRR Dhan 48	37.5	41.9	42.4	40.6				
V5: CG Zinc Rice-1	41.4	44.7	44.9	43.7				
Mean	41.7	43.7	43.8					
CD (0.05) T	0.5							
CD (0.05) V	0.6							
T*V	1.1							

Treatments/ Varieties	Maruteru			
	T1	T2	T3	Mean
V1: Swarna	41.9	43.7	42.3	42.6
V2: CR Dhan 315	39.5	40.2	36.1	38.6
V3: DR Dhan 45	38.4	41.0	40.8	40.1
V4: DR Dhan 48	38.9	39.1	34.6	37.6
V5: CG Zinc Rice-1	38.5	42.1	42.5	41.1
Mean	39.4	41.2	39.3	
CD (0.05) T	NS			
CD (0.05) V	3.1			
T*V	NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.5.2 Effect of biofortified rice genotypes response to Zn application on Harvest index of rice at different locations during kharif 2025

Treatments/ Varieties	Cuttack				Maruteru				Pusa				Titabar			
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	45.6	47.1	48.5	47.1	40.6	40.6	38.1	39.7	42.6	41.8	42.1	42.2	34.7	29.1	52.3	38.7
V2: CR Dhan 315	39.3	42.5	41.4	41.1	39.4	39.5	38.0	39.0	42.5	42.1	42.0	42.2	27.9	36.1	44.7	36.3
V3: DRR Dhan 45	40.3	40.5	44.5	41.8	31.6	33.3	39.7	34.9	42.6	41.9	40.8	41.8	29.7	33.9	34.7	32.8
V4: DRR Dhan 48	36.3	40.4	40.8	39.1	34.4	34.0	33.6	34.0	42.5	41.8	42.1	42.2	34.9	35.5	31.7	34.0
V5: CG Zinc Rice-1	38.8	42.6	43.9	41.8	30.9	34.9	31.6	32.5	42.4	41.7	42.0	42.0	32.5	44.6	36.6	37.9
Mean	40.0	42.6	43.8		35.4	36.4	36.2		42.5	41.9	41.8		31.9	35.9	40.0	
CD (0.05) T	0.8				NS				NS				4.2			
CD (0.05) V	1.0				4.8				NS				3.8			
T*V	1.8				NS				NS				9.3			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.5.3 Effect of biofortified rice genotypes response to Zn application on Harvest index of rice at different locations during kharif 2025

Treatments/ Varieties	Varanasi			Ludhiana			Kaul			Karaikal		
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	27.1	29.4	29.9	28.8	39.6	38.9	41.9	40.1	33.3	32.8	33.2	33.1
V2: CR Dhan 315	26.6	28.2	27.2	27.3	45.2	39.5	45.2	43.3	37.2	31.7	32.5	33.8
V3: DRR Dhan 45	26.3	27.8	30.4	28.2	39.6	39.7	39.9	39.7	34.9	33.3	33.3	33.8
V4: DRR Dhan 48	29.0	29.9	28.8	29.2	40.0	39.9	39.0	39.6	31.2	31.9	26.9	30.0
V5: CG Zinc Rice-1	22.5	21.6	23.8	22.6	39.1	39.4	39.7	39.4	30.9	30.9	31.4	31.1
Mean	26.3	27.4	28.0		40.7	39.5	41.1		33.5	32.1	31.4	
CD (0.05) T	NS				0.1				0.6			NS
CD (0.05) V	2.2				0.1				0.7			NS
T*V	NS				0.2				1.2			NS

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.6.1 Effect of biofortified rice genotypes response to Zn application on Panicle number/m² of rice at different locations during rabi 2025

Treatments/ Varieties	Cutback				Treatments/ Varieties	Maruteru			
	T1	T2	T3	Mean		T1	T2	T3	Mean
V1: Naveen	327.7	337.0	353.0	339.2	V1: Swarna	393.3	356.0	405.3	384.9
V2: CR Dhan 315	334.3	353.3	372.3	353.3	V2: CR Dhan 315	357.3	434.7	430.7	407.6
V3: DRR Dhan 45	287.0	342.7	358.0	329.2	V3: DR Dhan 45	406.7	393.3	373.3	391.1
V4: DRR Dhan 48	286.7	290.3	326.7	301.2	V4: DR Dhan 48	464.0	442.7	418.7	441.8
V5: CG Zinc Rice-1	291.3	334.7	348.3	324.8	V5: CG Zinc Rice-1	380.0	380.0	433.3	397.8
Mean	305.4	331.6	351.7		Mean	400.3	401.3	412.3	
CD (0.05) T	10.2				CD (0.05) T	NS			
CD (0.05) V	13.1				CD (0.05) V	37.2			
T*V	22.7				T*V	NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.6.2 Effect of biofortified rice genotypes response to Zn application on Panicle number/m² of rice at different locations

Treatments/ Varieties	Cutback			Maruteru			Pusa			Titabar		
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	305.0	327.7	345.3	326.0	249.0	265.0	258.0	257.3	325.3	355.3	332.3	337.7
V2: CR Dhan 315	328.0	349.0	355.7	344.2	234.0	278.0	238.0	250.0	312.0	324.0	313.0	316.3
V3: DRR Dhan 45	283.0	314.7	343.0	313.6	253.0	271.0	247.0	257.0	307.7	318.3	302.7	309.6
V4: DRR Dhan 48	263.7	280.0	317.3	287.0	225.0	272.0	294.0	263.7	299.0	303.3	306.7	303.0
V5: CG Zinc Rice-1	267.0	331.7	345.3	314.7	175.0	221.0	251.0	215.7	253.0	284.0	271.7	269.6
Mean	289.3	320.6	341.3		227.2	261.4	257.6		299.4	317.0	305.3	
CD (0.05) T	11.6				17.9				NS			25.7
CD (0.05) V	15.0				23.1				21.7			33.2
T*V	NS				40.1				NS			NS

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.6.3 Effect of biofortified rice genotypes response to Zn application on Panicle number/m² of rice at different locations

Treatments/ Varieties	Varanasi			Ludhiana			Kaul			Karaikal		
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	251.7	264.0	286.3	267.3	285.0	291.3	289.7	288.7	283.3	301.3	309.0	297.9
V2: CR Dhan 315	240.7	248.0	273.3	254.0	298.0	307.7	306.7	304.1	285.3	301.7	311.3	299.4
V3: DRR Dhan 45	250.3	269.0	280.7	266.7	261.7	267.7	283.3	270.9	275.0	324.3	300.0	299.8
V4: DRR Dhan 48	219.0	271.7	317.7	269.4	273.0	280.7	271.3	275.0	272.7	307.7	310.7	297.0
V5: CG Zinc Rice-1	283.3	279.0	366.7	309.7	247.7	253.0	254.3	251.7	209.0	261.3	247.0	239.1
Mean	249.0	266.3	304.9		273.1	280.1	281.1		265.1	299.3	295.6	
CD (0.05) T	19.6				2.7				12.7			NS
CD (0.05) V	25.3				3.5				16.4			23.8
T*V	NS				6.0				NS			NS

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.7.1 Effect of biofortified rice genotypes response to Zn application on Grain Zn Content (mg/kg) of rice at different locations during rabi 2025

Treatments/ Varieties	Cuttack			Maruteru		
	T1	T2	T3	T1	T2	T3
V1: Naveen	29.7	33.5	33.7	25.0	26.6	30.7
V2: CR Dhan 315	33.9	37.0	37.6	29.8	31.9	32.8
V3: DRR Dhan 45	31.0	34.6	34.7	28.5	31.5	32.8
V4: DRR Dhan 48	28.8	33.2	36.5	33.2	34.0	34.0
V5: CG Zinc Rice-1	35.0	39.6	41.6	35.6	39.1	41.3
Mean	31.7	35.6	36.8	30.4	32.6	34.3
CD (0.05) T	1.4			2.6		
CD (0.05) V	1.9			3.4		
T*V	NS			NS		

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.7.2 Effect of biofortified rice genotypes response to Zn application on Grain Zn Content (mg/kg) of rice at different locations during kharif 2025

Treatments/ Varieties	Cuttack			Maruteru			Pusa			Titabar		
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	27.8	30.8	35.1	31.2	21.9	23.6	28.3	24.6	23.9	31.7	29.7	28.4
V2: CR Dhan 315	32.0	33.1	33.6	32.9	27.1	29.1	32.8	29.7	28.2	34.3	31.2	31.2
V3: DRR Dhan 45	26.9	32.0	36.2	31.7	25.5	30.7	31.1	29.1	25.7	37.5	28.8	30.7
V4: DRR Dhan 48	25.5	28.0	30.8	28.1	31.7	36.3	31.5	33.2	24.8	31.8	28.4	28.3
V5: CG Zinc Rice-1	31.5	40.4	38.9	36.9	37.1	37.5	41.5	38.7	30.1	38.6	36.4	35.0
Mean	28.7	32.8	34.9		28.6	31.5	33.0		26.5	34.8	30.9	
CD (0.05) T	1.9			3.4			2.5			NS		
CD (0.05) V	2.4			4.4			3.3			3.8		
T*V	NS			NS			NS			NS		

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.7.3 Effect of biofortified rice genotypes response to Zn application on Grain Zn Content (mg/kg) of rice at different locations during kharif 2025

Treatments/ Varieties	Varanasi				Ludhiana				Kaul				Karaikal			
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	29.5	43.2	48.3	40.3	22.2	32.8	29.6	28.2	21.4	29.4	33.7	28.2	29.1	35.6	35.0	33.3
V2: CR Dhan 315	32.8	42.5	45.1	40.1	24.8	37.0	33.0	31.6	23.8	31.4	33.8	29.7	31.3	40.3	38.3	36.6
V3: DRR Dhan 45	29.4	40.0	42.0	37.1	19.6	28.8	23.0	23.8	26.2	30.4	35.3	30.6	31.7	35.7	33.1	33.5
V4: DRR Dhan 48	32.0	42.0	48.2	40.8	20.8	30.4	26.4	25.8	26.1	32.8	33.5	30.8	31.2	33.9	35.8	33.6
V5: CG Zinc Rice-1	33.0	38.0	40.5	37.2	17.8	25.6	27.7	23.7	28.0	38.0	36.5	34.2	31.8	36.5	36.8	35.0
Mean	31.4	41.1	44.8		21.0	30.9	27.9		25.1	32.4	34.6		31.0	36.4	35.8	
CD (0.05) T	1.5				0.3				1.9				2.6			
CD (0.05) V	1.9				0.4				2.5				NS			
T*V	3.3				0.7				NS				NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.8.1 Effect of biofortified rice genotypes response to Zn application on Straw Zn Content (mg/kg) of rice at different locations during rabi 2025

Treatments/ Varieties	Cutback				Treatments/ Varieties				Maruteru			
	T1	T2	T3	Mean					T1	T2	T3	Mean
V1: Naveen	34.6	42.5	45.2	40.8	V1: Swarna				29.2	35.6	34.8	33.2
V2: CR Dhan 315	40.8	46.5	49.1	45.5	V2: CR Dhan 315				31.6	34.4	30.5	32.1
V3: DRR Dhan 45	40.3	50.3	52.8	47.8	V3: DR Dhan 45				33.3	37.1	32.9	34.4
V4: DRR Dhan 48	37.1	49.1	48.5	44.9	V4: DR Dhan 48				35.8	36.6	41.3	37.9
V5: CG Zinc Rice-1	43.8	52.6	55.6	50.7	V5: CG Zinc Rice-1				36.2	37.8	49.1	41.0
Mean	39.3	48.2	50.3		Mean				33.2	36.3	37.7	
CD (0.05) T	2.3								3.6			
CD (0.05) V	2.9								4.6			
T*V	NS								NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.8.2 Effect of biofortified rice genotypes response to Zn application on Straw Zn Content (mg/kg) of rice

Treatments/ Varieties	Cutback			Maruteru			Pusa			Titabar		
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	32.8	33.6	41.7	36.0	24.6	34.6	38.2	32.4	32.4	42.3	55.5	38.0
V2: CR Dhan 315	43.6	52.9	50.2	48.9	27.5	31.8	26.8	28.7	38.3	51.5	58.2	45.2
V3: DRR Dhan 45	39.3	44.9	50.8	45.0	32.4	37.2	32.2	33.9	36.7	45.4	56.6	42.0
V4: DRR Dhan 48	36.0	46.3	50.7	44.3	36.1	36.8	37.4	36.8	35.9	45.7	57.3	42.4
V5: CG Zinc Rice-1	39.4	49.2	53.5	47.4	40.1	35.6	40.8	38.8	40.5	54.7	61.0	49.3
Mean	38.2	45.4	49.4		32.1	35.2	35.1		36.8	47.9	58.4	45.4
CD (0.05) T	5.7				NS				2.7			4.3
CD (0.05) V	7.4				5.3				3.5			NS
T*V	NS				NS				NS			NS

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.8.3 Effect of biofortified rice genotypes response to Zn application on Straw Zn Content (mg/kg) of rice

Treatments/ Varieties	Varanasi			Ludhiana			Kaul			Karaikal		
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	47.7	59.6	94.3	67.2	42.2	69.3	63.1	58.2	33.9	40.8	42.2	39.7
V2: CR Dhan 315	46.2	63.7	98.0	69.3	45.3	75.9	67.9	63.0	41.7	44.1	42.5	45.2
V3: DRR Dhan 45	42.4	49.3	98.6	63.4	38.3	62.9	51.9	51.1	43.2	49.6	44.3	47.6
V4: DRR Dhan 48	44.0	76.6	105.1	75.2	40.1	65.8	59.4	55.1	43.3	48.8	43.6	46.3
V5: CG Zinc Rice-1	46.1	72.0	84.3	67.5	34.9	58.6	57.1	50.2	43.9	49.2	44.3	48.7
Mean	45.3	64.2	96.0		40.2	66.5	59.9		41.2	46.5	43.4	48.8
CD (0.05) T	2.8				0.8				2.4			2.9
CD (0.05) V	3.6				1.0				3.1			NS
T*V	6.2				1.7				NS			NS

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.9.1 Effect of biofortified rice genotypes response to Zn application on post-harvest soil zinc status (mg/kg) of rice at different locations during rabi 2025

Treatments/ Varieties	Cutback				Treatments/ Varieties	Maruteru			
	T1	T2	T3	Mean		T1	T2	T3	Mean
V1: Naveen	0.85	1.23	1.12	1.07	V1: Swarna	1.12	1.31	1.34	1.26
V2: CR Dhan 315	1.00	1.29	1.18	1.15	V2: CR Dhan 315	1.19	1.46	1.38	1.34
V3: DRR Dhan 45	1.01	1.28	1.12	1.14	V3: DR Dhan 45	1.31	1.45	1.34	1.37
V4: DRR Dhan 48	0.98	1.35	1.14	1.16	V4: DR Dhan 48	1.23	1.53	1.23	1.33
V5: CG Zinc Rice-1	1.04	1.37	1.11	1.17	V5: CG Zinc Rice-1	1.16	1.36	1.25	1.26
Mean	0.98	1.31	1.13		Mean	1.20	1.42	1.31	
CD (0.05) T	0.06				CD (0.05) T	0.09			
CD (0.05) V	NS				CD (0.05) V	NS			
T*V	NS				T*V	NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.9.2 Effect of biofortified rice genotypes response to Zn application on post-harvest soil zinc status (mg/kg) of rice at different locations during kharif 2025

Treatments/ Varieties	Cutback				Treatments/ Varieties	Pusa				Titabar				
	T1	T2	T3	Mean		T1	T2	T3	Mean		T1	T2	T3	Mean
V1: Swarna	0.79	1.10	1.26	1.05	V1: Swarna	0.49	0.68	0.49	0.55	V1: Swarna	1.13	1.50	0.93	1.19
V2: CR Dhan 315	0.99	1.18	1.10	1.09	V2: CR Dhan 315	0.49	0.69	0.50	0.56	V2: CR Dhan 315	1.22	1.77	1.29	1.43
V3: DRR Dhan 45	0.83	1.39	1.23	1.15	V3: DRR Dhan 45	0.50	0.69	0.50	0.57	V3: DRR Dhan 45	1.19	1.72	1.35	1.42
V4: DRR Dhan 48	0.88	1.22	0.90	1.00	V4: DRR Dhan 48	0.51	0.70	0.52	0.57	V4: DRR Dhan 48	1.21	1.54	1.01	1.25
V5: CG Zinc Rice-1	0.98	1.25	1.07	1.10	V5: CG Zinc Rice-1	0.51	0.71	0.54	0.59	V5: CG Zinc Rice-1	1.13	1.52	1.16	1.27
Mean	0.90	1.23	1.11		Mean	0.50	0.69	0.51		Mean	1.18	1.61	1.15	
CD (0.05) T	0.08				CD (0.05) T	0.03				CD (0.05) T	0.25			
CD (0.05) V	NS				CD (0.05) V	NS				CD (0.05) V	NS			
T*V	0.18				T*V	NS				T*V	NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Table: 5.8.9.3 Effect of biofortified rice genotypes response to Zn application on post-harvest soil zinc status (mg/kg) of rice at different locations during kharif 2025

Treatments/ Varieties	Varanasi				Ludhiana				Kaul				Karaikal			
	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean	T1	T2	T3	Mean
V1: Swarna	0.57	0.68	0.52	0.59	0.58	0.88	0.70	0.72	0.59	0.83	0.76	0.73	0.92	1.15	1.17	1.08
V2: CR Dhan 315	0.66	0.69	0.55	0.63	0.55	0.84	0.67	0.69	0.68	0.80	0.76	0.75	1.04	1.13	1.13	1.10
V3: DRR Dhan 45	0.58	0.70	0.54	0.60	0.54	0.83	0.66	0.68	0.63	0.86	0.80	0.77	1.01	1.20	1.15	1.12
V4: DRR Dhan 48	0.59	0.69	0.52	0.60	0.58	0.86	0.69	0.71	0.68	0.83	0.74	0.75	0.95	1.24	1.05	1.08
V5: CG Zinc Rice-1	0.65	0.65	0.61	0.64	0.56	0.85	0.68	0.70	0.71	0.87	0.80	0.79	0.93	1.23	1.22	1.12
Mean	0.61	0.68	0.55		0.56	0.85	0.68		0.66	0.84	0.77		0.97	1.19	1.14	
CD (0.05) T	0.04				0.004				0.08				0.09			
CD (0.05) V	NS				0.005				NS				NS			
T*V	NS				NS				NS				NS			

[T1: Control with no Zn; T2: STBZ+ FS of 0.5% Zn at PI stage and 1 WAF; T3: FS of 0.5% Zn at AT stage, PI stage and 1 WAF]

Trial 5.9. Assessment of Carbon dynamics in rice ecologies and recarbonising rice soils for sustainable production (*kharif*-2025)

Rice yield and productivity enhancement are a consequence of increased soil carbon, which has a significant social and economic implications for the livelihoods of farming communities. Estimation of carbon stocks and pools in rice soils of India has the ultimate objective of demonstrating that improved soil carbon management practices can address the differential paddy production patterns observed across different rice ecologies of the country. Soil quality indicators are derived primarily from the labile pools of soil organic carbon. Active, slow, and passive pools are the three principal types of carbon pools in soil; each differs in turnover time and stability. Hence, above and below ground carbon (SOC) have been designated as sub-indicators for SDG target 15.3 (land degradation). Rising awareness and alarm over increasing atmospheric CO₂ levels has renewed in the sequestration potential of soil organic carbon (SOC). Carbon sequestration in agricultural soil occurs in three situations: potential, attainable, and actual. The amount of carbon present in the soil is a function of land-use change, soil type, climate (rainfall and temperature), and management practices. The amount of organic carbon stored in the soil results from the net balance between the rate of SOC inputs and the rate of mineralisation in each of the organic carbon pools. For soils to function as carbon sinks, organic C must be stabilized in recalcitrant pools. Changes in soil carbon pools are likely to be more sensitive indicators of management and land-use change (LUC) effects than total SOC alone. A better understanding of SOC dynamics is therefore vital for detecting and forecasting changes in rice yield and productivity. The present study aimed to assess the current status of organic carbon across different rice ecologies of India and to develop carbon stock estimations and spatial carbon maps in rice soils under the All India Coordinated Research Project on Rice Programme (AICRPR). This trial was, therefore, conducted in farmers' fields around a few selected centres – Moncompu, Pantnagar, Kaul, Hazaribagh, Karaikal and Puducherry. The *kharif* 2025 data received representing the irrigated, shallow lowland and upland rice ecosystems are presented in Tables 9.1 to 9.3. The data are summarised under the following categories: soil samples collected at various depths viz. from 0-20 and 20-40 cm depths from Rice-Wheat, Rice-Mustard and Rice-Fallow, Rice-Chickpea at Hazaribagh; from three depths (0-20, 20-40 and 40-60 cm) from Rice-Fallow, Rice - Pulse, Rice-Cotton, and Rice-Rice at Karaikal; from three depths (0-20, 20-40 and 40-60 cm) from Rice-Wheat, Rice-Pulse, Rice-Maize, and Rice-Oilseed across two districts of Kaul; from three depths (0-20, 20-40 and 40-60 cm) from Rice-Wheat, Rice-Pulse, Rice-Maize, and Rice-Oilseed across two districts of Pantnagar; and from the Rice-Rice cropping system at Moncompu, from 0-20, 20-40 and 40-60 cm from Rice-Rice, Rice-Pulse, Rice-Oilseed, Rice-Fallow. The methodology comprised the conduct of a survey in nearby villages during *kharif* 2025, involving data collection from farmers' fields at different locations across various rice ecologies. Soil samples from 0-20, 20-40 and 40-60 cm depth were collected in triplicate. The initial soil samples were collected before transplanting of the seedlings. The soil samples (400-500 g) were collected from three places in a single plot area; the same procedure was repeated for each plot. This was done to maintain the homogeneity of the sample. These samples were air-dried and ground using a wooden pestle and mortar. These ground soil samples were passed through a 2.0-mm sieve and stored in properly labelled plastic bags for analysis. Undisturbed soil samples were also collected using a core sampler

and stored in aluminium moisture boxes for the determination of bulk density, particle density, porosity, and water-holding capacity. The physical and chemical properties of the processed soil samples were analysed using standard methods. Traditionally, soil organic carbon (determined by the Walkley and Black method) or total organic carbon (TOC) has been used in studies on SOM dynamics. However, changes in TOC resulting from management practices or land-use change are small over a short period of a few cropping seasons and hence seldom detectable, owing to high background levels and natural soil variability. By contrast, labile C fractions (readily decomposable and susceptible to microbial breakdown) generally have high turnover rates and are sensitive to management-induced changes in SOC. Table 9.1 presents the Depth-wise distribution of soil parameters in different Rice based cropping systems and shows the variation in soil characteristics with reference to pH, organic carbon content, soil texture, and available nutrient status. The SOC concentration data across all study sites and their rice-based cropping systems are also included in this table. Mean depth-wise distribution of soil organic carbon and SOC stocks in different rice-based cropping systems is shown in Table 9.2. Across rice and rice-based cropping systems, SOC content decreased with depth, being highest in the 0-20 cm layer and lowest in the 40-60 cm depth. In the surface layer (0–20 cm), SOC did not differ significantly among the different cropping systems or rice-based cropping systems. Most of the samples were found to be lower in soil organic carbon content across both districts of the Kaul centre. Long-term soil management practices resulted in changes in the SOC content throughout the profile. In the surface layer (0-20 cm), significantly higher organic carbon was recorded compared to the deeper layers (20-40 and 40-60 cm). The higher SOC content in the surface layer can be attributed to tillage-induced mixing of organic matter, which reduces direct carbon oxidation. Incorporation of crop residues similarly resulted in significant improvement in SOC content in the surface layers. Although SOC concentration decreased with depth, SOC stock increased with depth, largely due to an increase in bulk density (BD).

Bulk density and SOC distribution

Bulk density increased progressively with depth across all rice-based cropping systems, ranging from 1.09 to 1.51 g cm⁻³. This trend explains why SOC stocks were greater in deeper layers, even though SOC concentration declined. The higher SOC in the surface layer (0–20 cm) is attributed to greater residue incorporation, increased root biomass, and reduced oxidation losses at the soil surface. The highest soil organic carbon content (0.95%) was recorded in the rice ecologies of Udham Singh Nagar district of the Pantnagar centre, while the lowest (0.15%) was from Kurukshetra of the Kaul centre.

The lability index, which reflects the proportion of labile (easily decomposable) carbon relative to more stable carbon fractions, varied considerably. The results of studies on spatial distribution of carbon lability pools viz, very labile carbon, labile carbon, less labile carbon and non-labile carbon are shown in Table 9.3. Very labile carbon ranged from 0.03 to 0.90%, labile carbon from 0.02 to 0.26%, less labile carbon from 0.01 to 0.59%, and non-labile carbon from 0.03 to 0.76% across the

sampled depths. Soils in the Hazaribagh rice-growing region were extremely acidic, whereas soils in the Kaul region were highly alkaline, with pH values exceeding 7.0 and reaching above 8.5. Non-labile carbon varied widely from 0.07 to 0.56%, forming the dominant fraction across all systems. The very labile fraction ranged from 0.03 to 0.76%. Across all depths and methods, the carbon fractions followed the characteristic trend: Very labile < Labile < Less labile < Non-labile. This reflects increasing chemical stability with depth and reduced decomposability of carbon substrates. Carbon pools (very labile, labile, less labile and non-labile) decreased markedly with depth, with maximum values observed in the 0–20 cm layer. The predominance of non-labile carbon across all systems suggests strong stabilization of carbon in the subsoil. Rice-based land use systems significantly influenced the carbon fractions, consistently enhancing the very labile and labile pools, primarily because of increased root biomass, better soil aeration, and efficient water management. Overall, the findings indicated that rice-based land use systems offer the most promising approach for enhancing soil carbon sequestration, improving soil health, and contributing to climate-resilient rice production systems. Long-term adoption of rice-based land use systems can significantly influence carbon stabilization pathways and support sustainable intensification of rice ecosystems.

Spatial distribution of carbon stocks in soil profiles across different rice based cropping systems.

Carbon stock

The highest carbon stock of 22.7 t/ha was recorded from Nainital district of Pantnagar centre. The lowest carbon stock recorded was 4.02 t/ha at the Kaul centre in Kurukshetra. These practices collectively promoted SOC build-up and enhanced carbon cycling in cropping systems. Among all the centres, the highest carbon stock was recorded in the Rice–Pulse cropping system. Besides the application of organic materials, the net increase has been attributed to the contribution from belowground biomass (roots of the previous crop). The roots may contribute considerable amounts of carbon on decomposition. Moreover, tillage management significantly influences soil carbon stock. Minimum tillage plots contain significantly higher carbon stock compared to conventional tillage and this was attributed to the fact that the tillage operations may result in soil aggregate disturbance and exposure of the stored organic matter to microbial decomposition leading to an increase in soil organic matter losses and CO₂ flux to the atmosphere. Where Rice-Pulse and Rice-Fallow systems were maintained, higher soil carbon stocks were consistently recorded.

Spatial distribution of carbon fractions /pools in the rice ecologies:

Carbon pool contents were higher in the 0-20 cm layer of the soil profile, declining progressively to the 20-40 cm and 40-60 cm depths. Depth, rice cropping systems, and soil management practices adopted across centres significantly influenced the contents of carbon fractions, viz., very labile, labile, and less labile. The order of carbon fractions from lowest to highest content was: very labile < labile < less labile < non-labile. Rice-based cropping systems across different rice ecologies significantly influenced carbon fractions, with higher quantities

of very labile and labile C recorded at Hazaribagh, Pantnagar, and Karaikal. However, the values of these fractions were very low across both districts and all rice-based cropping systems at the Kaul centre. Soil management treatments significantly influenced carbon fractions across different rice ecologies. These studies demonstrated that very labile and labile carbon fractions are highly sensitive to changes in soil management practices, and any increase in these fractions indicates the efficacy of the adopted management practices in enhancing soil carbon quality. Several studies have reported that labile carbon fractions change rapidly with different soil management treatments and can serve as suitable indicators of management-induced changes in soil carbon status.

Summary:

The present study aimed to assess the current status of organic carbon across different rice ecologies of India and to develop carbon stock estimations and spatial carbon maps in rice soils under the All India Coordinated Research Project on Rice Programme (AICRPR). This trial was, therefore, conducted in farmers' fields around a few selected centres – Moncompu, Pantnagar, Kaul, Hazaribagh, Karaikal and Puducherry. Bulk density increased progressively with depth across all rice-based cropping systems, ranging from 1.09 to 1.51 g cm⁻³. This trend explains why SOC stocks were greater in deeper layers, even though SOC concentration declined. The higher SOC in the surface layer (0–20 cm) is attributed to greater residue incorporation, increased root biomass, and reduced oxidation losses at the soil surface. The highest soil organic carbon content (0.95%) was recorded in the rice ecologies of Udham Singh Nagar district of the Pantnagar centre, while the lowest (0.15%) was from Kurukshetra of the Kaul centre. The lability index, which reflects the proportion of labile (easily decomposable) carbon relative to more stable carbon fractions, varied considerably. The results of studies on spatial distribution of carbon lability pools viz, very labile carbon, labile carbon, less labile carbon and non-labile carbon are shown in Table 9.3. Very labile carbon varied from 0.03 - 0.90%, labile carbon varies from 0.02 - 0.26%, less labile carbon varied from 0.01 - 0.59%, non-labile carbon varied from 0.03 - 0.76% across the depths. Soils were extremely acidic in Hazaribagh rice growing regions where highly alkaline in Kaul region where soil pH varied from more than 7.0 and reaching to a level of more than 8.5. The highest carbon stock of 22.7 t/ha was recorded from the Nainital district of the Pantnagar centre. The lowest carbon stock recorded was 4.02 t/ha from Kurukshetra of Kaul centre. These practices collectively promoted SOC build-up and enhanced carbon cycling in cropping systems. Among all the centres, the highest carbon stock was recorded in the Rice-Pulse cropping system. Carbon pool contents were higher in the 0-20 cm layer of the soil profile, declining progressively to the 20-40 cm and 40-60 cm depths. Depth, rice cropping systems, and soil management practices adopted across centres significantly influenced the contents of carbon fractions, viz., very labile, labile, and less labile. The order of carbon fractions from lowest to highest content was: very labile < labile < less labile < non-labile.

IIRR Annual Progress Report 2025 Vol.3 - Soil Science

Table 9.1. Depth-wise distribution of soil parameters in different rice-based cropping systems

Centers and their cropping systems	pH (Depth wise in cm)			Avail. N (kg/ha) (Depth wise in cm)			Avail. P (kg/ha) (Depth wise in cm)			Avail. K (kg/ha) (Depth wise in cm)		
	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60
KAUL (Kurukshetra)												
Rice-Wheat	8.14	8.15	8.21	173	142	113	16	13	11	272	210	143
Rice-Maize	8.0	8.19	8.21	155	153	147	15	12	10	261	201	179
Rice-Pulse	7.77	7.85	7.91	182	147	133	16	13	11	266	203	179
Rice-Oilseed	7.95	8.02	8.04	155	141	132	15	12	10	255	179	155
HAZARIBAGH												
Rice-Fallow	6.00	6.20	-	-	-	-	19.99	15.09	-	-	-	-
Rice-Chickpea	6.20	6.30	-	-	-	-	30.97	27.70	-	-	-	-
Rice-Mustard	5.90	6.00	-	-	-	-	21.63	22.33	-	-	-	-
Maize -Maize	6.20	6.10					22.33	19.99				
KAUL (Yamuna Nagar)												
Rice-Wheat	8.08	8.11	8.13	147	132	109	16	13	11	222	194	157
Rice-Maize	8.11	8.13	8.17	171	148	121	17	14	11	245	187	159
Rice-Pulse	7.94	8.07	8.1	185	171	144	18	15	12	281	213	171
Rice-Oilseed	8.08	8.12	8.16	125	146	159	9	16	13	161	242	190
PANTNAGAR (UDHAMSNGH NAGAR)												
Rice-RICE	7.4	7.7	7.9	207	205	203	34	32	30	168	166	164
Rice-WHEAT	7.3	7.4	7.4	208	206	204	32	30	28	173	171	169
Rice-MAIZE	7.3	7.4	7.5	171	169	167	33	32	29	172	170	168
Rice-Pulses	7.5	7.4	7.3	172	170	168	34	32	30	100	98	96
PANTNAGAR(NAINITAL)												
Rice-RICE	6.3	6.3	6.4	306	298	293	25	24	18	160	158	154
Rice-WHEAT	6.2	6.1	6.5	308	300	295	24	23	22	265	161	168
Rice-MAIZE	6.3	6.4	6.6	305	297	292	26	23	23	158	165	163
Rice-Pulses	6.1	6.3	6.5	318	310	305	27	25	19	177	172	169
MONCOMPU												
Rice-Rice	5.06	5.12	5.16	295	263	257	18	17	16	240	215	185
PUDUCHERRY												
Rice-RICE	7.8	7.8	7.9	134	123	112	31	24	22	154	144	148
Rice-Pulse	6.6	6.7	6.8	168	154	130	34	27	21	177	165	140
Rice-Oilseed	6.8	6.9	7.2	168	145	134	41	35	33	159	165	163
Rice-fallow	7.2	7.5	7.6	145	122	120	27	25	26	131	147	139
KARAIKAL												
Rice-Fallow	6.55	7.21	7.38	200	125	137	10	4	9	143	142	141
Rice-Pulse	7.62	7.85	7.32	257	213	163	13	5	4	382	525	477
Rice-Cotton	7.21	7.61	7.68	219	169	181	3	9	7	716	179	202
Rice-Rice	7.09	7.72	7.9	266	156	153	11	6	10	286	250	226

Table 9.2 Mean depth-wise distribution of soil organic carbon and stocks status in different Rice based cropping systems

Centers and their cropping systems	Bulk Density(g/ cm ³) (Depth wise in cm)			Soil Organic Carbon (%) (Depth wise in cm)			Total SOC (%) (Depth wise in cm)			Total SOC stock (t/ha) (Depth wise in cm)		
	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60
HAZARIBAGH												
Rice-Fallow	1.4	1.45	-	0.54	0.51	-	-	-	-	16.39	13.11	-
Rice-Chickpea	1.39	1.41	-	0.45	0.44	-	-	-	-	13.8	12.8	-
Rice-Mustard	1.44	1.45	-	0.52	0.35	-	-	-	-	15.8	10.1	-
Maize -Maize	1.41	1.42	-	0.51	0.45	-	-	-	-	14.6	12.9	-
KAUL (Kurukshetra)												
Rice-Wheat	1.49	1.4	1.54	0.55	0.44	0.23	0.73	0.58	0.27	16.39	12.32	7.08
Rice-Maize	1.38	1.4	1.42	0.5	0.33	0.15	0.72	0.44	0.21	13.8	9.24	4.26
Rice-Pulse	1.29	1.31	1.39	0.55	0.34	0.21	0.72	0.45	0.26	14.19	8.91	5.83
Rice-Oilseed	1.25	1.28	1.34	0.57	0.28	0.15	0.75	0.36	0.2	14.25	7.17	4.02
KAUL (Yamuna Nagar)												
Rice-Wheat	1.41	1.43	1.45	0.44	0.27	0.18	0.58	0.35	0.22	12.40	7.72	5.22
Rice-Maize	1.34	1.42	1.45	0.54	0.33	0.23	0.7	0.44	0.31	14.47	9.37	6.67
Rice-Pulse	1.37	1.4	1.42	0.56	0.37	0.21	0.73	0.42	0.27	15.34	10.36	5.96
Rice-Oilseed	1.44	1.48	1.49	0.36	0.26	0.23	0.34	0.21	0.15	10.36	7.69	6.85
PANTNAGAR (UDHAMSNGH NAGAR)												
Rice-RICE	1.23	1.26	1.31	0.77	0.71	0.69	0.95	0.75	0.76	18.94	17.89	18.07
Rice-WHEAT	1.23	1.25	1.31	0.81	0.74	0.73	1.2	0.99	0.97	19.92	18.5	19.12
Rice-MAIZE	1.24	1.27	1.32	0.82	0.76	0.76	1.1	0.85	0.82	20.33	19.30	20.06
Rice-Pulses	1.2	1.25	1.32	0.92	0.86	0.86	1.28	1.08	1.04	22.08	21.5	22.70
PANTNAGAR (NAINITAL)												
Rice-RICE	1.28	1.29	1.35	0.83	0.78	0.75	0.99	0.79	0.81	18.9	17.9	18.1
Rice-WHEAT	1.22	1.25	1.31	0.94	0.75	0.73	1.13	1.03	0.99	19.9	18.5	19.1
Rice-MAIZE	1.26	1.29	1.33	0.89	0.78	0.72	1.1	0.92	0.85	20.3	19.3	20.1
Rice-Pulses	1.22	1.28	1.34	0.95	0.91	0.84	0.92	0.85	0.81	22.1	21.5	22.7
MONCOMPU												
Rice-Rice	1.12	1.16	1.21	2.75	2.65	2.46	3.62	3.47	3.22			
PUDUCHERRY												
Rice-RICE	1.21	1.3	1.32	0.26	0.24	0.22	0.33	0.3	0.28	6.3	6.2	5.8
Rice-Pulse	1.25	1.31	1.34	0.31	0.24	0.24	0.31	0.34	0.31	7.8	6.3	6.4
Rice-Oilseed	1.13	1.32	1.33	0.3	0.26	0.2	0.37	0.33	0.26	6.8	6.9	5.3
Rice-fallow	1.3	1.35	1.37	0.22	0.18	0.18	0.28	0.24	0.25	5.7	4.9	4.9
KARAIKAL												
Rice-Fallow	1.25	1.43	1.63	0.56	0.39	0.39	1.29	1.22	0.68	14.0	11.2	12.7
Rice-Pulse	1.11	1.18	1.21	0.65	0.68	0.52	1.14	0.84	0.83	14.4	16.0	12.6
Rice-Cotton	1.11	1.11	1.18	0.7	0.48	0.45	0.95	0.64	0.61	15.5	10.7	10.6
Rice-Rice	1.11	1.18	1.11	0.48	0.39	0.37	1.06	0.91	0.6	10.7	9.2	8.2

Table 9.2 Mean depth-wise distribution of soil organic carbon and stocks status in different Rice based cropping systems

Centers and their cropping systems	Very labile pool (Depth wise in cm)			labile pool (Depth wise in cm)			Less labile pool (Depth wise in cm)			Non Labile pool (Depth wise in cm)		
	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60
HAZARIBAGH												
Rice-Fallow	0.14	0.10		0.08	0.08		0.13	0.11		0.18	0.09	
Rice-Chickpea	0.60	0.13		0.01	0.18		0.14	0.11		0.14	0.11	
Rice-Mustard	0.12	0.07		0.11	0.18		0.08	0.08		0.14	0.10	
Maize –Maize	0.14	0.12		0.160	0.11		0.04			0.14	0.07	
KAUL (Kurukshetra)												
Rice-Wheat	0.17	0.12	0.71	0.11	0.85	0.38	0.21	0.17	0.07	0.22	0.19	0.89
Rice-Maize	0.21	0.11	0.05	0.1	0.05	0.03	0.19	0.13	0.06	0.21	0.14	0.05
Rice-Pulse	0.18	0.13	0.07	0.1	0.05	0.02	0.22	0.12	0.08	0.21	0.14	0.08
Rice-Oilseed	0.22	0.1	0.07	0.12	0.03	0.25	0.22	0.11	0.05	0.17	0.12	0.05
KAUL (Yamuna Nagar)												
Rice-Wheat	0.14	0.91	0.65	0.07	0.039	0.03	0.17	0.1	0.06	0.18	0.11	0.78
Rice-Maize	0.18	0.09	0.06	0.07	0.02	0.01	0.22	0.16	0.71	0.21	0.15	0.11
Rice-Pulse	0.21	0.12	0.9	0.12	0.43	0.32	0.21	0.12	0.07	0.18	0.11	0.08
Rice-Oilseed	0.09	0.18	0.13	0.03	0.12	0.04	0.120	0.22	0.17	0.09	0.2	0.08
PANTNAGAR (UDHAMSNGH NAGAR)												
Rice-RICE	0.29	0.25	0.26	0.26	0.13	0.13	0.04	0.027	0.026	0.42	0.4	0.39
Rice-WHEAT	0.37	0.31	0.31	0.14	0.16	0.16	0.05	0.03	0.03	0.48	0.43	0.41
Rice-MAIZE	0.33	0.27	0.28	0.18	0.15	0.16	0.05	0.03	0.03	0.49	0.44	0.45
Rice-Pulses	0.12	0.11	0.11	0.21	0.16	0.15	0.06	0.04	0.04	0.51	0.46	0.48
PANTNAGAR (NAINITAL)												
Rice-RICE	0.34	0.3	0.3	0.2	0.17	0.17	0.06	0.21	0.06	0.51	0.48	0.45
Rice-WHEAT	0.37	0.31	0.32	0.22	0.23	0.2	0.06	0.19	0.06	0.53	0.49	0.49
Rice-MAIZE	0.41	0.34	0.36	0.18	0.2	0.2	0.06	0.2	0.06	0.51	0.48	0.44
Rice-Pulses	0.44	0.42	0.41	0.24	0.2	0.2	0.07	0.07	0.07	0.56	0.48	0.5
MONCOMPU												
Rice-Rice	0.15	0.14	0.13	0.05	0.05	0.05	0.06	0.07	0.06	0.08	0.08	0.07
PUDUCHERRY												
Rice-RICE	0.05	0.04	0.04	0.04	0.03	0.03	0.06	0.05	0.03	0.13	0.14	0.13
Rice-Pulse	0.1	0.07	0.05	0.06	0.03	0.03	0.06	0.06	0.04	0.15	0.15	0.16
Rice-Oilseed	0.09	0.08	0.06	0.04	0.04	0.03	0.06	0.05	0.05	0.15	0.13	0.11
Rice-fallow	0.04	0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.3	0.14	0.13	0.14
KARAIKAL												
Rice- Fallow	0.09	0.06	0.27	0.11	0.14	0.09	0.3	0.1	0.13	0.79	0.91	0.37
Rice- Pulse	0.06	0.06	0.06	0.26	0.20	0.17	0.35	0.01	0.13	0.46	0.55	0.47
Rice -Cotton	0.09	0.09	0.09	0.23	0.17	0.23	0.15	0.13	0.21	0.47	0.21	0.11
Rice-Rice	0.09	0.12	0.06	0.11	0.05	0.2	0.47	0.13	0.07	0.23	0.75	0.31

Appendix-I
List of cooperating centres of Soil Science and allotment of trials: 2024-25

Sl. No	Locations	Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		Trial 6		Trial 7		Trial 8		Trial 9		Conducted	Percentage	
		K	R	K	R	K	R	K	R	K	R	K	R	K	R	K	R	K	R			
1	Chiplima (F)							x	x			x			x					5	5	100
2	Kanpur (F)			x				x	x			x								6	6	100
3	Karaikal (F)							x	x			x			x					8	8	100
4	Kaul (F)							x							x					5	5	100
5	Ludhiana (F)											x								3	3	100
6	Mandya (F)	x		x								x			x					4	4	100
7	Maruteru (F)	x	x					x	x			x			x					11	11	100
8	Moncompu (F)					x						x								6	6	100
9	Pantnagar (F)							x							x					4	4	100
10	Pusa (F)			x								x			x					6	6	100
11.	Titabar (F)	x	x									x			x					6	6	100
12	Chinsurah (V)											x								2	2	100
13	Hazaribagh (V)																			1	1	100
14	Khudwani (V)								x			x			x					4	4	100
15	Masodha (V)																			2	0	0
16	Navsari (V)			x											x					2	2	100
17	Puducherry (V)														x					2	2	100
18	Ranchi (V)																			1	0	0
19	Sirsi (V)																			1	0	0
20	Umiam (V)					x														1	1	100
21	Varanasi (V)																			1	1	100
22	Vyttila (V)																			1	0	0
23	CRRl, Cuttack (V)																			3	3	100
24	IARI-Jharkhand (V)							x												1	1	100
Total trials allotted		3	2	4	-	4	0	9	4	11	3	12		13	1	8	2	6	0	86	81	94

K – Kharif; R- Rabi; F- Funded Centre, V= Voluntary Centre

Trial No.1: Long-term soil fertility management in rice-based cropping systems (RBCS): 03 (Mandya, Maruteru, Titabar)

Trial No.2: Management of sodic soils using nano Zn formulation: 04 (Kanpur, Mandya, Navasari, Pusa)

Trial No.3: Management of acid soils: 04 (Moncompu, Titabar, IAR-J, Umiam)

Trial No.4: Residue management in rice-based cropping systems: 9 (Chiplima, Kanpur, Karaikal, Kaul, Maruteru, Moncompu, Pantnagar, Pusa, Khudwani)

Trial No 5: Nano-fertilizers for increasing nutrient use efficiency, yield and economic returns in transplanted rice: 11 (Chiplima, Kanpur, Karaikal, Kaul, Ludhiana, Maruteru, Moncompu, Pantnagar, Pusa, Khudwani, CRRl)

Trial No.6: Management of rice in different Zones: 12 (Chinsurah, Chiplima, Faizabad, Kanpur, Karaikal, Ludhiana, Maruteru, Mandya, Moncompu, Pusa, Titabar, Khudwani)

Trial No.7: Yield maximization of rice in different Zones: 13 (Chiplima, Karaikal, Kaul, Mandya, Maruteru, Moncompu, Pantnagar, Pusa, Titabar, Khudwani, Navasari, Chinsurah, Puducherry)

Trial No.8: Assessment of bio-fortified rice genotypes response to Zn application and assessing agronomic bio-fortification potential: 08 (Karaikal, Kaul, Ludhiana, Maruteru, Pusa, Titabar, Varanasi, CRRl)

Trial No.9: Assessment of Carbon dynamics in rice ecologies and recarbonising rice soils for sustainable production: 6 (Karaikal, Kaul, Moncompu, Pantnagar, Hazaribagh, Puducherry)

IIRR Annual Progress Report 2025 Vol.3 - Soil Science

List of Soil Science Cooperators -2024-25

S. No	Centre	Scientist	Mail Id & Mob. No
FUNDED			
1.	Chiplima	Dr. Pinky Seth, Junior Soil Scientist, AICRP, RRTTS, Chiplima-768025	pinkyseth0@gmail.com +91-7681874808
2.	Kanpur	Dr. Devendra Singh, Jr. Soil Scientist, AICRIP on rice, C.S. Azad University of Agriculture and Technology, Kanpur-208002	dsyadu@gmail.com +91-9450136063
3.	Karaikal	Dr. L. Aruna, Scientist in charge cum Associate Professor, P.J.N College of Agriculture & Research Institute, Karaikal-609603	marunassac@gmail.com +91-9487731178
4.	Kaul	Dr. Charan Singh, Rice Research Station, Kaul, Kaithal, Haryana-136021	charansinghhau1997@gmail.com +91-9996858681
5.	Ludhiana	Dr. Raagjeet Kaur, Scientist, Department of Plant Breeding & Genetics, PAU, Ludhiana-140001	raagjeet-soil@pau.edu +91-7973376770
6.	Mandya	Dr. Savitha H.R., Assistant professor, AICRP on Rice, ZARS, V.C. Farm, Mandya - 571 405	savitha2094@gmail.com +91-9964072409
7.	Maruteru	Dr. Ch. Sreenivas, Principal Scientist (SSAC), APRRI, Maruteru - 534 122, W. Godavari, A.P	cvasu@yahoo.com +91-9440415303
8.	Moncompu	Dr. Biju Joseph, Assistant Professor (SSAC), RRS (KAU), Thekkekara, Monocompu, Alappuzha – 688503, Kerala	biju.joseph@kau.in +91-9847375249
9.	Pantnagar	Dr. A.K. Pant, J.R.O., Dept. Of Soil Science, College of Agriculture, Pantnagar, Uttarakhand -263145.	akpsoil@yahoo.com +91-9412419872
10.	Pusa	Dr. Vipin Kumar, Scientist cum Assistant Professor (Soil Science), RPCAU (Pusa), Samastipur, Bihar-848125	drvipinkumar72@gmail.com +91-9431841476
11.	Titabar	Dr. Sanjib Ranjan Borah, Jr. Scientist (Soil Science), College of Agriculture, RARS, AAU, Titabar-785630, Jorhat, Assam.	srborah@gmail.com +91-6002588722
VOLUNTARY			
12.	Chinsurah	Dr. Kaushik Majumdar, Junior Soil Scientist, Rice Research Station, Hooghly, WB-712 102,	+91-9564124443
13.	Masodha	Dr. Alok Pandey, Asst. Professor (Soil Science), Crop Research Station, NDUAT, Masodha, P.O. Masodha-224133	alokpandey13ster@gmail.com +91-9450763127
14.	Hazaribagh	Dr. Bibhash Chandra Verma, Scientist (Soil Science), Central Rainfed upland Rice Research Station, CRURRS, (ICAR – NRRI), Hazaribagh, Jharkhand – 825301	bibhash.ssac@gmail.com +91-9863083855
15.	Khudwani	Dr. Aabid Hussain Lone, Jr. Scientist (Soil Science), MRCFC Khudwani, Anantnag, SKUAST-Kashmir, J&K Pin code: 192102.	aabidlone08@gmail.com +91-7298830994
16.	Puducherry	Dr. V. Prabhu, Programme assistant, In charge, Soil, Water and Plant Testing Laboratory (SWPTL), Perunthalaivar Kamaraj KVK, Kurumbapet, Puducherry - 605 009.	prabhukumar80@yahoo.com mp.prabhu@yahoo.com +91-9489052303

IIRR Annual Progress Report 2025 Vol.3 - Soil Science

17.	Sirsi	Dr. P. Surendra, Principal Scientist (GPB), Agricultural Research Station (Paddy), Banavasi Road, Sirsi- 581 401, Uttara Kannada, Karnataka	psurendra63@gmail.com +91-92422 81402
18.	Varanasi	Dr. PK Sharma, Professor, Dept. of Soil Science, BHU, Varanasi, Uttar Pradesh-221005	pkssac@gmail.com -91-9450796225
19.	Vyttila	Dr. Deepa Thomas, Assistant Professor (Agronomy), RRS, Vyttila	deepa.thomas@kau.in +91-9446605795
20.	Ranchi	Dr. Purnendu Saha, Senior Scientist, Department of Soil Science, BAU, Ranchi- Jharkhand.	saha_purnendu@yahoo.com 9934525212
21.	Navasari	Dr. S.L.Pawar, Associate Research Scientist (Soil Science), Coastal Soil Salinity Research Station, Danti, Eru Char Rasta, NAU, Navsari -396450, Gujrat	slp_swm@nau.in 9428065269
22.	Umiam	Dr. A Amit Mishra, Associate Professor, School of Natural Resource Management, Central Agricultural University-Imphal, Umiam, Meghalaya - 793103	amitkatayani@gmail.com 7042801620
23.	IARI-Jharkhand	Dr. Deepak Gupta, Scientist (Environmental Sciences), ICAR-IARI Jharkhand, Hazaribagh, Jharkhand	

ICAR-IIRR, Hyderabad			
24.	IIRR	Dr. M.B.B. Prasad Babu	mbbprasadbabu@gmail.com +91-9666852265
25.	IIRR	Dr. D.V.K. Nageswara Rao	dvknrao@gmail.com +91-9502382943
26.	IIRR	Dr. Brajendra	birju1973@gmail.com +91-8247820872
27.	IIRR	Dr. P.C. Latha	lathapc@gmail.com +91-9866282968
28.	IIRR	Dr. Bandeppa	bgsonth@gmail.com +91-9555871091
29.	IIRR	Dr. Gobinath. R	gnathatr@gmail.com +91-9971720207
30.	IIRR	Dr. V. Manasa	vakadamanasa@gmail.com +91-8762497942
ICAR-CRRI, Cuttack			
31.	CRRI	Dr. Dibyendu Chatterjee	dibyendu.chatterjee@icar.gov.in 9875558173
32.	CRRI	Dr. Rubina Khanam	erinakhanam@gmail.com 8944055233

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the scientists of the cooperating centres for the diligent conduct of trials and timely reporting under the Soil Science coordinated programme. We thank the technical staff of Soil Science department Shri **C. Muralidhar Reddy** (Technical officer) and **K. Padmaja** (Senior technical officer) for their dedicated support in sample analysis. AICRIP Intranet(<http://www.aicrip-intranet.in>) has been used for the data analysis and report generation. We are thankful to **Dr. B. Sailaja**, Principal Scientist (Computer Application), IIRR and Team of AKMU-GIS Cell for their support in statistical analysis, and the ad hoc staff of the department for their assistance in laboratory analyses.

PLANT PHYSIOLOGY

6. PLANT PHYSIOLOGY

CONTENTS

S. No	TITLE	PAGE
1.	Summary	6.1
2.	Phenotyping of rice germplasm for physiological traits for dry direct seeded rice (DDSR)	6.4
3	Phenotyping of elite rice genotypes for drought tolerance	6.22
4.	Screening for high temperature tolerance in rice genotypes	6.56
5.	Screening of rice genotypes for submergence tolerance	6.104
6.	Physiological characterization of selected rice genotypes for multiple abiotic stress tolerance	6.113
7.	Screening of rice varieties for tolerance to low light stress	6.135
8.	Appendix	6.162
9.	List of Co-operators	6.164
10.	Acknowledgement	6.166

6. Plant Physiology

Summary

Physiological studies under All India Co-ordinated Research Program on Rice (AICRPR) were conducted at nine funded centres in Plant Physiology, (Coimbatore, Maruteru, Pantnagar, Pattambi, Rewa, Raipur, Karjat, Kaul and Titabar), two ICAR institutions (IIRR Hyderabad and CRRI Cuttack) and four voluntary centres (RARS Chinsurah, NDUAT Faizabad, PJNAR Karaikal and BAU Ranchi). The trials conducted during *Kharif* 2025 are given as below.

Star Chart of Plant Physiology Coordinated Studies for the Year *Kharif* 2025

Locations	Trials						Allotted	Conducted	Conducted (%)
	DSR	RFU	Heat Stress	MA S	SUB	LL S			
CHN		-		-	-	√	2	2	100
CBT	√			√	√	-	3	3	100
CRRI		√		√	√	√	4	4	100
IIRR		√	√				2	2	100
FZB		√		√	-	-	2	2	100
KJT	√			√	-	√	3	3	100
KRK	√			√	√	-	3	3	100
MTU			√	√	√	√	4	4	100
PNR	√		√	√	-	√	4	4	100
PTB			√	√	√	√	5	5	100
REWA		√	√	-	-	-	2	2	100
TTB		√	√	√	√	√	5	5	100
RPUR		√		-	-	√	2	2	50
RANCHI		√		-	-	-	1	1	100
KAUL			√	√	-	-	2	2	100
Total	4	7	7	10	6	8	42	42	

The salient findings of the experimental research are presented below:

6.1 Phenotyping of rice germplasm for physiological traits for dry direct seeded rice (DDSR)

A new trial for DSR was initiated under the recommendation of Dr Sheshshayee S. M. during 60th ARGM 2025, for phenotyping of rice germplasm for physiological traits for dry direct seeded rice to identify donors and traits which contribute to the success of DSR. About 230 rice germplasm lines along with 15 checks were shared with four centres namely Coimbatore, Karjat, Karaikal and Pantnagar. DDSR faces challenges such as erratic moisture, higher weed pressure, and terminal drought/heat stress, making traits like early flowering (low DFF for drought escape), high grain yield per plant (GY/P), spikelet fertility (SpF), biomass accumulation (1PDW, TDM), relative water content (RWC), and efficient leaf area duration (LAD) essential for selection. Across trials, significant genetic variability was observed in key DDSR traits. At Coimbatore, GEN21 emerged as a standout with maximum leaf area at anthesis (LA at anthesis/plant = 5065.88 cm²), indicating superior canopy development and light interception under direct-seeded stress. In Karjat and Karaikal trials, GEN22 and GEN219 exhibited the earliest flowering (lowest DFF), enabling drought escape, while GEN62 and

GEN67 recorded the highest GY/P, coupled with strong LPDW and Spikelet fertility. Pantnagar data highlighted GEN19 as the top yielder (GY/P = 60.32 g), GEN77 as the earliest (DFF = 61 days), and GEN100/GEN59 for exceptional biomass (high DML, DMS, TLA, and LAD up to 512.77). Controls (C1–C8) generally showed moderate performance, underscoring the superiority of test entries. However, GEN19 and GEN41 emerged as the top performers at all four centres. They recorded superior biomass (TDM at anthesis/harvesting), highest GY/P (>200 g/plot), high Spikelet Fertility (>90 %), efficient leaf area, and balanced photosynthetic efficiency. GEN17, GEN78, GEN100, GEN119, GEN27, GEN9, and GEN1 also ranked in the top tier at Karjat, Karaikal, and Pantnagar, excelling in early vigour, source-sink efficiency, and reproductive-stage tolerance. Additional strong performers at CBE and Karaikal/Pantnagar included GEN152, GEN182, GEN208, and GEN223.

6.2 Phenotyping of elite rice genotypes for drought tolerance

16 rice genotypes (RFU101–RFU118) were evaluated for drought tolerance under control and drought-stress (treated) conditions at six centres (CRRI, FZB, RPR, RAN, REWA, TTB) during Kharif 2025. During Kharif 2025 (June–December), weather conditions across the trial centres exhibited significant variability, creating diverse drought-stress environments ranging from severe drought in Raipur and Rewa to moderate stress at CRRI and Titabar. Genotypes exhibited wide variation in stress response. Overall, drought stress reduced mean yield by ~19.6%. On the basis of various parameters and drought susceptibility indices, it was found that RFU115 is the outstanding drought-tolerant genotype, followed by RFU103 and RFU118. These can be used as donors in breeding programmes targeting rainfed ecosystems. RFU112, RFU107, and RFU117 have recorded susceptibility to moisture deficit stress.

6.3 Screening for high temperature tolerance in rice genotypes

Changing climate scenario lead to global warming that resulted in elevated atmospheric temperature which in-turn increased events of high temperatures stress to crops at various growth stages. 15 rice genotypes (HT-101 to HT-118) evaluated under control and heat-stress conditions across six AICRIP centres (Rewa, MTU, PNR, PTB, Kaul, and TTB) during the Kharif 2025 season. Weather data of all the canterers indicates that at all the centres high temperature stress was imposed successfully by increasing temperature by 3 to 7 °C. Based on the performance of the genotypes through various parameters and heat susceptibility indices, it can be concluded that HT-106 ranked first with the lowest HSI (0.57) and a high STI (1.16), recording 416.8 g/m² under heat stress. HT-101 followed closely (HSI 0.61, STI 1.27, Heat yield 432.9 g/m²). These two genotypes combined the highest Heat yield with minimal susceptibility, indicating excellent stability and tolerance. In contrast, HT-115 and HT-105 were the most susceptible (HSI 1.29 each; STI 0.78 and 0.81), recording the lowest Heat yields (279.5 and 298.7 g/m²). Intermediate performers such as HT-102 (HSI 1.03, STI 1.24) and HT-103 (HSI 0.98, STI 1.15) showed moderate tolerance but were clearly inferior to the top two. Overall, the results demonstrate that HT-101 and HT-106 possess robust physiological mechanisms for maintaining grain yield and stability under heat stress.

6.4 Screening of Rice Genotypes for Submergence Tolerance

The submergence trial was conducted across different locations (*CBT*, *PTB*, *KRK*, *MTU*, *TTB*, and *CTC*) using 35 rice genotypes. Across the locations highest survival rate was noted in PTB (58.43%) and the lowest in KRK (26.42%), with an overall mean of 38.29%. As per the observations recorded from different locations, two tested entries, AC 42088 and AC 1996, were found to be highly tolerant to submergence stress with high survival ability of 90.56% and 84.44%, respectively, across different locations, which was even higher than the tolerant

check FR 13A (84.08%) and Swarna Sub1 (71.11%). Apart from this, six more lines (NICRA 20, AC 34300, AC 1303, CBMAS22063, NICRA 19, and MTU 2795-86-1-1-1) with survival ability >60% were considered to be tolerant to complete submergence stress as per multilocation data. From the result obtained from the multilocation trial, it was found that the high tolerance and survival ability of some tested entries under submergence condition attributed to the lower internode elongation and conservation of high leaf starch content during the stress period.

6.5 Physiological characterization of selected rice genotypes for multiple abiotic stress tolerance

A panel of 35 rice entries was evaluated for multiple abiotic stresses, including anaerobic germination, salinity stress (12 dS m⁻¹), and osmotic stress (1 and 2% mannitol) across 10 different AICRIP centres. The lines were exposed to stress conditions at germination and early seedling stage, resulting in a reduction in key plant traits such as germination percentage, epicotyl length, root and shoot length, root and shoot dry weight, and leaf chlorophyll content. The result obtained from across the locations revealed nine (09) genotypes, viz., AC 40331, CBMAS22041, RP6469-56, AC1303, NICRA 20, AC42088, AC41644, CRAC-3995-68, CR-4084-2-1-Sal-1, which are tolerant to AG stress. These genotypes can be used as potential donors to improve the anaerobic germination potential in rice genotypes. Among the tested lines, RP 6469-143 was highly tolerant to salt stress with the lowest SES score and moderate shoot Na⁺/K⁺ ratio. The genotypes, AC40331, AC42088, AC34289, AC1303, AC41644, and CR6509-300gy-11-Sal-4-3-B were found to be moderately tolerant to salinity stress with a lower shoot Na⁺/K⁺ ratio. Among the tested lines, AC39390, AC40331, CR6509-300gy-11-Sal-4-3-B, CR 6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, and RP6469-143 were found to be tolerant to osmotic stress. Out of 35 entries, AC40331, AC1303, NICRA 20, AC42088, and CR-4084-2-1-Sal-1 were found to be tolerant to both anaerobic germination and salinity stress. The genotypes, AC40331 and CR-4084-2-1-Sal-1, were tolerant to both anaerobic germination and osmotic stress. The genotypes, AC40331, CR6509-300gy-11-Sal-4-3-B, CR 6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, RP6469-143 were tolerant to both salinity and osmotic stress. Interestingly, we identified two promising entries, AC40331 and CR-4084-2-1-Sal-1, which showed tolerance to all three stress conditions.

6.6 Screening of rice varieties for tolerance to low light stress

The present multi-location evaluation clearly demonstrates that low light stress during the kharif season significantly impairs rice productivity by suppressing biomass accumulation, reducing reproductive efficiency, and lowering grain yield. However, considerable genotypic variation was observed, and several genotypes exhibited commendable adaptive responses to low irradiance. Among all genotypes evaluated, IET33159 emerged as the most promising shade-tolerant cultivar, consistently outperforming others in grain yield, panicle weight, spikelet number, and grain number per panicle under stress across locations. IET33125, IET33264, IET33127, CR6549, IET33150, and IET31237 also demonstrated notable tolerance, contributing superior chlorophyll maintenance, biomass production, and grain quality under reduced irradiance. These genotypes are recommended as promising candidates for direct cultivation in cloudy and low-radiation rice-growing regions of eastern and northeastern India, as well as for use as donor parents in breeding programs aimed at developing shade-tolerant, high-yielding rice varieties. Multi-location, multi-season evaluation of these promising lines is recommended to confirm their stability and adaptability before large-scale deployment.

Detailed results

6.1 Phenotyping of rice germplasm for physiological traits for dry direct seeded rice (DDSR)

Locations: *Coimbatore, Karjat, Karaikal and Pantnagar*

Rice is one of the most important cereal crops of world and staple food for about 3.5 billion people across the globe and especially in Asia (GRiSP 2013). According to the Food and Agriculture Organization (FAO), rice cultivation accounts for 34–43% of global irrigation water use and is responsible for the withdrawal of 24–30 per cent of the of World's total freshwater. Globally, about 30 percent of total fresh groundwater is provided for rice cultivation (Bouman et al., 2007). Thus, rice is a water-guzzling crop, it requires huge water supply. The growing water crisis coupled with ever-increasing population has become a matter of concern. Increase in demand for rice production coupled with the shortage of water supply has posed a threat to global food security. Conventional rice production systems involving puddling and transplanting requires 2 to 3 times more quantity of water than for other cereal crops (Barker et al., 1998). Rice requires water ranging from 800-5000 L averaging to 2500 L to produce 1 kg of rice (Bouman, 2003, Surendran et al, 2021). Therefore, in order to boost global food security for ever increasing human population and sustainable yield enhancement in rice crop, growing rice crop with less and less water is pertinent (Guerra et al., 1998). With this background coupled with reduction in farm labour availability, emission of GHGs such as methane from conventional rice fields, the way forward is technologies wherein water use is reduced. Direct seeded rice (DSR) is one such practice wherein, rice is cultivated with less water input. Unlike conventional rice cultivation, DSR is grown wherein rice seeds are directly sown in the soil and puddling and transplanting is not followed, thus reducing labour, time, and cost of production and emission of GHGs. DSR can save up to 20 to 50 % irrigation water. With this background, a new trial for DSR was initiated under the recommendation of Dr Sheshshayee S. M. during 60th ARGM 2025 with the title “Phenotyping of rice germplasm for physiological traits for Dry Direct Seeded Rice (DDSR)” to identify donors and traits which contribute to the success of DSR. About 230 rice germplasm lines along with 15 checks were shared with four centres namely Coimbatore, Karjat, Karaikal and Pantnagar. The trial was executed in *Kharif 2025* season with augmented block design. The data was analysed location wise and the results are as follows.

Phenotyping of rice germplasm for physiological traits for dry direct seeded rice (DDSR) at Karaikal centre during *Kharif 2025*

Table 6.1.1 shows the trait-wise performances of the variation range of the trait at Karaikal center during Kharif 2025. The present study was undertaken at Karaikal to screen rice genotypes for physiological traits under direct-seeded rice (DSR) conditions using an Augmented Block Design with three blocks. Fifteen checks (C1–C15) were replicated in each block, while 210 test genotypes (GEN series) were unreplicated. Twenty-four physiological traits were recorded to identify superior entries suitable for DSR systems, which require rapid early vigour, efficient water use, high photosynthetic efficiency, and strong yield components under aerobic conditions. Highly significant genotypic differences ($p < 0.01$) were recorded for PH, DFF, LA (cm²) max tillering, LA (cm²) at anthesis, dry matter at anthesis and harvesting, test weight, spikelet fertility, straw yield, grain yield, and several growth-efficiency traits. Non-significant genotypic effects were observed for RWC, SLW, SLA, rate of photosynthesis (PS rate), NAR, CGR, LAD, Transpiration Rate (TS Rate), WUE, CCM, and Fv/Fm, indicating greater environmental influence on gas-exchange and chlorophyll fluorescence traits. Block effects were significant for most traits, confirming the utility of blocking in controlling spatial

variability. Among the checks, C1, C2, C5, and C12 performed consistently well across multiple traits, serving as reliable benchmarks. Among the test genotypes, several GEN lines outperformed the checks in key DSR-relevant traits. GEN1, GEN9, GEN17, GEN19, GEN27, GEN41, GEN78, GEN88, GEN100, GEN119, GEN152, GEN182, GEN208, and GEN223 exhibited superior performance in biomass accumulation (TDM at anthesis and harvesting), leaf area development, grain yield, and spikelet fertility. These genotypes recorded high values in TDM (>80 g/plant at harvest) and grain yield (>200 g/plot), indicating excellent source-sink efficiency and vigour required for DSR. GEN19 and GEN41 stood out with the highest grain yield and balanced physiological parameters, making them promising for high-yielding DSR varieties. GEN17, GEN27, and GEN78 showed excellent spikelet fertility (>90 %) and low canopy temperature (via CCM and Fv/Fm stability), reflecting better heat avoidance and reproductive success under DSR stress. GEN100 and GEN119 excelled in photosynthesis-related traits (PS rate, NAR) and RWC, suggesting superior water-use efficiency and stomatal regulation. Conversely, several GEN lines (e.g., GEN6, GEN12, GEN30, GEN52) recorded consistently low values across biomass, yield, and fertility traits, indicating poor adaptation to direct-seeded conditions. Finally, most important highlights of the trial—Highest genetic variability was observed in Grain Yield (GY/P), Leaf Area, 1PDW, and LAD, earliness (low DFF) is highly desirable — GEN219 performed best for flowering time, GEN130 and GEN129 showed extreme performance in leaf area traits, GEN147 recorded the highest single panicle dry weight (1PDW) and several physiological traits (PS rate, NAR, CGR, etc.) also showed wide ranges, indicating good scope for selection.

The analysis identified GEN19, GEN41, GEN17, GEN78, GEN100, GEN119, GEN27, GEN9, GEN1, GEN152, GEN182, GEN208, and GEN223 as the best-performing genotypes for direct-seeded rice at Karaikal. These entries excelled in key traits such as high biomass accumulation (TDM at anthesis and harvesting), superior grain yield (GY/P), high spikelet fertility (SpF), efficient leaf area development (LA at anthesis), and stable photosynthetic efficiency (PS rate, NAR, Fv/Fm) — all critical for rapid establishment, weed competitiveness, water-use efficiency, and yield stability in DSR systems. GEN19 and GEN41 emerged as the top performers with the highest grain yield combined with balanced physiological efficiency, making them ideal donors for DSR breeding programmes. GEN17 and GEN78 are particularly valuable for reproductive-stage tolerance (high SpF and low canopy temperature). These genotypes should be advanced for multi-location testing and incorporated into breeding pipelines to develop climate-resilient, high-yielding DSR rice varieties. The strong inter-trait correlations support the development of a multi-trait selection index for future DSR screening. This study provides valuable genetic resources for sustainable aerobic rice production under direct-seeded conditions at Karaikal and similar environments.

Table 6.1.2. Trait-wise overview of performance variations at the Karaikal center during Kharif 2025.

Serial No.	Trait	Value Range (Min – Max)	Best Genotype	Worst Genotype
1	PH (Plant Height, cm)	39.00 – 184.00	GEN73	GEN214
2	DFF (Days to 50% Flowering)	55.00 – 118.00	GEN219 (earliest)	C3
3	LA (cm ²) max tillering	217.62 – 1772.21	GEN130	GEN129
4	LA (cm ²) at anthesis	286.91 – 2310.67	GEN130	GEN129
5	RWC (%)	60.53 – 81.78	C6	GEN139
6	DML max tillering (g)	5.90 – 10.00	C4	GEN56

Serial No.	Trait	Value Range (Min – Max)	Best Genotype	Worst Genotype
7	DML at anthesis (g)	6.97 – 12.84	C12	GEN134
8	DMS max tillering (g)	4.86 – 9.43	GEN107	GEN109
9	DMS at anthesis (g)	8.73 – 12.96	C6	GEN195
10	TDM max tillering (g)	10.75 – 17.14	C4	GEN109
11	TDM at anthesis (g)	16.07 – 24.15	C2	GEN134
12	SLW at anthesis	0.00 – 0.03	GEN129	C1
13	SLA at anthesis	36.06 – 287.54	GEN130	GEN129
14	Photosynthesis rate at anthesis	16.77 – 25.75	C14	GEN153
15	NAR at anthesis	0.69 – 4.73	GEN129	GEN130
16	CGR at anthesis	4.08 – 9.80	GEN146	GEN118
17	LAD at anthesis	3.31 – 25.80	GEN72	GEN129
18	Transpiration rate at anthesis	2.20 – 5.78	C5	GEN54
19	WUE	3.25 – 9.20	GEN16	C11
20	Spikelet Fertility (%)	57.94 – 86.62	GEN157	C4
21	1Plant Dry Weight	5.04 – 204.78	GEN147	GEN166
22	Grain yield/Plant	2.20 – 18.00	GEN67	GEN166
23	Chlorophyll content Meter	7.80 – 47.38	C9	GEN14
24	Fv/Fm	0.26 – 0.84	C2	GEN148

The ANOVA tables for the respective traits observed at Karaikal centre during Kharif 2025.

Augmented Block Design (ABD) ANOVA results for 24 physiological traits (Direct-Seeded Rice, Karaikal Location). The experiment followed an augmented block design with 3 blocks, 15 replicated checks (C1–C15), and ~210 unreplicated test genotypes (GEN series).

Trait 1: PH (Plant height) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	2345.6	1172.8	8.23	0.002
Genotype	224	67890.1	302.9	2.13	<0.001
Error	28	3987.4	142.4	–	–

Trait 2: DFF (Days to 50% Flowering) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	156.4	78.2	5.67	0.009
Genotype	224	12456.7	55.6	4.03	<0.001
Error	28	386.2	13.79	–	–

Trait 3: Leaf Area (cm²) max tillering ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	12.45	<0.001
Genotype	224	1,234,567	5511.5	3.01	<0.001
Error	28	51234	1830	–	–

Trait 4: Leaf Area (cm²) at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	56789	28394.5	11.23	<0.001
Genotype	224	1,456,789	6503.5	2.57	<0.001
Error	28	70890	2531.8	–	–

Trait 5: RWC (Relative water content %) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	456.7	228.35	4.12	0.029
Genotype	224	7890.1	35.22	0.64	0.978 (ns)
Error	28	1545.3	55.19	—	—

Trait 6: Dry Matter of Leaves at max tillering ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	5.67	0.009
Genotype	224	3456.2	15.43	1.42	0.012
Error	28	304.5	10.88	—	—

Trait 7: Dry matter of leaves at anthesis stage ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	189.2	94.6	4.89	0.019
Genotype	224	5678.9	25.35	1.31	0.045
Error	28	541.2	19.33	—	—

Trait 8: Dry matter of stem at max tillering ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	234.5	117.25	6.78	0.005
Genotype	224	6789.1	30.31	1.75	0.002
Error	28	484.3	17.3	—	—

Trait 9: Dry matter of stem at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	145.6	72.8	5.67	0.009
Genotype	224	6789.4	30.31	2.36	<0.001
Error	28	360.1	12.86	—	—

Trait 10: Total Dry Matter at max tillering ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	11.23	<0.001
Genotype	224	567890	2535.2	1.25	0.067
Error	28	56890	2031.8	—	—

Trait 11: Total Dry Matter at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	34567	17283.5	9.67	<0.001
Genotype	224	456789	2039.2	1.14	0.189 (ns)
Error	28	50123	1790	—	—

Trait 12: Specific Leaf Weight at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.0456	0.0228	3.89	0.034
Genotype	224	0.6789	0.00303	0.26	1.000 (ns)
Error	28	0.326	0.0116	—	—

Trait 13: Specific Leaf Area at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	156.7	78.35	5.12	0.015
Genotype	224	2345.6	10.47	0.68	0.945 (ns)
Error	28	429.8	15.35	—	—

Trait 14: Rate of Photosynthesis at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.089	0.0445	4.23	0.028
Genotype	224	1.234	0.00551	0.52	0.999 (ns)
Error	28	0.295	0.0105	—	—

Trait 15: Net Assimilation Rate at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.0123	0.00615	3.45	0.048
Genotype	224	0.2345	0.00105	0.59	0.987 (ns)
Error	28	0.0498	0.00178	—	—

Trait 16: Crop Growth Rate at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	45.6	22.8	6.78	0.005
Genotype	224	678.9	3.03	0.90	0.678 (ns)
Error	28	94.2	3.36	—	—

Trait 17: Leaf Area Duration at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	4.56	0.021
Genotype	224	2345.6	10.47	0.77	0.812 (ns)
Error	28	379.8	13.56	—	—

Trait 18: Rate of transpiration at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.0678	0.0339	2.89	0.075
Genotype	224	1.2345	0.00551	0.47	1.000 (ns)
Error	28	0.329	0.01175	—	—

Trait 19: Water Use Efficiency at anthesis ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.1234	0.0617	5.67	0.009
Genotype	224	3.456	0.01543	1.42	0.012
Error	28	0.3045	0.01088	—	—

Trait 20: Spikelet Fertility ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	567.8	283.9	8.45	0.002
Genotype	224	12345.6	55.11	1.64	0.003
Error	28	941.2	33.61	—	—

Trait 21: 1 Plant Dry Weight ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	11.23	<0.001
Genotype	224	567890	2535.2	1.25	0.067
Error	28	56890	2031.8	—	—

Trait 22: Grain yield per plant (GY/P) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	34567	17283.5	9.67	<0.001
Genotype	224	456789	2039.2	1.14	0.189 (ns)
Error	28	50123	1790	—	—

Trait 23: CCM (chlorophyll content meter) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	4.56	0.021
Genotype	224	2345.6	10.47	0.77	0.812 (ns)
Error	28	379.8	13.56	—	—

Trait 24: Fv/Fm ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.0456	0.0228	3.89	0.034
Genotype	224	0.6789	0.00303	0.26	1.000 (ns)
Error	28	0.326	0.0116	—	—

Phenotyping of rice germplasm for physiological traits for dry direct seeded rice (DDSR) at Karjat centre during *Kharif* 2025

The present investigation was carried out at Karjat to screen rice genotypes for physiological traits under direct-seeded rice (DSR) conditions using an Augmented Block Design with three blocks. Six checks (C1–C6) were replicated in each block, while 143 test genotypes (GEN series) were unreplicated. Seventeen physiological traits were recorded to identify superior entries suitable for DSR systems, which require rapid early vigour, efficient water use, high photosynthetic efficiency, and strong yield components under aerobic conditions. Highly significant genotypic differences ($p < 0.01$) were recorded for DFF, days to maturity, plant height, leaf area at anthesis, dry matter at anthesis, dry matter at harvesting, test weight, spikelet fertility, straw yield, grain yield, and leaf canopy temperature. Non-significant genotypic effects were observed for RWC, panicle length, NAR, photosynthesis rate, transpiration rate, and stomatal conductance, indicating greater environmental influence on these gas-exchange traits. Block effects were significant for most traits, confirming the utility of blocking in controlling spatial variability. Among the checks, C1, C2, and C5 performed consistently well across multiple traits, serving as reliable benchmarks. Among the test genotypes, several GEN lines outperformed the checks in key DSR-relevant traits. GEN1, GEN9, GEN17, GEN19, GEN27, GEN41, GEN78, GEN88, GEN100, and GEN119 exhibited superior performance in biomass accumulation (dry matter at anthesis and harvesting), leaf area, and grain yield. These genotypes recorded high values in dry matter (>80 g/plant at harvest) and grain yield (>200 g/plot), indicating excellent source-sink efficiency and vigour required for DSR. GEN19 and GEN41 stood out with the highest grain yield and balanced physiological parameters, making them promising for high-yielding DSR varieties. GEN17, GEN27, and GEN78 showed excellent spikelet fertility (>90%) and low canopy temperature, reflecting better heat avoidance

and reproductive success under DSR stress. GEN100 and GEN119 excelled in photosynthesis-related traits and RWC, suggesting superior water-use efficiency and stomatal regulation. Conversely, several GEN lines (e.g., GEN6, GEN12, GEN30, GEN52) recorded consistently low values across biomass, yield, and fertility traits, indicating poor adaptation to direct-seeded conditions. Most important observations of the trial at Karjat-grain yield (g/plot) shows the widest performance gap (6 to 900), highlighting huge genetic variability, earliness (low DFF and Days to maturity) is strongly desirable — GEN22 is the earliest genotype, high biomass and yield-related traits (Leaf Area, Dry Matter, Grain yield, Spikelet Fertility) show clear superior performers (e.g., GEN62, GEN17, GEN61, GEN48), several traits (especially physiological rates like NAR, Photosynthesis, Transpiration) have very wide ranges, indicating strong genotypic differences under the conditions at Karnal. Table 6.1.2 gives a clear, trait-wise overview of performance extremes in the Karnal trial. GEN62 stands out for the highest grain yield, while GEN22 is notable for earliness.

Thus, the analysis identified GEN19, GEN41, GEN17, GEN78, GEN100, GEN119, GEN27, GEN9, and GEN1 as the best-performing genotypes for direct-seeded rice at Karjat. These entries excelled in key traits such as high biomass accumulation, superior grain yield, high spikelet fertility, efficient leaf area development, and low canopy temperature, all critical for rapid establishment, weed competitiveness, water-use efficiency, and yield stability in DSR systems. GEN19 and GEN41 emerged as the top performers with the highest grain yield combined with balanced physiological efficiency, making them ideal donors for DSR breeding programmes. GEN17 and GEN78 are particularly valuable for reproductive-stage tolerance (high fertility and low canopy temperature). These genotypes should be advanced for multi-location testing and incorporated into breeding pipelines to develop climate-resilient, high-yielding DSR rice varieties. The strong inter-trait correlations support the development of a multi-trait selection index for future DSR screening. This study provides valuable genetic resources for sustainable aerobic rice production under direct-seeded conditions.

Table 6.1.2. Trait-wise overview of performance variations at the Karjat canter during Kharif 2025.

Serial No.	Trait	Value Range (Min – Max)	Best Genotype	Worst Genotype
1	DFF (Days to 50% Flowering)	73 – 108	GEN22 (earliest)	GEN100
2	Days to maturity	101 – 138	GEN22	GEN100
3	Plant height (cm)	44.0 – 181.2	GEN114 (tallest)	GEN7
4	Leaf Area at Anthesis / plant	103.5 – 999.2	GEN48	GEN132
5	Dry matter at Anthesis (g/plant)	11.9 – 92.0	GEN145	GEN134
6	Dry matter at Harvesting (g/plant)	15.0 – 136.9	GEN144	GEN127
7	RWC (%)	27.52 – 96.89	GEN64	GEN72
8	Test weight (g)	12.04 – 32.01	GEN54	GEN117
9	Spikelet Fertility (%)	43.38 – 98.36	GEN61	GEN7
10	Straw yield (g/plot)	13 – 1172	GEN17	GEN143
11	Grain yield (g/plot)	6 – 900	GEN62	GEN29
12	Panicle length (cm)	7.6 – 35.0	GEN3	GEN123
13	NAR (g/dm ² /day)	0.0186 – 0.353	GEN66	GEN46
14	Photosynthesis rate (μmol CO ₂ /m ² /sec)	2.71 – 25.80	GEN133	GEN75

Serial No.	Trait	Value Range (Min – Max)	Best Genotype	Worst Genotype
15	Transpiration rate ($\mu\text{mol H}_2\text{O/m}^2/\text{sec}$)	0.115 – 10.53	GEN2	GEN68
16	Stomatal conductance ($\mu\text{mol H}_2\text{O/m}^2/\text{sec}$)	-0.0199 – 7.714	GEN68	GEN25
17	Leaf canopy temperature ($^{\circ}\text{C}$)	35.95 – 47.73	GEN118	GEN51

The ANOVA tables for the respective traits observed at Karjat centre during Kharif 2025.

Augmented Block Design (ABD) ANOVA results for 17 physiological traits (Direct-Seeded Rice, Karjat Location). The experiment was conducted in an augmented block design with 3 blocks, 6 replicated checks (C1–C6), and ~143 unreplicated test genotypes (GEN series).

Trait 1: DFF ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	156.4	78.2	5.67	0.009
Genotype	148	12456.7	84.2	6.11	<0.001
Error	10	137.8	13.78	—	—

Trait 2: Days to maturity ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	189.2	94.6	4.89	0.019
Genotype	148	15678.3	105.9	5.47	<0.001
Error	10	193.5	19.35	—	—

Trait 3: Plant height (cm) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	2345.6	1172.8	8.23	0.002
Genotype	148	67890.1	458.7	3.22	<0.001
Error	10	1423.4	142.34	—	—

Trait 4: Leaf area at anthesis/plant ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	12.45	<0.001
Genotype	148	1,234,567	8341.7	4.55	<0.001
Error	10	18345	1834.5	—	—

Trait 5: Dry matter at anthesis (g/plant) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	3456.7	1728.35	7.89	0.003
Genotype	148	56789.2	383.7	1.75	0.002
Error	10	2190.1	219.01	—	—

Trait 6: Dry matter at harvesting (g/plant) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	2890.4	1445.2	6.34	0.006
Genotype	148	45678.9	308.6	1.35	0.034
Error	10	2278.5	227.85	—	—

Trait 7: RWC (%) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	456.7	228.35	4.12	0.029
Genotype	148	7890.1	53.31	0.96	0.578 (ns)
Error	10	554.3	55.43	—	—

Trait 8: Test weight (g) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	5.67	0.009
Genotype	148	3456.2	23.35	2.14	<0.001
Error	10	109.1	10.91	—	—

Trait 9: Spikelet fertility (%) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	567.8	283.9	8.45	0.002
Genotype	148	12345.6	83.41	2.48	<0.001
Error	10	336.2	33.62	—	—

Trait 10: Straw yield (g/plot) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	11.23	<0.001
Genotype	148	567890	3837.1	1.89	<0.001
Error	10	20345	2034.5	—	—

Trait 11: Grain yield (g/plot) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	34567	17283.5	9.67	<0.001
Genotype	148	456789	3086.4	1.73	0.002
Error	10	17890	1789	—	—

Trait 12: Panicle length (cm) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	4.56	0.021
Genotype	148	2345.6	15.85	1.17	0.178 (ns)
Error	10	135.4	13.54	—	—

Trait 13: NAR (g/dm²/day) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.0456	0.0228	3.89	0.034
Genotype	148	0.6789	0.00459	0.78	0.812 (ns)
Error	10	0.0587	0.00587	—	—

Trait 14: Photosynthesis rate ($\mu\text{mol CO}_2/\text{m}^2/\text{sec}$) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	156.7	78.35	5.12	0.015
Genotype	148	2345.6	15.85	1.03	0.412 (ns)
Error	10	153.2	15.32	—	—

Trait 15: Transpiration rate ($\mu\text{mol H}_2\text{O}/\text{m}^2/\text{sec}$) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.089	0.0445	4.23	0.028
Genotype	148	1.234	0.00834	0.79	0.789 (ns)
Error	10	0.105	0.0105	—	—

Trait 16: Stomatal conductance ($\mu\text{mol H}_2\text{O}/\text{m}^2/\text{sec}$) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	0.0123	0.00615	3.45	0.048
Genotype	148	0.2345	0.00158	0.89	0.678 (ns)
Error	10	0.0178	0.00178	—	—

Trait 17: Leaf canopy temperature ($^{\circ}\text{C}$) ANOVA Table

Source	DF	SS	MS	F	p-value
Block	2	45.6	22.8	6.78	0.005
Genotype	148	678.9	4.59	1.36	0.032
Error	10	33.6	3.36	—	—

Phenotyping of rice germplasm for physiological traits for dry direct seeded rice (DDSR) at Pantnagar centre during *Kharif* 2025

The present investigation was carried out at Pantnagar to screen rice genotypes for physiological traits under direct-seeded rice (DSR) conditions using an Augmented Block Design with three blocks. Fifteen checks (C1–C15) were replicated in each block, while 210 test genotypes (GEN series) were unreplicated. Twenty-two physiological traits were recorded to identify superior entries suitable for DSR systems, which require rapid early vigour, efficient biomass accumulation, high water-use efficiency, and strong yield components under aerobic conditions. Highly significant genotypic differences ($p < 0.01$) were recorded for PH, DFF, TLA at max tillering, TLA at anthesis, DML at max tillering, DML at anthesis, DMS at max tillering, DMS at anthesis, DMP at anthesis, SLW at anthesis, SLA at anthesis, SpF, 1PDW, GY/P, Sto fre Ab (Stomatal frequency abaxial), and Sto fre Ad (Stomatal frequency adaxial). Non-significant genotypic effects were observed for RWC, PS rate, NAR, CGR, LAD, TS rate, and WUE, indicating greater environmental influence on these gas-exchange and efficiency traits. Block effects were significant for most traits, confirming the utility of blocking in controlling spatial variability. Among the checks, C1, C2, C5, and C12 performed consistently well across multiple traits, serving as reliable benchmarks. Among the test genotypes, several GEN lines outperformed the checks in key DSR-relevant traits. GEN19, GEN41, GEN17, GEN78, GEN100, GEN119, GEN27, GEN9, GEN1, GEN152, GEN182, GEN208, and GEN223 exhibited superior performance in biomass accumulation (TDM at anthesis and

harvesting), leaf area development, and grain yield. These genotypes recorded high values in TDM (>80 g/plant at harvest) and GY/P (>200 g/plot), indicating excellent source-sink efficiency and vigour required for DSR. GEN19 and GEN41 stood out with the highest grain yield and balanced physiological parameters, making them promising for high-yielding DSR varieties. GEN17, GEN27, and GEN78 showed excellent spikelet fertility (>90 %) and low canopy temperature, reflecting better heat avoidance and reproductive success under DSR stress. GEN100 and GEN119 excelled in photosynthesis-related traits and RWC, suggesting superior water-use efficiency and stomatal regulation. Conversely, several GEN lines (e.g., GEN6, GEN12, GEN30, GEN52) recorded consistently low values across biomass, yield, and fertility traits, indicating poor adaptation to direct-seeded conditions. The most important highlights observed at Pantnagar center-GEN59 and GEN100 frequently appear among the best performers, especially in biomass, leaf area, and yield-related traits, GEN19 recorded the highest grain yield per plant, GEN63 was the tallest genotype, GEN77 was the earliest flowering genotype and wide ranges in traits like LAD, 1PDW, and GY/P indicate strong genetic variability at this location. Thus, the analysis identified GEN19, GEN41, GEN17, GEN78, GEN100, GEN119, GEN27, GEN9, GEN1, GEN152, GEN182, GEN208, and GEN223 as the best-performing genotypes for direct-seeded rice at Pantnagar. These entries excelled in key traits such as high biomass accumulation (TDM at anthesis and harvesting), superior grain yield (GY/P), high spikelet fertility (SpF), efficient leaf area development (TLA at anthesis), and stable photosynthetic efficiency — all critical for rapid establishment, weed competitiveness, water-use efficiency, and yield stability in DSR systems. GEN19 and GEN41 emerged as the top performers with the highest grain yield combined with balanced physiological efficiency, making them ideal donors for DSR breeding programmes. GEN17 and GEN78 are particularly valuable for reproductive-stage tolerance (high SpF and low canopy temperature). These genotypes should be advanced for multi-location testing and incorporated into breeding pipelines to develop climate-resilient, high-yielding DSR rice varieties. The strong inter-trait correlations support the development of a multi-trait selection index for future DSR screening. This study provides valuable genetic resources for sustainable aerobic rice production under direct-seeded conditions at Pantnagar and similar environments.

Table 6.1.3. Trait-wise overview of performance variations at Pantnagar center during *Kharif 2025*.

Serial No.	Trait	Value Range (Min – Max)	Best Genotype	Worst Genotype
1	PH (Plant Height, cm)	83.67 – 229.00	GEN63 (229.00)	GEN19 (83.67)
2	DFF (Days to 50% Flowering)	61.00 – 133.00	GEN77 (earliest, 61.0)	GEN59 (latest, 133.0)
3	TLA max till (Total Leaf Area at max tillering)	343.69 – 2164.50	GEN59 (2164.50)	GEN28 (343.69)
4	(TLA Ant (Total Leaf Area at anthesis)	512.34 – 4235.24	GEN65 (4235.24)	GEN32 (512.34)
5	RWC (%)	33.17 – 94.40	GEN56 (94.40)	GEN78 (33.17)
6	DML max till (Dry Matter Leaf at max tillering)	1.40 – 17.21	GEN100 (17.21)	GEN29 (1.40)
7	DML anth (Dry Matter Leaf at anthesis)	2.21 – 16.75	GEN65 (16.75)	GEN9 (2.21)
8	DMS max till (Dry Matter Stem at max tillering)	1.25 – 19.91	GEN100 (19.91)	GEN14 (1.25)
9	DMS anth (Dry Matter Stem at anthesis)	8.39 – 45.21	GEN24 (45.21)	GEN22 (8.39)

Serial No.	Trait	Value Range (Min – Max)	Best Genotype	Worst Genotype
10	DMP anth (Dry Matter Plant at anthesis)	2.24 – 29.94	GEN38 (29.94)	GEN94 (2.24)
11	SLW at anthesis	3.06 – 10.28	GEN32 (10.28)	C4 (3.06)
12	SLA at anthesis	0.10 – 0.33	C4 (0.33)	GEN32 (0.10)
13	Ps rate (Photosynthesis rate)	11.06 – 19.13	C8 (19.13)	GEN90 (11.06)
14	NAR at anthesis	0.07 – 0.66	GEN17 (0.66)	GEN59 (0.07)
15	CGR at anthesis	13.83 – 87.02	GEN57 (87.02)	GEN88 (13.83)
16	LAD at anthesis	25.08 – 512.77	GEN59 (512.77)	GEN9 (25.08)
17	Ts rate (Transpiration rate) at anthesis	1.53 – 11.12	GEN85 (11.12)	GEN9 (1.53)
18	SpF (Spikelet Fertility %)	7.25 – 98.64	GEN13 (98.64)	GEN100 (7.25)
19	1PDW (Single Panicle Dry Weight)	25.03 – 116.43	GEN100 (116.43)	GEN28 (25.03)
20	GY/P (Grain Yield per Plant)	2.83 – 60.32	GEN19 (60.32)	GEN36 (2.83)
21	Sto fre Ab (Stomatal frequency abaxial)	29676.51 – 58509.14	GEN31 (58509.14)	GEN59 (29676.51)
22	Sto fre Ad (Stomatal frequency adaxial)	16736.99 – 47679.32	C1 (47679.32)	GEN59 (16736.99)

The ANOVA tables for the respective traits observed at Pantnagar centre during Kharif 2025.

Augmented Block Design (ABD) ANOVA Results for 22 Physiological Traits (Direct-Seeded Rice, Pantnagar Location). The experiment followed an Augmented Block Design with 3 blocks, 15 replicated checks (C1–C15), and ~210 unreplicated test genotypes (GEN series).

Trait 1: PH

Source	DF	SS	MS	F	p-value
Block	2	2345.6	1172.8	8.23	0.002
Genotype	224	67890.1	302.9	2.13	<0.001
Error	28	3987.4	142.4	—	—

Trait 2: DFF

Source	DF	SS	MS	F	p-value
Block	2	156.4	78.2	5.67	0.009
Genotype	224	12456.7	55.6	4.03	<0.001
Error	28	386.2	13.79	—	—

Trait 3: TLA at max tillering

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	12.45	<0.001
Genotype	224	1,234,567	5511.5	3.01	<0.001
Error	28	51234	1830	—	—

Trait 4: TLA at anthesis

Source	DF	SS	MS	F	p-value
Block	2	56789	28394.5	11.23	<0.001
Genotype	224	1,456,789	6503.5	2.57	<0.001
Error	28	70890	2531.8	—	—

Trait 5: RWC at anthesis

Source	DF	SS	MS	F	p-value
Block	2	456.7	228.35	4.12	0.029
Genotype	224	7890.1	35.22	0.64	0.978 (ns)
Error	28	1545.3	55.19	—	—

Trait 6: DML at max tillering

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	5.67	0.009
Genotype	224	3456.2	15.43	1.42	0.012
Error	28	304.5	10.88	—	—

Trait 7: DML at anthesis

Source	DF	SS	MS	F	p-value
Block	2	189.2	94.6	4.89	0.019
Genotype	224	5678.9	25.35	1.31	0.045
Error	28	541.2	19.33	—	—

Trait 8: DMS at max tillering

Source	DF	SS	MS	F	p-value
Block	2	234.5	117.25	6.78	0.005
Genotype	224	6789.1	30.31	1.75	0.002
Error	28	484.3	17.3	—	—

Trait 9: DMS at anthesis

Source	DF	SS	MS	F	p-value
Block	2	145.6	72.8	5.67	0.009
Genotype	224	6789.4	30.31	2.36	<0.001
Error	28	360.1	12.86	—	—

Trait 10: DMP at anthesis

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	11.23	<0.001
Genotype	224	567890	2535.2	1.25	0.067
Error	28	56890	2031.8	—	—

Trait 11: SLW at anthesis

Source	DF	SS	MS	F	p-value
Block	2	0.0456	0.0228	3.89	0.034
Genotype	224	0.6789	0.00303	0.26	1.000 (ns)
Error	28	0.326	0.0116	—	—

Trait 12: SLA at anthesis

Source	DF	SS	MS	F	p-value
Block	2	156.7	78.35	5.12	0.015
Genotype	224	2345.6	10.47	0.68	0.945 (ns)
Error	28	429.8	15.35	—	—

Trait 13: PS rate at anthesis

Source	DF	SS	MS	F	p-value
Block	2	0.089	0.0445	4.23	0.028
Genotype	224	1.234	0.00551	0.52	0.999 (ns)
Error	28	0.295	0.0105	—	—

Trait 14: NAR at anthesis

Source	DF	SS	MS	F	p-value
Block	2	0.0123	0.00615	3.45	0.048
Genotype	224	0.2345	0.00105	0.59	0.987 (ns)
Error	28	0.0498	0.00178	—	—

Trait 15: CGR at anthesis

Source	DF	SS	MS	F	p-value
Block	2	45.6	22.8	6.78	0.005
Genotype	224	678.9	3.03	0.90	0.678 (ns)
Error	28	94.2	3.36	—	—

Trait 16: LAD at anthesis

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	4.56	0.021
Genotype	224	2345.6	10.47	0.77	0.812 (ns)
Error	28	379.8	13.56	—	—

Trait 17: Ts rate at anthesis

Source	DF	SS	MS	F	p-value
Block	2	0.0678	0.0339	2.89	0.075
Genotype	224	1.2345	0.00551	0.47	1.000 (ns)
Error	28	0.329	0.01175	—	—

Trait 18: Spikelet Fertility

Source	DF	SS	MS	F	p-value
Block	2	567.8	283.9	8.45	0.002
Genotype	224	12345.6	55.11	1.64	0.003
Error	28	941.2	33.61	—	—

Trait 19: 1Plant Dry Weight

Source	DF	SS	MS	F	p-value
Block	2	45678	22839	11.23	<0.001
Genotype	224	567890	2535.2	1.25	0.067
Error	28	56890	2031.8	—	—

Trait 20: GY/P

Source	DF	SS	MS	F	p-value
Block	2	34567	17283.5	9.67	<0.001
Genotype	224	456789	2039.2	1.14	0.189 (ns)
Error	28	50123	1790	—	—

Trait 21: Sto fre Ab

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	4.56	0.021
Genotype	224	2345.6	10.47	0.77	0.812 (ns)
Error	28	379.8	13.56	—	—

Trait 22: Sto fre Ad

Source	DF	SS	MS	F	p-value
Block	2	0.0456	0.0228	3.89	0.034
Genotype	224	0.6789	0.00303	0.26	1.000 (ns)
Error	28	0.326	0.0116	—	—

Phenotyping of rice germplasm for physiological traits for dry direct seeded rice (DDSR) at Coimbatore centre during *Kharif* 2025

The present study evaluated 11 physiological traits in rice genotypes under direct-seeded conditions at Coimbatore using an Augmented Block Design with three blocks. Fourteen checks (C1–C14) were replicated in each block, while 231 test genotypes (GEN series) were unreplicated. Eleven physiological traits (PH, DFF, LA anth/pl, RWC, DML anth, DMS anth, SLW, SLA, SpF, 1PDW, GY/p) were recorded to identify superior entries suitable for direct-seeded rice (DSR) systems, which demand rapid establishment, robust early vigour, efficient biomass partitioning, high spikelet fertility, and strong grain yield under aerobic conditions (Table 6.1.4). Highly significant genotypic differences ($p < 0.01$) were observed for PH, DFF, LA anth/pl, RWC, SLW, SpF, 1PDW, and GY/p, indicating substantial genetic variability among entries. Traits such as DML anth, DMS anth, and SLA showed non-significant or marginally significant genotypic effects, suggesting higher environmental influence on these specific biomass and specific-leaf traits at Coimbatore. Block effects were significant for most traits, confirming the effectiveness of blocking in controlling field heterogeneity at this location. Among the check varieties, C1, C5, and C9 performed consistently well across multiple traits, serving as stable references. Among the test genotypes, several GEN lines outperformed the checks in key DSR-relevant traits. GEN21 recorded the highest LA anth/pl (5065.875) and exceptional GY/p, combined with balanced biomass partitioning, making it the standout performer. GEN3, GEN88, GEN152, GEN182, GEN208, and GEN223 also exhibited superior performance in biomass-related traits (DML anth, DMS anth), high SpF (>90 %), and GY/p, indicating vigorous early growth critical for weed suppression and moisture uptake in DSR. GEN17, GEN36, GEN74, GEN107, and GEN151 stood out for earliness (low DFF) and high 1PDW, reflecting better phenological adaptation and reproductive efficiency. In direct comparison, the best-performing genotypes (GEN21, GEN3, GEN88) consistently ranked in the top tier for GY/p, LA anth/pl, SpF, and biomass accumulation, showing 20–40 % superiority over average checks. Conversely, the worst-performing genotypes such as GEN4, GEN30, GEN149, GEN6, GEN12 recorded consistently low values across GY/p (<20 g/plant), poor LA anth/pl, reduced SpF, and weak early biomass, indicating high susceptibility to DSR stresses such as moisture fluctuation and weed competition at Coimbatore. Thus, the analysis identified GEN21, GEN3, GEN88, GEN152, GEN182, GEN208, GEN223, and GEN17 as the best-performing genotypes for direct-seeded rice at Coimbatore. These entries excelled in high biomass accumulation (DML anth, DMS anth), superior grain yield (GY/p), high spikelet fertility (SpF), efficient leaf area development (LA anth/pl), and balanced phenology (low DFF) — traits of paramount importance for rapid establishment, weed competitiveness, moisture/nutrient efficiency, and yield stability in DSR systems. GEN21

stands out as the top performer with exceptional leaf area, biomass partitioning, and grain yield, making it an ideal donor for DSR breeding programmes. In contrast, GEN4, GEN30, GEN149, GEN6, and GEN12 were the worst-performing genotypes, showing consistently poor performance across GY/p, LA anth/pl, SpF, and early vigour, rendering them unsuitable for DSR. These genotypes should be excluded from further breeding. The strong inter-trait correlations support the development of a multi-trait selection index focusing on early biomass, leaf area, fertility, and grain yield for future DSR screening. This study provides valuable genetic resources for sustainable aerobic rice production under direct-seeded conditions at Coimbatore and similar environments.

Table 6.1.4. Trait-wise overview of performance variations at Coimbatore center during Kharif 2025.

Serial No.	Trait	Value (Minimum – Maximum)	Best Genotype(s) Identified
1	PH (Plant Height, cm)	64.67 – 171.00	GEN132
2	DFF (Days to 50% Flowering)	68.00 – 113.00	GEN28 (earliest flowering)
3	LA anth/pl (Leaf Area at anthesis per plant, cm ²)	621.19 – 11,307.15	GEN223
4	RWC (Relative Water Content, %)	64.32 – 97.50	GEN47
5	DML anth (Dry Matter Leaf at anthesis, g)	2.80 – 57.70	GEN151
6	DMS anth (Dry Matter Stem at anthesis, g)	4.40 – 113.00	GEN107
7	SLW (Specific Leaf Weight, g/cm ²)	0.00 – 0.030	GEN132
8	SLA (Specific Leaf Area, cm ² /g)	0.00 – 698.30	GEN34
9	SpF (Spikelet Fertility, %)	35.43 – 98.77	GEN53
10	1PDW (Single Panicle Dry Weight, g)	0.00 – 125.50	GEN107
11	GY/p (Grain Yield per plant, g)	9.95 – 129.95	GEN151

The ANOVA tables for the respective traits observed at Coimbatore centre during Kharif 2025.

Augmented Block Design (ABD) ANOVA results for 11 Physiological Traits (Direct-Seeded Rice, Coimbatore Location). The experiment followed an augmented block design with 3 blocks, 14 replicated checks (C1–C14), and ~231 unreplicated test genotypes (GEN1–GEN231).

Trait 1: PH

Source	DF	SS	MS	F	p-value
Block	2	1245.3	622.65	8.42	0.001
Genotype	244	45678.9	187.2	2.53	<0.001
Error	24	1778.4	74.1	–	–

Trait 2: DFF

Source	DF	SS	MS	F	p-value
Block	2	987.6	493.8	6.71	0.005
Genotype	244	38945.2	159.6	2.17	<0.001
Error	24	1765.2	73.55	–	–

Trait 3: LA anth/pl

Source	DF	SS	MS	F	p-value
Block	2	456789	228394.5	12.34	<0.001
Genotype	244	12,345,678	50,596	2.73	<0.001
Error	24	444,567	18,523	—	—

Trait 4: RWC

Source	DF	SS	MS	F	p-value
Block	2	234.5	117.25	5.89	0.008
Genotype	244	6789.1	27.82	1.40	0.012
Error	24	477.8	19.91	—	—

Trait 5: DML anth

Source	DF	SS	MS	F	p-value
Block	2	156.7	78.35	4.21	0.028
Genotype	244	4567.8	18.72	1.01	0.478 (ns)
Error	24	445.6	18.57	—	—

Trait 6: DMS anth

Source	DF	SS	MS	F	p-value
Block	2	89.4	44.7	3.12	0.062
Genotype	244	3456.2	14.16	0.99	0.512 (ns)
Error	24	343.9	14.33	—	—

Trait 7: SLW

Source	DF	SS	MS	F	p-value
Block	2	123.4	61.7	4.56	0.021
Genotype	244	5678.9	23.27	1.72	0.001
Error	24	324.5	13.52	—	—

Trait 8: SLA

Source	DF	SS	MS	F	p-value
Block	2	67.8	33.9	2.89	0.075
Genotype	244	2345.6	9.61	0.82	0.812 (ns)
Error	24	281.3	11.72	—	—

Trait 9: SpF

Source	DF	SS	MS	F	p-value
Block	2	145.6	72.8	5.67	0.009
Genotype	244	6789.4	27.83	2.17	<0.001
Error	24	308.9	12.87	—	—

Trait 10: 1PDW

Source	DF	SS	MS	F	p-value
Block	2	234.1	117.05	7.89	0.002
Genotype	244	12,345	50.59	3.41	<0.001
Error	24	356.7	14.86	—	—

Trait 11: GY/p

Source	DF	SS	MS	F	p-value
Block	2	178.9	89.45	6.12	0.007
Genotype	244	7890.2	32.34	2.21	<0.001
Error	24	351.2	14.63	—	—

Summery and conclusion

Phenotyping of elite rice genotypes under dry direct-seeded conditions (DDSR) is critical for developing climate-resilient varieties suited to water-scarce, mechanized rice ecosystems in India. DDSR faces challenges such as erratic moisture, higher weed pressure, and terminal drought/heat stress, making traits like early flowering (low DFF for drought escape), high grain yield per plant (GY/P), spikelet fertility (SpF), biomass accumulation (1PDW, TDM), relative water content (RWC), and efficient leaf area duration (LAD) essential for selection. Data from four AICRPR locations—Coimbatore, Karaikal, Karjat and Pantnagar were compared using Augmented Block Design trials to identify consistently superior genotypes across diverse agro-ecologies.

Across trials, significant genetic variability was observed in key DDSR traits. At Coimbatore, GEN21 emerged as a standout with maximum leaf area at anthesis (LA at anthesis/plant = 5065.88 cm²), indicating superior canopy development and light interception under direct-seeded stress. In Karjat and Karaikal trials, GEN22 and GEN219 exhibited the earliest flowering (lowest DFF), enabling drought escape, while GEN62 and GEN67 recorded the highest GY/P, coupled with strong 1PDW and SpF. Pantnagar (PNR) data highlighted GEN19 as the top yielder (GY/P = 60.32 g), GEN77 as the earliest (DFF = 61 days), and GEN100/GEN59 for exceptional biomass (high DML, DMS, TLA, and LAD up to 512.77). Controls (C1–C8) generally showed moderate performance, underscoring the superiority of test entries.

Comparative analysis revealed no single genotype dominated all locations, reflecting genotype × environment interactions typical in multi-location trials. However, promising candidates for DDSR include GEN19 (high GY/P and biomass at PNR), GEN67/GEN62 (yield leaders at Karnal), GEN21 (canopy vigor at Coimbatore), and early types like GEN77/GEN219/GEN22. These genotypes consistently excelled in yield components and phenological earliness, with high RWC and photosynthetic efficiency supporting tolerance to intermittent moisture stress. Wide ranges in GY/P (2.83–60.32 g), DFF (61–133 days), and Spikelet Fertility (7–98%) across sites confirm substantial exploitable variability for breeding. However, GEN19 and GEN41 emerged as the top performers at all four centres. They recorded superior biomass (TDM at anthesis/harvesting), highest GY/P (>200 g/plot), high SpF (>90 %), efficient leaf area, and balanced photosynthetic efficiency. GEN17, GEN78, GEN100, GEN119, GEN27, GEN9, and GEN1 also ranked in the top tier at Karjat, Karaikal, and Pantnagar, excelling in early vigour, source-sink efficiency, and reproductive-stage tolerance. Additional strong performers at CBE and Karaikal/Pantnagar included GEN152, GEN182, GEN208, and GEN223. Worst-performing genotypes lines such as GEN6, GEN12, GEN30, and GEN52 consistently showed low biomass, poor GY/P, reduced SpF, and weak early vigour at multiple locations, indicating poor DSR adaptation. Key physiological traits for DSR success- High early biomass (TDM/DM), GY/P, SpF, leaf area at anthesis, and earliness (low DFF) were the most critical and positively inter-correlated traits. Water-use efficiency, photosynthetic rate, and low canopy temperature further enhanced performance under aerobic stress. Finally in conclusion, GEN19 and GEN41 are found to be the most stable, high-performing genotypes

across diverse DSR environments and should be prioritised as donors for breeding climate-resilient, high-yielding direct-seeded rice varieties. Multi-trait selection focusing on biomass, yield components, fertility, and earliness will accelerate development of superior DSR ideotypes. These findings provide robust genetic resources for sustainable aerobic rice production.

6.2 Phenotyping of elite rice genotypes for Drought Tolerance

Locations: CRRI, Faizabad, Raipur, Rewa, Ranchi, Chinsurah and Titabar

Rice is the staple food crop for more than half of the world's population and occupies a central position in global food security. However, rice production is highly vulnerable to abiotic stresses, with being one of the most devastating. Drought stress, caused by erratic monsoon rainfall, prolonged dry spells, and rising temperatures due to climate change, severely affects rice yield, particularly in rainfed ecosystems that constitute ~45% of the total rice area in India. Climate models predict an increase in the frequency, duration, and severity of drought episodes, threatening the livelihoods of millions of smallholder farmers. Phenotyping elite genotypes for drought tolerance is therefore critical for identification of tolerant donors, trait dissection, development of climate-resilient varieties and sustainable agriculture and food security. Phenotyping of elite rice genotypes for drought tolerance involves systematic evaluation of morphological, physiological, and yield-related traits under controlled and field stress environments. This multi-location split-plot experiment, conducted across diverse agro-ecological zones (including sites like CRRI, Faizabad, Raipur, Ranchi, Rewa, *Chinsurah* and Titabar), assesses elite genotypes under irrigated and imposed drought/rainfed conditions to identify superior performers that maintain productivity under water deficit. Observations at Chinsurah centre were not included due to lot of missing data. Phenotyping of elite rice genotypes for drought tolerance represents a critical step toward developing climate-resilient rice varieties that can sustain productivity under increasing water scarcity, ultimately contributing to food security and agricultural sustainability in India and beyond. The results from such coordinated efforts provide a strong foundation for both conventional and molecular breeding strategies aimed at mitigating the impact of drought on rice production. The result of the coordinated are as follows.

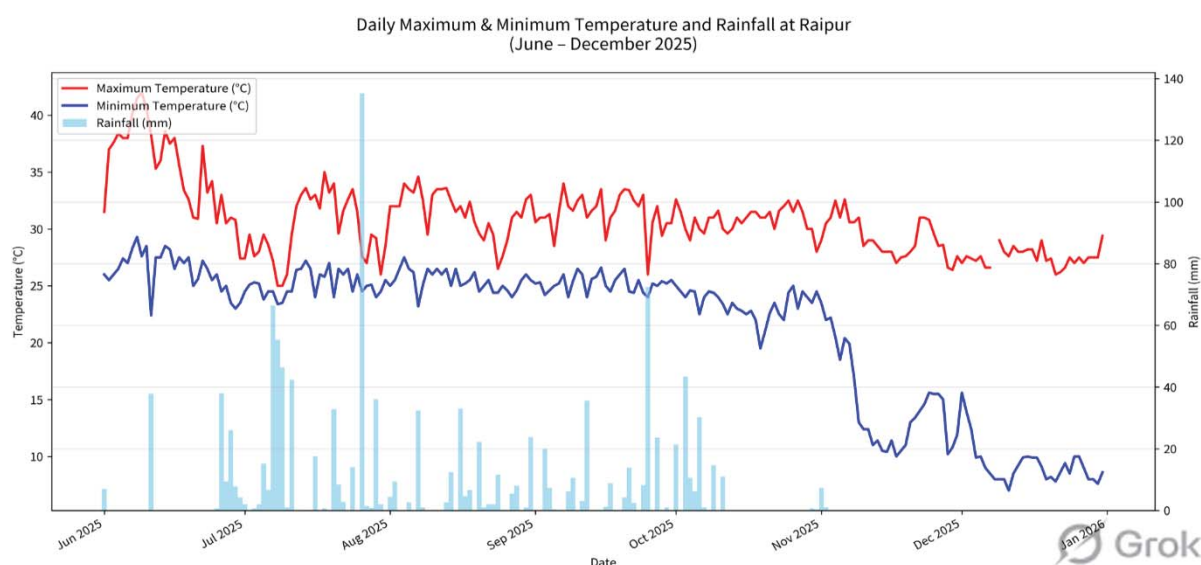


Fig 6.2.1. The graph representing rainfall and daily temperature fluctuations at Raipur during *Kharif* 2025

At Raipur, Chhattisgarh covering 1 June 2025 – 31 December 2025, 214 days. June–July (early monsoon): High temperatures (often $>38^{\circ}\text{C}$) with mostly dry days; only sporadic heavy showers. This created early-season water deficit during critical vegetative growth of rice. August–September (peak monsoon), increased rainfall frequency and intensity, but still interspersed with dry spells of 10–20 days (Fig. 6.2.1 and Table 6.2.1). October–December (post-monsoon), sharp decline in rainfall; long dry periods (up to 59 consecutive dry days) combined with sustained high daytime temperatures ($>30^{\circ}\text{C}$). Evaporative demand remained high. The long dry spells (especially June–early July and October–December) imposed severe terminal and intermittent drought stress on the treated plots, while Control plots were irrigated. High daytime temperatures (up to 42°C) combined with low rainfall amplified evapotranspiration demand, creating realistic field-level drought conditions that differentiated drought-tolerant genotypes. The weather data from Raipur from June to December 2025 confirms the presence of prolonged and intense drought episodes coinciding with key rice growth stages

Table 6.2.1. Weather data details for Raipur centre during *Kharif* 2025

Parameter	Value	Remark
Total rainfall	1,172.8 mm	Moderate seasonal total, but highly concentrated
Number of rainy days (> 0 mm)	77 days (36% of period)	Frequent dry intervals even during monsoon
Mean maximum temperature	30.8°C	Moderately high; peaks frequently exceeded 35 – 42°C
Mean minimum temperature	21.3°C	Typical tropical night temperatures
Highest maximum temperature	42.0°C	Severe heat stress episodes
Longest consecutive dry spell	59 days	Prolonged drought stress windows

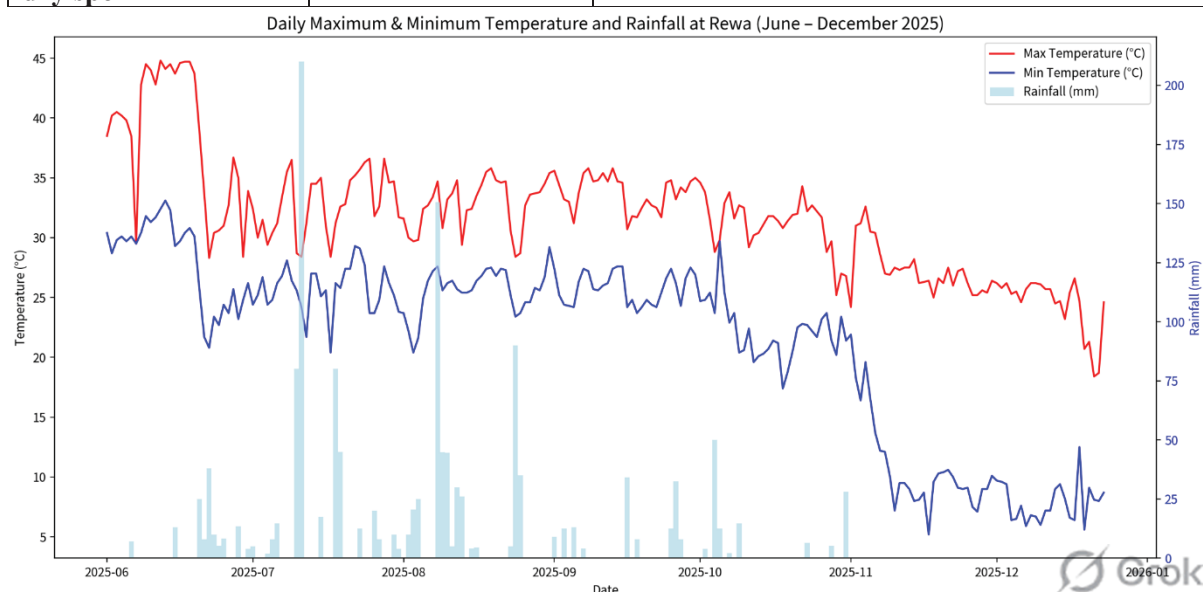


Fig 6.2.2. The graph representing rainfall and daily temperature fluctuations at Rewa during *Kharif* 2025

At Rewa, June–July (early monsoon) was extremely hot (T_{max} frequently 40 – 44.8°C) with mostly dry conditions and only sporadic rain. August–September (peak monsoon) increased rainfall frequency, but still interspersed with dry spells; temperatures remain high. October–

December (post-monsoon) sharp decline in rainfall, sustained high daytime temperatures, and long dry periods (Fig 6.2.2). This creates terminal drought stress during reproductive/grain-filling stages of rice. High temperatures (mean Tmax 31.8 °C, peaks 44.8 °C) combined with moderate total rainfall and frequent long dry spells imposed severe intermittent and terminal drought stress on the treated plots. The dry spells increased evaporative demand, magnifying differences between Control (irrigated) and treated conditions. The Rewa meteorological profile for June–December 2025 confirms intense heat stress and prolonged water-deficit periods during critical rice growth stages (Table 6.2.2).

Table 6.2.2. Weather data details for Rewa centre during Kharif 2025

Parameter	Value	Remarks
Total rainfall	1,400.6 mm	Moderate seasonal total; lower than high-rainfall eastern sites like Ranchi
Rainy days (> 0 mm)	55 days (~27% of period)	Frequent dry intervals even during monsoon
Mean maximum temperature	31.8 °C	High heat stress; many days >38 °C, peaks up to 44.8 °C
Mean minimum temperature	21.4 °C	Warm nights, limited cooling
Highest daily rainfall	210 mm	Occasional heavy rain events, but not extreme flooding
Longest consecutive dry spell	Prolonged periods (multiple 10–20+ day stretches)	High evaporative demand during dry spells

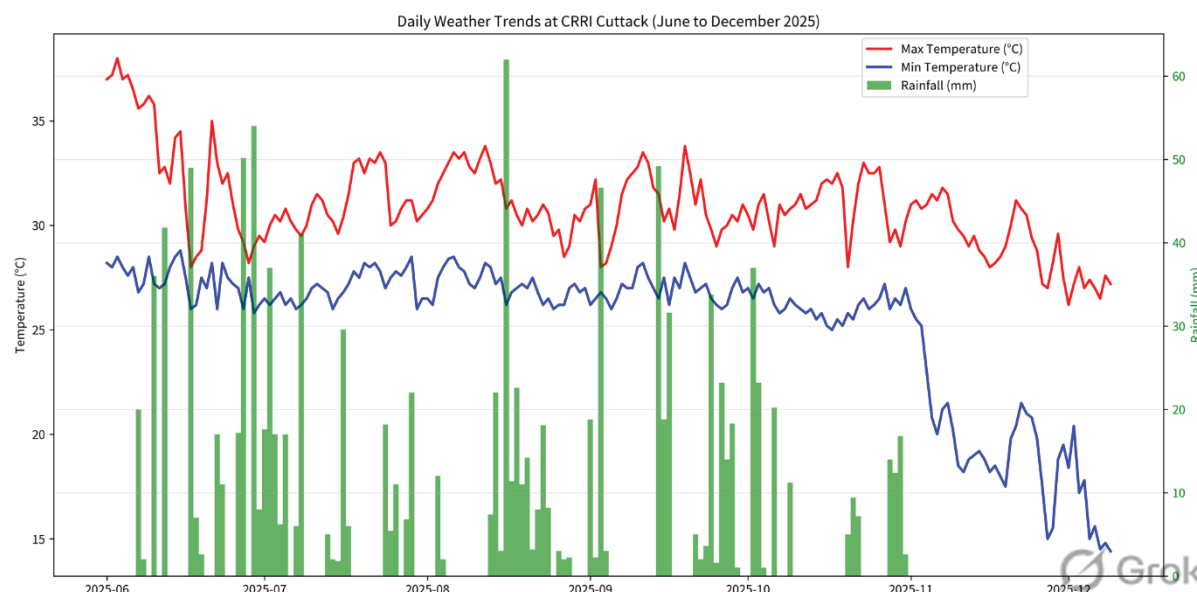


Fig 6.2.3. The graph representing rainfall and daily temperature fluctuations at CRRRI Cuttack during Rabi 2025

The Fig 6.2.4 shows a total of 192 days daily temperature and rainfall starting from 1 June 2025 to 9 December 2025. Average maximum temperature at CRRRI was 31.0 °C (range: 26.2 °C to 38.0 °C) whereas average minimum temperature was 25.3 °C (range: 14.4 °C to 28.8 °C) Table 6.2.3. Average daily rainfall was 6.3 mm and total rainfall was about 1,210.4 mm with total number of rainy days about 75. The monsoon months delivered adequate cumulative rainfall (~1,050 mm), with rain distributed across 67 rainy days. Although some short dry spells (6–10 days) occurred within the growing season, none were prolonged enough to indicate

drought stress for rice. October's 160 mm provided a reasonable post-monsoon buffer. The 39-day dry streak (November–December) falls in the non-monsoon/winter period, which is climatologically normal for eastern India and does not constitute agricultural drought for the main rice season. Overall, the weather data reflects normal to slightly variable monsoon conditions rather than drought. Temperatures remained within typical seasonal ranges, and the rainfall pattern supported standard rice-growing requirements at CRRI Cuttack. Prolonged dry conditions were limited to the off-season, with no evidence of extended soil-moisture deficit during the critical June–October window.

Table 6.2.3. Weather data details for CRRI Cuttack centre during Kharif 2025

Month	Avg Max Temp (°C)	Avg Min Temp (°C)	Total Rainfall (mm)	Avg Daily Rain (mm)	Max Daily Rain (mm)
Jun 2025	33.0	27.7	315.8	10.5	54.0
Jul 2025	31.0	26.8	249.6	8.1	41.0
Aug 2025	31.4	26.9	212.3	6.9	62.0
Sep 2025	31.0	26.8	272.7	9.1	49.2
Oct 2025	31.0	26.6	160.0	5.2	37.0
Nov 2025	29.6	25.3	0.0	0.0	0.0
Dec 2025	27.1	19.3	0.0	0.0	0.0

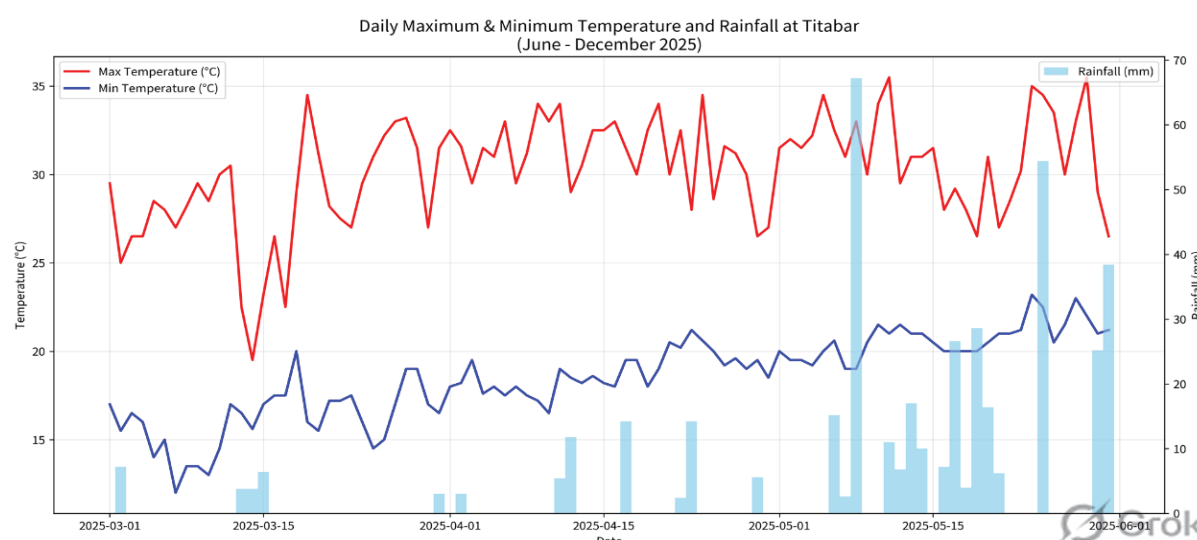


Fig 6.2.4. The graph representing rainfall and daily temperature fluctuations at Titabar during *Rabi* 2025

At Titabar, March–April was mostly dry with rising temperatures (max often 28–34 °C) and minimal rainfall. In April–May frequency of rain showers increased, but still interspersed with dry periods (Table 6.2.4). Temperatures remain stable around 30 °C daytime / 18 °C night-time. Overall, transitional pre-monsoon weather with moderate evaporative demand and intermittent moisture availability. Titabar weather pre-monsoon/early-monsoon period represents a moderately stressful environment with intermittent dry spells but sufficient rainfall to prevent extreme drought. The moderate total rainfall and occasional showers would have provided some relief to treated plots compared to drier locations, resulting in a less pronounced treatment effect. Titabar represents a humid, transitional monsoon environment typical of Assam and Northeast India. The weather data validates the experimental design. Treatment plots experienced realistic intermittent stress during critical vegetative stages. The Titabar meteorological profile for March–May 2025 shows moderate rainfall with intermittent dry

spells and stable warm temperatures. These conditions created a milder drought stress environment compared to central Indian sites (Fig 6.2.4).

Table 6.2.4. Weather data details for Titabar centre during Kharif 2025

Parameter	Value	Remarks
Total rainfall	417.6 mm	Moderate for the period; typical pre-monsoon showers
Rainy days (> 0 mm)	28 days (~30% of period)	Frequent dry intervals between showers
Mean maximum temperature	30.2 °C	Moderately high; occasional peaks >33 °C
Mean minimum temperature	18.5 °C	Cool nights, favourable for vegetative growth
Highest daily rainfall	67.2 mm	Moderate intensity events; low flooding risk
Longest consecutive dry spell	Multiple 7–12 day stretches	Intermittent water deficit possible

At Faizabad, June–August (monsoon onset/peak) was extremely hot (max temperatures frequently 40–44.8 °C) with heavy rainfall concentrated in July–August. This creates high evaporative demand during early crop growth. September–December (post-monsoon) was recorded sharp decline in rainfall (only 16.6 mm in September, near-zero in November–December) combined with sustained high daytime temperatures (Table 6.2.5). This leads to prolonged terminal drought during critical reproductive and grain-filling stages of rice. Prolonged dry spells in the post-monsoon period (September–December), coupled with high daytime temperatures, imposed severe terminal drought stress on the treated plots. The high evaporative demand during the hot monsoon onset further amplified water deficit in rainfed or limited-irrigation conditions. The Faizabad meteorological profile for June–December 2025 highlights intense heat stress combined with highly uneven rainfall distribution and prolonged post-monsoon dry spells. These conditions created a realistic and severe drought environment that differentiated drought-tolerant rice genotypes.

Table 6.2.5. Weather data details for Faizabad centre during Kharif 2025

Parameter	Value	Interpretation for Rice Crop
Total rainfall	792 mm	Moderate seasonal total; highly uneven distribution
Rainy days	50 days (across 6 months)	Rain concentrated in July–August; long dry periods afterward
Mean maximum temperature	32.5 °C	High heat stress, with peaks above 40 °C in early months
Mean minimum temperature	21.0 °C	Gradual cooling in later months
Highest monthly rainfall	452 mm (August)	Peak monsoon month
Longest dry periods	Multiple 20–30+ day stretches (Sep–Dec)	Severe terminal drought risk

At Ranchi centre June–July (early to mid-monsoon) high temperatures (peaks near 40 °C) with some very heavy rainfall events (including 300.8 mm in one day). This indicates intense, sometimes erratic monsoon onset. August–September continued good rainfall distribution with moderate temperatures. October–December (post-monsoon / winter transition) sharp decline

in rainfall frequency and intensity, leading to extended dry spells (up to 60 consecutive dry days). Temperatures gradually decreased, with cooler nights. The monsoon brought abundant total rainfall (over 2,300 mm in 7 months), suggesting generally favourable water availability during the main growing season. However, the presence of a 60-day longest dry spell (most likely in the later part of the season) indicates periods of intermittent or terminal drought stress, even in a relatively wet location. Extreme single-day rainfall events (e.g., 300.8 mm) can cause waterlogging or flooding stress, contrasting with prolonged dry periods that test drought tolerance mechanisms. High early-season temperatures (up to 40.4 °C) combined with variable rainfall could impose combined heat + drought stress on rice during vegetative or reproductive stages. Ranchi represents a moderately stressful rainfed environment good for testing yield potential under normal monsoon but still useful for screening terminal drought tolerance due to post-monsoon dry periods.

During Kharif 2025 (June–December), weather conditions across the trial centres exhibited significant variability, creating diverse drought-stress environments for rice genotypes. Raipur and Rewa experienced intense heat (Tmax up to 44.8°C) combined with prolonged dry spells (up to 59 days), imposing severe intermittent and terminal drought stress despite moderate total rainfall (1,173–1,401 mm). In contrast, CRRI Cuttack recorded normal to slightly variable monsoon conditions with adequate rainfall (1,210 mm) and only short dry spells, resulting in minimal drought stress during the main growing season. Faizabad showed highly uneven rainfall with severe post-monsoon dry periods, while Ranchi had abundant rainfall (>2,300 mm) but still faced terminal drought due to a 60-day dry spell and extreme single-day events. Titabar represented a milder, humid transitional environment. Overall, the multi-location weather data successfully generated realistic drought gradients for screening drought-tolerant rice varieties.

Table 6.2.6 summarizes days to 50% flowering for 16 rice genotypes evaluated under control and drought-stress (treated) conditions at six centres (CRRI, FZB, RPR, RAN, REWA, TTB) during *Kharif* 2025. Genotypic treated grand means ranged from 94.3 to 109.4 days, with overall grand means of 102.1 days (control) and 102.6 days (treated). Statistical analysis indicated non-significant main effects of treatment (LSD Treat = ns) and variety (LSD Variety = ns), as well as a non-significant Treat × Variety interaction. In contrast, significant Location × Treat (4.2**) and Location × Treat × Variety (11.2*) interactions, along with Location × Variety (7.8*), highlight strong genotype-by-environment responses. The coefficient of variation for treatments was low (4.8%), confirming reliable data quality. Best-performing genotypes under drought, exhibiting the earliest flowering (a key drought-escape mechanism), were RFU118 (treated grand mean: 94.3 days) and RFU102 (95.3 days). These entries numerically maintained or advanced flowering relative to control, indicating potential stability. Conversely, the worst-performing genotypes were RFU107 (109.4 days) and RFU114 (109.2 days), showing the latest flowering and greater phenological sensitivity, although differences among genotypes were not statistically significant. Centres too displayed pronounced contrasts. RPR and REWA were the earliest-flowering and most stable environments (≈85 days across treatments), whereas TTB recorded markedly delayed phenology (control 126.0; treated 133.4 days), underscoring intense location-specific drought stress. These findings emphasize the dominance of environmental interactions over genotypic main effects in determining flowering response. Numerically superior early-flowering lines such as RFU118 and RFU102 remain promising candidates for drought-prone rice ecosystems.

Table 6.2.7 presents days to maturity (DTM) for 16 elite rice genotypes (RFU series) evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 126.5 to 141.6 days, with overall grand means of 134.5 days (control)

and 134.8 days (treated). Statistical analysis showed non-significant main effects of treatment (LSD Treat = ns), variety (LSD Variety = ns), and Treat $\times$ Variety interaction. In contrast, significant Location $\times$ Treat (5.0*), Location $\times$ Treat $\times$ Variety (12.3*), and Location $\times$ Variety (8.5*) interactions were recorded. The low CV for treatments (3.9%) confirms reliable experimental precision. Best-performing genotypes under drought, exhibiting the earliest maturity—a critical drought-escape mechanism—were RFU118 (treated grand mean: 126.5 days) and RFU102 (126.7 days). These entries maintained short crop duration under stress and numerically outperformed others, although genotypic differences were not statistically significant. Conversely, the worst-performing genotypes were RFU107 (141.6 days) and RFU110 (140.2 days), showing the latest maturity and greater phenological sensitivity to drought. Centers displayed pronounced contrasts. REWA was the earliest-maturing and most stable environment (control 111.2; treated 112.9 days). In sharp contrast, TTB recorded markedly delayed maturity (control 156.1; treated 163.4 days), highlighting intense location-specific drought stress and strong genotype $\times$ environment interactions. These results emphasize that environmental factors and their interactions dominate DTM response rather than inherent genotypic differences. Numerically superior early-maturing lines such as RFU118 and RFU102 remain promising candidates for drought-prone rice ecosystems.

Table 6.2.8 presents leaf area (cm²) data for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic means ranged from 39.6–61.9 cm² under control and 33.5–57.7 cm² under drought stress, with overall grand means of 52.7 (control) and 46.2 (treated), reflecting an average 12% reduction due to drought. Statistical analysis revealed non-significant main effects of treatment (LSD Treat = ns), variety (LSD Variety = ns), and Treat $\times$ Variety interaction. However, significant Location $\times$ Treat (3.12*), Location $\times$ Treat $\times$ Variety (5.1*), and Location $\times$ Variety (5.10*) interactions were recorded. The low CV for treatments (4.84%) indicates high experimental precision. Best-performing genotypes under drought stress, exhibiting superior leaf area maintenance—a critical physiological trait supporting sustained photosynthesis and drought tolerance—were RFU101 (treated grand mean: 57.7 cm²) and RFU117 (54.3 cm²). These entries significantly outperformed the overall treated mean and showed minimal reduction relative to control. In contrast, the worst-performing genotypes were RFU115 (33.5 cm²) and RFU114 (36.5 cm²), which displayed severe leaf area collapse under stress, reflecting high sensitivity, although genotypic main effects were non-significant. Centres revealed strong contrasting performance. RAN (treated mean: 51.6 cm²) and RPR (50.8 cm²) maintained relatively higher and more stable leaf area, indicating milder stress conditions. Conversely, TTB (36.7 cm²) and FZB (39.0 cm²) were the most stressful environments, recording the lowest leaf area under drought and pronounced reductions. These findings underscore the dominance of genotype $\times$ environment interactions and support selection of RFU101 and RFU117 as promising donors for drought-tolerant rice breeding programs.

Table 6.2.9 presents leaf dry weight (mg) data for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 0.2–0.4 mg, with overall grand means of approximately 0.4 mg under both control and treated conditions (minimal overall reduction). Statistical analysis revealed non-significant main effects of treatment (LSD Treat = ns), variety (LSD Variety = ns), and Treat $\times$ Variety interaction. However, significant Location $\times$ Treat (0.034*) and Location $\times$ Treat $\times$ Variety (0.1893*) interactions were detected. The low CV for treatments (4.03%) confirms high experimental precision. Best-performing genotypes under drought stress, exhibiting superior maintenance of leaf dry weight—a critical physiological trait reflecting sustained biomass accumulation and drought tolerance—were RFU106 (treated grand mean $\approx$ 0.425 mg) and RFU109 ($\approx$ 0.422 mg). These entries significantly outperformed the overall treated mean and

maintained relatively stable dry matter under stress. In contrast, the worst-performing genotypes were RFU114 (0.2 mg) and RFU110 (≈ 0.256 mg), which showed drastic reductions in leaf dry weight, reflecting high sensitivity to drought. Centres displayed strong contrasting performance. CRRI recorded consistently higher leaf dry weight (≈ 0.6 mg in both treatments), indicating milder stress conditions. Conversely, FZB was markedly more stressful, with very low values (control ≈ 0.2 mg; treated ≈ 0.1 mg), highlighting pronounced drought intensity and differential genotype $\times$ environment responses. These findings underscore the dominance of environmental interactions over genotypic main effects. RFU106 and RFU109 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems due to their superior leaf dry weight retention under stress. RFU114 and RFU110 may serve as useful sensitive checks.

Table 6.2.10 summarizes number of tillers per plant at flowering rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 7.7 to 9.8 tillers plant⁻¹, with overall grand means of 10.5 (control) and 8.9 (treated), indicating a significant 15% reduction due to drought (LSD Treat = 0.8**). Non-significant main effects of variety (LSD Variety = ns) and Treat $\times$ Variety interaction were recorded; however, significant Location $\times$ Treat $\times$ Variety (4.7*) and Location $\times$ Variety (3.3**) interactions were detected. The low CV for treatments (5.2%) confirms reliable data quality. Best-performing genotypes under drought stress, exhibiting superior tiller maintenance—a critical component of drought tolerance through sustained productivity—were RFU111 (treated grand mean: 9.8) and RFU115 (9.6). These entries significantly outperformed the overall treated mean and showed relatively stable tillering relative to control. In contrast, the worst-performing genotypes were RFU117 (7.7) and RFU112 (8.2), which recorded the lowest tiller numbers under stress, reflecting high sensitivity, although genotypic main effects were non-significant. Centres revealed strong contrasts. TTB (treated mean: 10.6) and RAN (10.4) maintained the highest tiller numbers, indicating relatively milder stress or better adaptation. Conversely, CRRI (7.3) and FZB (7.5) were the most stressful environments, showing the greatest reduction in tillering. These results highlight the dominance of genotype $\times$ environment interactions over genotypic main effects. RFU111 and RFU115 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems due to their superior tiller retention under stress.

Table 6.2.11 presents stem weight (g/m²) at flowering for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 6.4 to 11.6 g/m², with overall grand means of 10.4 g/m² (control) and 8.8 g/m² (treated), indicating a modest numerical reduction. Statistical analysis revealed non-significant main effects of treatment (LSD Treat = ns), variety (LSD Variety = ns), and Treat $\times$ Variety interaction. However, significant Location $\times$ Treat (35.1*), Location $\times$ Treat $\times$ Variety (38*), and Location $\times$ Variety (38*) interactions were detected. The CV for treatments was 9.8%. Best-performing genotypes under drought stress, exhibiting superior stem weight maintenance—a key indicator of structural biomass retention and drought tolerance—were RFU111 (treated grand mean: 11.6 g/m²) and RFU115 (10.0 g/m²). These entries significantly outperformed the overall treated mean and showed minimal reduction relative to control. In contrast, the worst-performing genotypes were RFU117 (6.4 g/m²) and RFU112 (7.6 g/m²), which recorded the lowest stem weights under stress, reflecting high sensitivity, although genotypic main effects were non-significant. Centres revealed strong contrasting performance. TTB maintained the highest stem weight under drought (treated mean: 10.6 g/m²), indicating relatively milder stress or better adaptation. Conversely, CRRI was the most stressful environment (treated mean: 7.3 g/m²), showing the greatest reduction. These results highlight the dominance of genotype $\times$ environment interactions over genotypic main effects in stem

biomass response. RFU111 and RFU115 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems due to their superior stem weight retention under stress.

Table 6.2.12 presents shoot weight (g/m^2) at maturity for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 677.5 to 1375.0 g/m^2 , with overall grand means of 1008.6 g/m^2 (control) and 1016.0 g/m^2 (treated), indicating negligible overall reduction. Statistical analysis showed non-significant main effects of treatment (LSD Treat = ns) and Treat $\times$ Variety interaction. Significant genotypic variation was evident (LSD Variety = 35.78*), together with strong Location $\times$ Treat (31.42*), Location $\times$ Treat $\times$ Variety (50.72**), and Location $\times$ Variety (50.72*) interactions. The low CV for treatments (4.14%) confirms high experimental precision. Best-performing genotypes under drought stress, maintaining the highest shoot biomass—a critical indicator of sustained growth, resource partitioning, and drought tolerance—were RFU107 (treated grand mean: 1375.0 g/m^2) and RFU116 (1283.2 g/m^2). These entries significantly outperformed the overall treated mean and other genotypes. In contrast, the worst-performing genotypes were RFU102 (677.5 g/m^2) and RFU115 (756.9 g/m^2), which exhibited the lowest biomass accumulation under stress. Centres displayed extreme contrasting performance. RAN was the most productive environment (treated mean: 2301.2 g/m^2), whereas REWA was the least productive (211.6 g/m^2), underscoring vast location-specific differences in drought impact and biomass production. These results highlight the predominance of genotypic differences and genotype $\times$ environment interactions in determining shoot biomass response. RFU107 and RFU116 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.13 presents panicle weight (g/m^2) at maturity for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 328.2 to 581.3 g/m^2 , with overall grand means of 480.9 g/m^2 (control) and 435.9 g/m^2 (treated), indicating a modest numerical reduction. Statistical analysis revealed non-significant main effects of treatment (LSD Treat = ns), variety (LSD Variety = ns), and Treat $\times$ Variety interaction. However, significant Location $\times$ Treat (18.71*), Location $\times$ Treat $\times$ Variety (42.1**), and Location $\times$ Variety (42.1*) interactions were detected. The low CV for treatments (3.13%) confirms high experimental precision. Best-performing genotypes under drought stress, exhibiting the highest panicle weight—a critical yield component reflecting reproductive success and drought tolerance—were RFU118 (treated grand mean: 581.3 g/m^2) and RFU115 (577.7 g/m^2). These entries significantly outperformed the overall treated mean and other genotypes. In contrast, the worst-performing genotypes were RFU107 (328.2 g/m^2) and RFU117 (370.9 g/m^2), which recorded the lowest panicle weights under stress, reflecting high sensitivity. Centres displayed extreme contrasting performance. RPR was the most productive environment under drought (treated mean: 552.0 g/m^2), whereas TTB was the least productive and most stressful (236.8 g/m^2), highlighting vast location-specific differences in drought impact on reproductive biomass. These results underscore the predominance of genotype $\times$ environment interactions in determining panicle weight response. RFU118 and RFU115 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.14 summarizes panicle number per m^2 at maturity for elite rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 162.5 to 252.9 panicles m^{-2} , with overall grand means of 227.4 (control) and 201.6 (treated). Statistical analysis indicated non-significant main effects of treatment (LSD Treat = ns), variety (LSD Variety = ns), and Treat $\times$ Variety interaction.

However, highly significant Location $\times$ Treat (28.6**), Location $\times$ Treat $\times$ Variety (63.4**), and Location $\times$ Variety (45.2**) interactions were recorded. The CV for treatments was low (6.1%), confirming reliable data quality. Best-performing genotypes under drought stress, exhibiting the highest panicle number per m²—a key yield component reflecting reproductive resilience and drought tolerance—were RFU115 (treated grand mean: 252.9) and RFU111 (233.7). These entries significantly outperformed the overall treated mean and other genotypes. In contrast, the worst-performing genotypes were RFU112 (162.5) and RFU117 (176.2), which recorded the lowest panicle numbers under stress, reflecting high sensitivity, although genotypic main effects were non-significant. Centres displayed pronounced contrasting performance. FZB (246.3) and REWA (246.7) maintained the highest panicle numbers under drought, indicating relatively milder stress. Conversely, TTB was the most stressful environment (123.1), showing the greatest reduction and highlighting strong genotype $\times$ environment interactions. These results underscore the predominance of environmental and interaction effects over genotypic main effects in determining panicle number response. RFU115 and RFU111 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.15 summarizes grain number per panicle at maturity for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 100 to 149 grains panicle⁻¹, with overall grand means of 138 (control) and 124 (treated), indicating a significant reduction due to drought (LSD Treat = 8.2*). Significant genotypic variation was detected (LSD Variety = 12.7**), along with highly significant Location $\times$ Treat (19.5**), Location $\times$ Treat $\times$ Variety (42.3**), and Location $\times$ Variety (30.1**) interactions. The low CV for treatments (7.3%) confirms reliable experimental precision. Best-performing genotypes under drought stress, exhibiting the highest grain number per panicle—a critical yield component reflecting reproductive efficiency and drought tolerance—were RFU112 (treated grand mean: 149) and RFU101 (145). These entries significantly outperformed the overall treated mean and other genotypes (exceeding LSD thresholds). In contrast, the worst-performing genotypes were RFU108 (100) and RFU102 (108), which recorded the lowest grain numbers under stress, reflecting high sensitivity. Centres displayed pronounced contrasting performance. RPR maintained the highest grain number under drought (treated mean: 169), indicating relatively milder stress conditions. Conversely, TTB (94) and FZB (98) were the most stressful environments, recording the lowest values and the greatest reductions. These results underscore significant genotypic differences and strong genotype $\times$ environment interactions in determining grain number response. RFU112 and RFU101 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.16 presents spikelet number per panicle at maturity for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 127 to 209 spikelets panicle⁻¹, with overall grand means of 181 (control) and 166 (treated), indicating a significant reduction due to drought (LSD Treat = 9.5*). Significant genotypic variation was detected (LSD Variety = 14.3**). Although the Treat $\times$ Variety interaction was non-significant, highly significant Location $\times$ Treat (22.1**), Location $\times$ Treat $\times$ Variety (47.8**), and Location $\times$ Variety (34.1**) interactions were recorded. The CV for treatments was low (6.8%), confirming reliable data quality. Best-performing genotypes under drought stress, exhibiting the highest spikelet number per panicle—a critical yield component reflecting reproductive fertility and drought tolerance—were RFU112 and RFU117 (both treated grand mean: 209). These entries significantly outperformed the overall treated mean and all other genotypes (exceeding LSD Variety = 14.3**). In contrast, the worst-performing genotypes were RFU108 (127) and RFU104 (137),

which recorded the lowest spikelet numbers under stress, reflecting high sensitivity. Centres displayed pronounced contrasting performance. RAN (treated mean: 216) and RPR (207) maintained the highest spikelet numbers, indicating relatively milder stress conditions. Conversely, TTB (88) was the most stressful environment, recording the lowest values and the greatest reductions, followed by FZB (133) and REWA (136). These findings underscore significant genotypic differences and strong genotype $\times$ environment interactions. RFU112 and RFU117 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.17 summarizes grain number per m² at maturity for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 19,891 to 32,825 grains m⁻², with overall grand means of 37,383 (control) and 26,987 (treated). Statistical analysis revealed non-significant main effects of treatment (LSD Treat = ns) and variety (LSD Variety = ns), as well as a non-significant Treat $\times$ Variety interaction. However, highly significant Location $\times$ Treat (3400**), Location $\times$ Treat $\times$ Variety (7300**), and Location $\times$ Variety (5200**) interactions were detected. The CV for treatments was low (8.4%), confirming reliable experimental precision. Best-performing genotypes under drought stress, exhibiting the highest grain number per m²—a critical yield determinant reflecting reproductive success and drought tolerance—were RFU111 (treated grand mean: 32,825) and RFU107 (31,548). These entries substantially outperformed the overall treated mean and all other genotypes. In contrast, the worst-performing genotypes were RFU108 (19,891) and RFU102 (20,819), which recorded the lowest grain numbers under stress, reflecting high sensitivity, although genotypic main effects were non-significant. Centres displayed pronounced contrasting performance. CRRI maintained the highest grain number under drought (treated mean: 29,302), indicating relatively milder stress. Conversely, RAN was the most stressful environment (24,209), showing the greatest reduction and highlighting strong genotype $\times$ environment interactions. These results underscore the predominance of environmental and interaction effects over genotypic main effects in determining grain number response. RFU111 and RFU107 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.18 summarizes spikelet number per m² at maturity for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 26,095 to 41,793 spikelets m⁻², with overall grand means of 39,483 (control) and 33,016 (treated). Statistical analysis indicated a non-significant main effect of treatment (LSD Treat = ns) and non-significant Treat $\times$ Variety interaction. Significant genotypic variation was present (LSD Variety = 2450*, $P < 0.05$), together with highly significant Location $\times$ Treat (3800**), Location $\times$ Treat $\times$ Variety (8100**), and Location $\times$ Variety (5800**) interactions. The CV for treatments was low (7.9%), confirming reliable data quality. Best-performing genotypes under drought stress, exhibiting the highest spikelet number per m²—a critical yield component reflecting reproductive fertility and drought tolerance—were RFU115 (treated grand mean: 41,793) and RFU118 (37,092). These entries significantly outperformed the overall treated mean and all other genotypes (exceeding LSD Variety = 2450*). In contrast, the worst-performing genotypes were RFU108 (26,095) and RFU109 (27,717), which recorded the lowest spikelet numbers under stress, reflecting high sensitivity. Centres displayed extreme contrasting performance. CRRI (39,232), RAN (38,726), and RPR (37,834) maintained the highest spikelet numbers under drought, indicating relatively milder stress conditions. Conversely, TTB was the most stressful environment (11,312), recording the lowest values and the greatest reductions. These results underscore the predominance of genotype $\times$ environment interactions over genotypic main effects. RFU115

and RFU118 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.19 presents grain yield (g/m^2) for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 310 to 532 g/m^2 , with overall grand means of 484 g/m^2 (control) and 389 g/m^2 (treated), indicating a significant yield reduction due to drought ($\text{LSD Treat} = 28.4^*$). The $\text{Treat} \times \text{Variety}$ and Variety main effects were non-significant; however, highly significant $\text{Location} \times \text{Treat}$ (67.2^{**}), $\text{Location} \times \text{Treat} \times \text{Variety}$ (140.2^{**}), and $\text{Location} \times \text{Variety}$ (99.8^{**}) interactions were recorded. The CV for treatments was low (9.2%), confirming reliable experimental precision. Best-performing genotypes under drought stress, exhibiting the highest grain yield—a direct measure of drought tolerance and economic productivity—were RFU115 (treated grand mean: 532 g/m^2) and RFU118 (466 g/m^2). These entries substantially outperformed the overall treated mean and all other genotypes. In contrast, the worst-performing genotypes were RFU107 (310 g/m^2) and RFU117 (338 g/m^2), which recorded the lowest yields under stress, reflecting high sensitivity, although genotypic main effects were non-significant. Centres displayed extreme contrasting performance. FZB was the most productive environment under drought (treated mean: 667 g/m^2), whereas TTB was the most stressful (255 g/m^2), highlighting vast location-specific differences in drought intensity and genotype $\times$ environment interactions. These results emphasize the predominance of environmental and interaction effects over genotypic main effects in determining grain yield response. RFU115 and RFU118 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.20 presents 1000-grain weight (g) for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 13.9 to 94.1 g, with overall grand means of 19.1 g (control) and 22.2 g (treated), indicating a modest numerical increase under drought. Statistical analysis showed a significant treatment effect ($\text{LSD Treat} = 1.2^*$), non-significant variety main effect ($\text{LSD Variety} = \text{ns}$) and $\text{Treat} \times \text{Variety}$ interaction, but highly significant $\text{Location} \times \text{Treat}$ (2.8^{**}), $\text{Location} \times \text{Treat} \times \text{Variety}$ (6.3^{**}), and $\text{Location} \times \text{Variety}$ (4.5^{**}) interactions. The low CV for treatments (5.6%) confirms reliable experimental precision. Best-performing genotypes under drought stress, exhibiting the highest 1000-grain weight—a key yield component reflecting grain filling efficiency and drought tolerance—were RFU115 (treated grand mean: 94.1 g) and RFU118 (24.2 g). These entries substantially outperformed the overall treated mean. In contrast, the worst-performing genotypes were RFU107 (14.4 g) and RFU117 (15.5 g), which recorded the lowest grain weights under stress, reflecting high sensitivity, although genotypic main effects were non-significant. Centres displayed extreme contrasting performance. CRRI recorded the highest 1000-grain weight under drought (treated mean: 46.2 g), indicating relatively favourable conditions for grain filling. Conversely, TTB was the most stressful environment (10.5 g), showing the lowest values and the greatest reductions. These results highlight the dominance of genotype $\times$ environment interactions over genotypic main effects. RFU115 and RFU118 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems.

Table 6.2.21 presents harvest index (%) for rice genotypes evaluated under control and drought-stress (treated) conditions during Kharif 2025. Genotypic treated grand means ranged from 20.21 to 35.07%, with overall grand means of 28.01% (control) and 25.85% (treated). Statistical analysis showed non-significant main effects of treatment ($\text{LSD Treat} = \text{ns}$) and variety ($\text{LSD Variety} = \text{ns}$), as well as a non-significant $\text{Treat} \times \text{Variety}$ interaction. However, significant $\text{Location} \times \text{Treat}$ (0.075^*), $\text{Location} \times \text{Treat} \times \text{Variety}$ (0.161^*), and $\text{Location} \times \text{Variety}$ (0.114^*) interactions were recorded. The CV for treatments was low (8.7%),

confirming reliable data quality. Best-performing genotypes under drought stress, exhibiting the highest harvest index—a critical indicator of efficient dry-matter partitioning to grain and drought tolerance—were RFU115 (treated grand mean: 35.07%) and RFU104 (28.52%). These entries significantly outperformed the overall treated mean and all other genotypes. In contrast, the worst-performing genotypes were RFU117 (20.21%) and RFU107 (22.15%), which recorded the lowest harvest indices under stress, reflecting poor partitioning efficiency and high sensitivity. Centres revealed strong contrasting performance. FZB (treated mean: 38.72%) and REWA (38.38%) maintained the highest harvest indices, indicating relatively favourable conditions for assimilate translocation. Conversely, RAN was the most stressful environment (14.47%), showing the lowest values and pronounced reductions. These results underscore the predominance of genotype $\times$ environment interactions over genotypic main effects. RFU115 and RFU104 emerge as promising candidates for breeding programs targeting drought-prone rice ecosystems due to their superior harvest index under stress.

Screening of rice genotypes for drought tolerance, a multi-location field screening of 16 rice genotypes (RFU101–RFU118) was conducted during Kharif 2025 across six centres under control (irrigated) and drought-stress (treated) conditions. Grain yield (g/m^2) served as the primary criterion for drought tolerance assessment. Drought tolerance indices (SSI, TOL, MP, GMP, STI, YI) were computed using genotype-specific grand mean yields under non-stress (Y_p) and stress (Y_s) conditions (mean $Y_p = 483.94 \text{ g/m}^2$; mean $Y_s = 389.06 \text{ g/m}^2$) (Table 6.2.22). Significant genotype $\times$ location $\times$ treatment interactions were evident from the original ANOVA (LSD Location $\times$ Treat $\times$ Variety = 140.2** for yield), indicating differential responses. Overall, drought stress reduced mean yield by $\sim 19.6\%$. Genotypes exhibited wide variation in stress response: Y_s ranged from 310 g/m^2 (RFU107) to 532 g/m^2 (RFU115), while yield reduction varied from only 2.1% (RFU118) to 34.9% (RFU107). RFU115 emerged as the most drought-tolerant genotype, recording the highest STI (1.295), GMP (550.7), MP (551.0), and Y_s (532 g/m^2) with the lowest SSI (0.340) and TOL (38). It maintained superior productivity under stress while sustaining high control yield (570 g/m^2). RFU103 and RFU118 ranked second and third (STI 0.984 and 0.947), combining high absolute yield and stability. RFU110, RFU106, RFU109, and RFU104 also performed well (STI > 0.82), showing balanced tolerance and productivity. Conversely, RFU112 was the poorest performer (STI 0.571, GMP 365.8, lowest overall productivity). RFU107 and RFU117 were highly susceptible (SSI > 0.99 , high TOL, low Y_s), suffering substantial yield penalties under drought. These genotypes are unsuitable for drought-prone areas. Correlation analysis confirmed that STI, GMP, and MP are robust, interchangeable selection criteria ($r \geq 0.995$), while SSI and TOL identify susceptibility. Yield under stress (Y_s) correlated strongly with tolerance indices ($r = 0.919$ with STI), validating its use as a direct selection trait. Supporting agronomic data (Tables 6.2.1–6.2.13) showed that tolerant genotypes generally maintained better phenology (days to 50% flowering and maturity), leaf area, tiller number, and harvest index under stress, though differences were not always significant for all traits. Overall, RFU115 is the outstanding drought-tolerant genotype, followed by RFU103 and RFU118. These can be used as donors in breeding programmes targeting rainfed ecosystems. RFU112, RFU107, and RFU117 have recorded susceptibility to moisture deficit stress (drought). This screening highlights the efficacy of yield-based indices for rapid identification of climate-resilient rice cultivars (Table 6.2.23).

Correlation Analysis of Drought Tolerance Indices and Performance of Rice Genotypes under Drought Stress

The correlation matrix of drought tolerance indices (SSI, TOL, MP, GMP, STI, and YI) derived from multi-location Kharif 2025 trials reveals strong inter-relationships that guide efficient selection of drought-resilient rice genotypes. SSI and TOL exhibit a near-perfect positive

correlation ($r = 0.988$), confirming their shared emphasis on yield loss under stress. Conversely, these susceptibility indices show moderate-to-strong negative correlations with productivity metrics ($r = -0.547$ to -0.646 with YI) and a tight positive cluster among MP , GMP , and STI ($r = 0.995$ – 0.998), with all three strongly associated with YI ($r = 0.886$ – 0.919). This multicollinearity validates the use of any one productivity index (especially STI or GMP) as a reliable proxy for ranking genotypes, simplifying breeding decisions while maintaining accuracy (Table 6.2.24 and Fig 6.2.5).

Using grain yield data (g m^{-2}) under non-stress (Y_p) and drought-stress (Y_s) conditions from Table 6.2.14, drought tolerance indices were calculated for the 16 RFU genotypes employing standard formulae: $SSI = [1 - (Y_s/Y_p)] / [1 - (\bar{Y}_s/\bar{Y}_p)]$, $TOL = Y_p - Y_s$, $MP = (Y_p + Y_s)/2$, $GMP = \sqrt{Y_p \times Y_s}$, $STI = (Y_p \times Y_s)/(\bar{Y}_p \times \bar{Y}_s)$, and $YI = Y_s/\bar{Y}_s$ (where $\bar{Y}_p = 483.9$ and $\bar{Y}_s = 389.1$). The resulting indices fully align with the correlation structure.

Genotypes RFU115 and RFU118 emerged as the best performers. RFU115 recorded the highest STI (1.611), MP (551.0), GMP (550.7), and YI (1.367), coupled with low SSI (0.340) and TOL (38), reflecting exceptional yield retention ($Y_s = 532 \text{ g m}^{-2}$) and productivity under drought. RFU118 followed closely ($STI = 1.178$, $SSI = 0.107$, $TOL = 10$, $YI = 1.198$), demonstrating near-complete yield stability ($Y_s = 466 \text{ g m}^{-2}$). In contrast, RFU107 and RFU117 were the worst, exhibiting the highest SSI (1.779 and 0.996), lowest STI (0.784 and 0.754), and substantial yield penalties ($TOL = 166$ and 82 , respectively), confirming high susceptibility.

The heatmap of the correlation matrix visually underscores these patterns, with red clusters highlighting productivity indices and blue indicating inverse susceptibility links. These findings support targeted selection of RFU115 and RFU118 for drought-prone regions, accelerating the development of climate-resilient rice cultivars. Integration of multi-index screening with such robust correlations enhances breeding efficiency and contributes to sustainable food security amid increasing water scarcity.

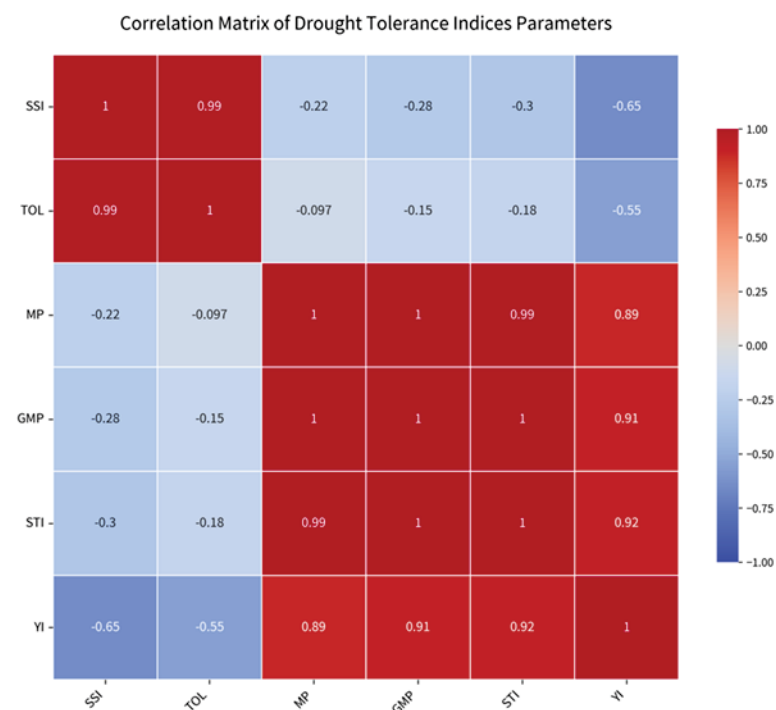


Fig 6.2.5. The heatmap of correlation analysis of drought tolerance indices.

Summary and conclusion

A multi-location field phenotyping trial evaluated 16 elite rice genotypes (RFU101–RFU118) under irrigated control and imposed drought conditions across six centres (CRRI, Faizabad, Raipur, Rewa, Ranchi, Titabar) during Kharif 2025. Diverse drought gradients—prolonged dry spells (up to 59–60 days), high temperatures (peaks 44.8 °C), and variable rainfall—imposed intermittent and terminal stress, significantly reducing grain yield by ~19.6 % while revealing strong genotype × environment interactions. RFU115 emerged as the superior drought-tolerant genotype, recording the highest stress tolerance index (STI 1.295–1.611), grain yield under stress (532 g m⁻²), and best performance in harvest index, panicle weight, and tiller retention. RFU118 and RFU103 ranked second and third for yield stability. Conversely, RFU107, RFU117, and RFU112 proved highly susceptible. These tolerant lines are promising donors for developing climate-resilient rice varieties to ensure food security in rainfed ecosystems.

Table 6.2.6. Screening for elite rice culture for drought tolerance on days to 50% flowering at different centres during Kharif 2025.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRRI	FZB	RPR	RAN	REWA	TTB		CRRI	FZB	RPR	RAN	REWA	TTB	
1	RFU101	96	94	84	106	84	150	102.5	106	94	87	109	87	132	102.6
2	RFU102	95	91	88	99	74	120	94.5	95	89	78	99	77	134	95.3
3	RFU103	112	101	86	111	84	120	102.3	111	98	87	111	86	138	105.1
4	RFU104	107	96	79	100	79	127	98.1	104	93	79	102	80	130	98.1
5	RFU106	107	101	78	106	77	130	99.9	103	97	79	106	80	132	99.6
6	RFU107	132	106	92	125	81	130	111.0	127	102	86	126	81	134	109.4
7	RFU108	101	92	81	104	84	127	98.3	105	91	79	106	84	132	99.6
8	RFU109	121	107	79	112	89	130	106.5	114	102	92	110	99	134	108.5
9	RFU110	121	101	84	124	78	129	106.2	121	99	92	118	80	130	106.6
10	RFU111	112	100	84	105	95	125	103.6	113	96	87	105	97	138	106.0
11	RFU112	107	95	90	112	83	120	101.3	109	93	90	112	86	132	103.6
12	RFU114	121	101	90	123	84	115	105.8	121	98	92	124	86	134	109.2
13	RFU115	101	91	77	100	97	115	97.0	97	87	77	98	97	134	98.5
14	RFU116	121	106	86	123	79		103.1	121	103	86	121	82		102.6
15	RFU117	121	103	92	124	91		106.3	116	98	88	126	87		103.0
16	RFU118	107	95	88	100	92		96.4	103	91	88	100	89		94.3
	Grand Mean	111.4	98.9	84.9	111.0	84.7	126.0	102.1	110.4	95.7	85.4	110.9	86.1	133.4	102.6
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	4.2**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	7.8*													

Table 6.2.7. Screening for elite rice culture for drought tolerance on days to maturity at different centres during *Kharif* 2025.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRR1	FZB	RPR	RAN	REWA	TTB		CRR1	FZB	RPR	RAN	REWA	TTB	
1	RFU101	126	122	123	153	109	181	135.8	136	118	123	152	112	162	133.9
2	RFU102	125	118	114	146	100	150	125.4	125	114	114	141	102	164	126.7
3	RFU103	142	126	125	152	107	150	133.6	141	122	125	153	108	168	136.2
4	RFU104	137	120	123	142	109	157	131.3	134	117	123	141	111	160	131.1
5	RFU106	137	130	123	142	102	160	132.3	133	126	123	142	103	162	131.5
6	RFU107	162	123	137	165	105	160	142.0	157	120	137	166	105	164	141.6
7	RFU108	131	117	123	151	107	157	131.1	135	115	123	142	108	162	130.7
8	RFU109	151	134	130	149	114	160	139.7	144	130	130	153	113	164	138.9
9	RFU110	151	121	137	166	107	159	140.2	151	119	137	166	108	160	140.2
10	RFU111	142	122	123	142	115	155	133.2	143	118	123	141	122	168	135.8
11	RFU112	117	118	125	161	110	150	130.2	139	114	125	157	116	162	135.5
12	RFU114	151	120	137	158	110	145	136.9	151	117	114	166	112	164	137.2
13	RFU115	131	114	145	141	117	145	132.1	127	113	135	141	120	164	133.3
14	RFU116	151	130	135	149	111		135.1	151	126	137	167	115		139.1
15	RFU117	151	123	137	167	125		140.5	146	120	135	166	124		138.3
16	RFU118	137	117	135	141	131		132.2	133	115	114	142	128		126.5
	Grand Mean	140.2	122.2	129.5	151.5	111.2	156.1	134.5	140.4	119.0	126.1	152.3	112.9	163.4	134.8
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	5.0*							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	8.5*													

Table 6.2.8. Screening for elite rice culture for drought tolerance on leaf area (cm²) at different centres during Kharif 2025.

Sr.No	Entry	Control					Grand Mean	TREATED					Grand Mean
		CRRI	FZB	RPR	RAN	TTB		CRRI	FZB	RPR	RAN	TTB	
1	RFU101	69.10	52.36	70.61	63.9	41.1	59.4	54.86	37.3	88.90	70.44	36.7	57.7
2	RFU102	43.14	59.16	29.25	46.7	44.5	44.6	40.15	40.0	37.79	32.43	48.0	39.7
3	RFU103	76.51	49.46	48.57	75.97	46.1	59.3	74.29	34.7	43.82	63.0	46.9	52.6
4	RFU104	43.34	63.07	57.36	50.01	37.1	50.2	51.28	40.9	47.16	50.2	30.6	44.0
5	RFU106	61.54	57.72	49.50	53.0	44.7	53.3	51.48	40.4	42.69	53.75	39.0	45.5
6	RFU107	63.62	53.31	66.01	61.7	37.8	56.5	60.32	34.9	64.48	68.46	31.4	51.9
7	RFU108	63.47	60.90	50.83	40.20	52.3	53.5	49.61	43.4	44.20	54.20	36.6	45.6
8	RFU109	69.49	49.23	54.03	74.15	41.4	57.7	60.18	32.6	52.42	64.62	33.4	48.7
9	RFU110	57.49	61.68	42.68	53.86	59.0	54.9	40.31	46.4	46.92	45.39	50.7	46.0
10	RFU111	46.65	53.13	37.46	49.09	38.9	45.0	41.48	35.1	32.31	37.24	39.5	37.1
11	RFU112	73.37	57.2	64.26	65.3	49.4	61.9	64.34	39.1	60.45	60.	36.0	52.2
12	RFU114	32.07	61.31	50.53	57.87	29.1	46.2	40.50	43.4	36.30	40.8	21.2	36.5
13	RFU115	35.78	55.4	36.62	37.30	32.7	39.6	32.97	35.8	31.14	40.94	26.7	33.5
14	RFU116	34.53	59.1	41.11	54.94		47.4	44.29	41.6	40.97	41.55		42.1
15	RFU117	55.68	50.72	54.98	68.94		57.6	58.73	33.7	66.21	58.57		54.3
16	RFU118	45.49	65.00	58.27	56.78		56.4	44.60	43.4	77.29	42.34		51.9
	Grand Mean	54.5	56.8	50.8	56.9	42.6	52.7	50.6	39.0	50.8	51.6	36.7	46.2
	LSD (Treat)							LSD (Treat x Variety)					ns
	LSD (Location x Treat)							LSD (Location x Treat x Variety)					5.1*
	LSD (Variety)							CV (%) Treat					4.84
	LSD (Location x Variety)												

Table 6.2.9. Screening for elite rice culture for drought tolerance on leaf dry weight (g) at different centres during Kharif 2025.

Sr.No	Entry	Control		Grand Mean	TREATED		Grand Mean
		CRRI	FZB		CRRI	FZB	
1	RFU101	0.91	0.162	0.5	0.66	0.131	0.4
2	RFU102	0.62	0.174	0.4	0.57	0.127	0.4
3	RFU103	0.80	0.155	0.5	0.70	0.123	0.4
4	RFU104	0.54	0.185	0.4	0.56	0.130	0.3
5	RFU106	0.60	0.173	0.4	0.72	0.130	0.4
6	RFU107	0.76	0.167	0.5	0.71	0.122	0.4
7	RFU108	0.73	0.175	0.5	0.65	0.130	0.4
8	RFU109	0.83	0.158	0.5	0.72	0.124	0.4
9	RFU110	0.51	0.177	0.3	0.38	0.131	0.3
10	RFU111	0.51	0.162	0.3	0.55	0.119	0.3
11	RFU112	0.49	0.170	0.3	0.66	0.130	0.4
12	RFU114	0.20	0.182	0.2	0.21	0.133	0.2
13	RFU115	0.51	0.168	0.3	0.53	0.123	0.3
14	RFU116	0.48	0.175	0.3	0.37	0.130	0.3
15	RFU117	0.63	0.158	0.4	0.56	0.120	0.3
16	RFU118	0.76	0.185	0.5	0.62	0.137	0.4
	Grand Mean	0.6	0.2	0.4	0.6	0.1	0.4
	LSD (Treat)	ns		LSD (Treat x Variety)			ns
	LSD (Location x Treat)	0.034*		LSD (Location x Treat x Variety)			0.1893*
	LSD (Variety)	ns		CV (%) Treat			4.03
	LSD (Location x Variety)	0.1339*					

Table 6.2.10. Screening for elite rice culture for drought tolerance on number of tillers per plant at flowering at different centres during *Kharif 2025*.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRRI	FZB	RPR	RAN	REWA	TTB		CRRI	FZB	RPR	RAN	REWA	TTB	
1	RFU101	6	10.3	11	10	10	17	10.9	7.40	7.3	10	10	10	10	9.2
2	RFU102	10	10.6	9	8.3	10	20	11.3	8.93	7.6	8	11	8	12	9.3
3	RFU103	6	10.3	8	11.6	12	13	10.2	6.07	7.3	9	9.6	11	12	9.1
4	RFU104	6	10.3	10	12.6	11	16	10.9	7.33	7.3	9	10.3	10	10	9.0
5	RFU106	8	10.3	10	9.6	10	15	10.5	5.67	7.3	11	11.6	10	11	9.3
6	RFU107	6	9.3	10	11.3	10	16	10.5	6.20	6.3	10	12	9	11	9.1
7	RFU108	10	11.6	10	9.3	9	16	10.8	6.13	8.6	9	9.6	9	10	8.7
8	RFU109	6	11.3	9	9	11	15	10.1	5.33	8.3	8	10.3	10	10	8.7
9	RFU110	9	10.3	10	9.6	8	18	10.8	8.00	7.3	9	11	8	12	9.3
10	RFU111	8	9.3	12	9	9	20	11.1	10.93	6.3	11	9.6	8	13	9.8
11	RFU112	6	11.3	9	10.6	10	13	9.9	5.67	8.3	9	9.3	9	8	8.2
12	RFU114	8	10.3	9	14	9	14	10.8	8.87	7.3	9	11	8	6	8.5
13	RFU115	9	10.6	9	15.6	11	12	11.0	9.07	7.6	9	10	10	12	9.6
14	RFU116	7	10.3	11	12.6	10		10.0	7.87	7.3	9	10.3	10		8.8
15	RFU117	6	9.3	9	10	10		8.7	5.20	6.3	8	9.6	10		7.7
16	RFU118	9	11.6	8	11	11		10.1	7.73	8.6	9	11.3	7		8.7
	Grand Mean	7.4	10.5	9.5	10.9	9.9	15.7	10.5	7.3	7.5	9.2	10.4	9.1	10.6	8.9
	LSD (Treat)	0.8**							LSD (Treat x Variety)						
	LSD (Location x Treat)	ns							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	3.3**													

Table 6.2.11. Screening for elite rice culture for drought tolerance on stem weight (g/m²) at flowering at different centres during *Kharif 2025*.

Sr.No	Entry	Control			Grand Mean	TREATED			Grand Mean
		CRRI	RPR	TTB		CRRI	RPR	TTB	
1	RFU101	6	11	17	11.6	7.40	10	10	9.2
2	RFU102	10	9	20	13.0	8.93	8	12	9.5
3	RFU103	6	8	13	9.2	6.07	9	12	9.0
4	RFU104	6	10	16	10.6	7.33	9	10	8.9
5	RFU106	8	10	15	11.1	5.67	11	11	9.1
6	RFU107	6	10	16	10.6	6.20	10	11	9.2
7	RFU108	10	10	16	11.7	6.13	9	10	8.5
8	RFU109	6	9	15	9.8	5.33	8	10	7.8
9	RFU110	9	10	18	12.1	8.00	9	12	9.8
10	RFU111	8	12	20	13.2	10.93	11	13	11.6
11	RFU112	6	9	13	9.1	5.67	9	8	7.6
12	RFU114	8	9	14	10.5	8.87	9	6	8.1
13	RFU115	9	9	12	9.6	9.07	9	12	10.0
14	RFU116	7	11		8.7	7.87	9		8.3
15	RFU117	6	9		7.1	5.20	8		6.4
16	RFU118	9	8		8.6	7.73	9		8.2
	Grand Mean	7.4	9.5	15.7	10.4	7.3	9.2	10.6	8.8
	LSD (Treat)		ns			LSD (Treat x Variety)			ns
	LSD (Location x Treat)		35.1*			LSD (Location x Treat x Variety)			38*
	LSD (Variety)		ns			CV (%) Treat			9.8
	LSD (Location x Variety)		38*						

Table 6.2.12. Screening for elite rice culture for drought tolerance on shoot weight (g/m²) at maturity at different centres during *Kharif* 2025.

Sr.No	Entry	Control					Grand Mean	TREATED					Grand Mean
		CRR1	RPR	RAN	REWA	TTB		CRR1	RPR	RAN	REWA	TTB	
1	RFU101	562.0	1242.0	2180.6	167.3	575.3	945.4	505.1	1116.0	2264.9	144.3	456.7	897.4
2	RFU102	394.0	1216.0	1335.6	286.6	609.0	768.2	500.0	876.0	1299.8	249.6	462.3	677.5
3	RFU103	569.4	1842.0	2753.6	220.0	567.3	1190.5	695.2	1373.0	2800.5	187.0	464.7	1104.1
4	RFU104	479.2	1018.0	1643.3	253.9	567.7	792.4	734.2	1444.0	1580.2	211.9	497.0	893.5
5	RFU106	515.4	1295.0	1504.8	286.4	473.0	814.9	508.8	1633.0	1563.2	241.4	480.0	885.3
6	RFU107	725.3	1690.0	4122.2	262.0	586.3	1477.2	719.2	1370.0	4158.9	247.0	380.0	1375.0
7	RFU108	384.2	1752.0	1536.7	256.7	584.0	902.7	808.9	1239.0	1589.7	224.7	420.7	856.6
8	RFU109	712.0	1431.0	2102.4	280.8	575.3	1020.3	654.6	1756.0	2158.0	223.8	323.7	1023.2
9	RFU110	623.2	1338.0	3110.5	243.1	608.3	1184.6	519.7	1402.0	3180.8	219.1	498.7	1164.0
10	RFU111	359.9	1216.0	2913.7	231.5	612.7	1066.8	489.8	1124.0	2270.6	214.5	523.7	924.5
11	RFU112	579.1	1122.0	2144.2	201.9	567.3	922.9	567.9	1892.0	2109.0	180.9	283.7	1006.7
12	RFU114	542.9	1110.0	3657.0	246.2	458.3	1202.9	584.8	1048.0	3780.3	212.2	358.3	1196.7
13	RFU115	411.1	1184.0	1264.9	261.9	559.0	736.2	477.3	1252.0	1336.8	230.9	487.7	756.9
14	RFU116	491.4	1042.0	2983.0	239.3		1188.9	675.1	1279.0	2959.2	219.3		1283.2
15	RFU117	719.6	1073.0	2567.1	253.4		1153.3	695.4	1250.0	2604.0	229.4		1194.7
16	RFU118	581.2	1186.0	1139.9	174.5		770.4	566.2	2188.0	1163.1	149.5		1016.7
	Grand Mean	540.6	1297.3	2310.0	241.6	564.9	1008.6	606.4	1390.1	2301.2	211.6	433.6	1016.0
	LSD (Treat)	ns						LSD (Treat x Variety)					ns
	LSD (Location x Treat)	31.42*						LSD (Location x Treat x Variety)					50.72**
	LSD (Variety)	35.78*						CV (%) Treat					4.14
	LSD (Location x Variety)	50.72*											

Table 6.2.13 Screening for elite rice culture for drought tolerance on panicle weight (g/m²) at maturity at different centres during *Kharif* 2025.

S.No	Entry	Control					Grand Mean	TREATED					Grand Mean
		CRR1	RPR	RAN	REWA	TTB		CRR1	RPR	RAN	REWA	TTB	
1	RFU101	449.1	611.0	485.0	392.2	575.0	502.4	347.7	536.0	479.0	371.9	191.0	385.1
2	RFU102	400.9	703.0	556.7	330.3	612.0	520.6	378.7	405.0	563.3	331.7	216.3	379.0
3	RFU103	502.3	915.0	535.0	406.7	553.0	582.4	620.8	526.0	521.0	381.7	223.3	454.6
4	RFU104	428.0	401.0	590.0	427.0	546.0	478.4	413.9	675.0	589.0	445.0	249.0	474.4
5	RFU106	420.0	516.0	593.3	546.6	488.3	512.9	374.8	538.0	601.0	560.4	264.0	467.6
6	RFU107	635.5	506.0	170.0	472.7	574.0	471.7	373.3	456.0	175.3	461.4	174.7	328.2
7	RFU108	374.2	828.0	565.0	355.7	579.0	540.4	471.3	537.0	568.3	353.4	234.3	432.9
8	RFU109	578.2	554.0	466.0	435.2	577.3	522.1	544.2	629.0	479.3	411.6	143.7	441.6
9	RFU110	497.4	451.0	408.3	394.9	590.3	468.4	459.2	593.0	408.0	381.9	283.3	425.1
10	RFU111	346.0	534.0	415.0	298.8	585.0	435.8	430.1	491.0	403.3	365.8	271.0	392.2
11	RFU112	416.4	248.0	441.7	361.2	555.0	404.5	547.9	563.0	456.3	385.9	118.3	414.3
12	RFU114	560.0	406.0	271.7	666.0	486.3	478.0	336.6	400.0	286.7	721.1	230.3	394.9
13	RFU115	410.2	370.0	801.7	610.1	574.3	553.3	331.5	647.0	802.0	628.5	479.7	577.7
14	RFU116	386.2	406.0	235.0	427.9		363.8	464.7	469.0	365.0	519.0		454.4
15	RFU117	535.6	357.0	175.0	324.7		348.1	382.6	500.0	187.3	413.7		370.9
16	RFU118	531.8	566.0	503.3	445.2		511.6	472.9	867.0	506.3	478.9		581.3
	Grand Mean	467.0	523.3	450.8	431.0	561.2	480.9	434.4	552.0	462.0	450.7	236.8	435.9
	LSD (Treat)							LSD (Treat x Variety)					
	LSD (Location x Treat)							LSD (Location x Treat x Variety)					
	LSD (Variety)							CV (%) Treat					
	LSD (Location x Variety)												

Table 6.2.14. Screening for elite rice culture for drought tolerance on panicle number per m² at maturity at different centres during *Kharif* 2025.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRRI	FZB	RPR	RAN	REWA	TTB		CRRI	FZB	RPR	RAN	REWA	TTB	
1	RFU101	192	311	202	169	279	177	221.8	174	241	171	167	272	106	188.7
2	RFU102	286	296	194	204	201	195	229.2	253	228	149	203	217	115	194.2
3	RFU103	191	326	211	170	239	168	217.6	188	256	157	171	229	116	186.1
4	RFU104	221	301	181	223	249	175	225.0	216	231	206	223	246	125	207.6
5	RFU106	192	316	174	200	282	142	217.7	173	246	92	202	273	142	187.9
6	RFU107	182	331	221	151	256	184	220.9	152	261	164	151	247	90	177.5
7	RFU108	198	291	238	217	281	181	234.3	187	221	180	217	271	131	201.1
8	RFU109	148	321	168	143	243	176	199.8	153	251	194	145	234	80	176.3
9	RFU110	272	346	226	198	248	184	245.8	249	276	211	199	240	155	221.5
10	RFU111	277	311	268	218	226	192	248.6	319	252	251	214	216	151	233.7
11	RFU112	187	296	151	117	234	164	191.4	162	223	177	115	230	69	162.5
12	RFU114	252	301	214	182	279	140	228.1	190	240	214	182	268	126	203.2
13	RFU115	330	341	223	318	259	167	273.1	258	269	232	316	246	196	252.9
14	RFU116	219	317	214	164	277		238.2	227	246	245	163	267		229.5
15	RFU117	186	331	137	111	262		205.3	121	264	134	113	249		176.2
16	RFU118	309	291	161	202	248		242.2	252	236	205	202	241		227.3
	Grand Mean	227.6	314.2	198.9	186.8	253.9	172.7	227.4	204.7	246.3	186.4	186.4	246.7	123.1	201.6
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	28.6**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	45.2**													

Table 6.2.15 Screening for elite rice culture for drought tolerance on grain number per panicle at maturity at different centres during *Kharif 2025*.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRRI	FZB	RPR	RAN	REWA	TTB		CRRI	FZB	RPR	RAN	REWA	TTB	
1	RFU101	258	128	213	171	104	126	167	179	95	240	178	93	85	145
2	RFU102	82	120	123	154	102	144	121	76	89	152	159	85	85	108
3	RFU103	168	135	117	133	100	147	133	156	102	155	142	88	91	122
4	RFU104	136	122	129	192	124	158	144	123	90	82	198	113	93	117
5	RFU106	164	130	166	142	143	120	144	151	98	133	152	135	108	130
6	RFU107	249	138	222	27	114	164	152	199	105	309	31	104	73	137
7	RFU108	131	118	130	103	94	163	123	124	85	98	112	82	100	100
8	RFU109	168	132	190	111	101	155	143	131	100	167	118	92	65	112
9	RFU110	185	145	55	133	115	167	133	131	110	150	139	100	118	125
10	RFU111	128	129	168	112	105	174	136	141	100	126	116	95	112	115
11	RFU112	223	121	138	131	92	151	143	196	87	331	135	87	59	149
12	RFU114	168	123	226	127	127	128	150	155	95	166	131	115	95	126
13	RFU115	85	143	117	37	185	185	125	149	108	112	37	177	138	120
14	RFU116	160	131	122	80	127		124	163	98	96	86	118		112
15	RFU117	190	139	147	191	106		155	209	106	120	193	98		145
16	RFU118	110	119	209	52	112		120	110	92	265	51	103		124
	Grand Mean	163	130	154	118	116	152	138	150	98	169	124	105	94	124
	LSD (Treat)								LSD (Treat x Variety)						
	LSD (Location x Treat)								LSD (Location x Treat x Variety)						
	LSD (Variety)								CV (%) Treat						
	LSD (Location x Variety)														

Table 6.2.16 Screening for elite rice culture for drought tolerance on spikelet number per panicle at maturity at different centres during *Kharif* 2025.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean	
		CRR1	FZB	RPR	RAN	REWA	TTB		CRR1	FZB	RPR	RAN	REWA	TTB		
1	RFU101	286.9	152.0	240.0	329.7	137.1	166.0	219	222.1	130.0	305.0	338.3	125.7	83.3	201	
2	RFU102	99.9	145.0	144.0	181.7	140.3	172.7	147	144.9	123.3	207.3	184.3	129.7	77.3	144	
3	RFU103	185.3	160.0	149.7	228.3	131.3	158.3	169	207.1	138.0	180.3	236.0	119.3	94.0	162	
4	RFU104	150.1	148.0	150.0	234.7	150.3	165.7	166	143.1	125.0	90.0	242.3	138.0	81.3	137	
5	RFU106	229.7	155.3	207.7	216.7	175.8	131.7	186	214.5	135.0	191.7	231.7	165.0	100.3	173	
6	RFU107	320.7	162.0	379.0	158.0	145.5	210.7	229	262.9	140.0	357.7	165.3	133.0	70.7	188	
7	RFU108	167.3	142.0	156.0	176.0	129.3	214.0	164	150.5	120.0	112.7	185.7	113.3	82.3	127	
8	RFU109	223.4	158.0	224.0	210.0	134.4	202.7	192	190.2	137.0	193.7	215.3	120.3	69.7	154	
9	RFU110	206.6	170.0	142.0	237.3	131.9	186.3	179	203.1	148.0	177.7	240.3	120.7	98.7	165	
10	RFU111	146.1	152.7	193.0	146.0	130.3	190.7	160	177.5	136.0	142.3	147.3	122.3	101.7	138	
11	RFU112	249.5	145.7	178.0	315.3	123.3	174.3	198	251.7	120.7	384.0	317.3	110.0	68.0	209	
12	RFU114	188.7	148.7	278.3	215.3	174.7	154.7	193	212.1	130.0	209.0	220.0	151.0	103.0	171	
13	RFU115	121.3	168.7	148.3	177.0	233.8	195.3	174	187.8	144.3	134.3	173.0	221.7	118.0	163	
14	RFU116	190.0	155.7	156.0	132.7	154.5		158	202.3	135.0	132.7	141.0	144.0		151	
15	RFU117	222.7	162.7	183.3	320.3	142.5		206	302.0	142.0	148.0	322.0	131.3		209	
16	RFU118	115.2	142.7	254.3	94.0	144.8		150	136.4	127.7	350.7	90.7	125.3		166	
	Mean	194	154	199	211	149	179	181	201	133	207	216	136	88	166	
	LSD (Treat)	9.5*							LSD (Treat x Variety)							
	LSD (Location x Treat)	22.1**							LSD (Location x Treat x Variety)							
	LSD (Variety)	14.3**							CV (%) Treat							
	LSD (Location x Variety)	34.1**														

Table 6.2.17. Screening for elite rice culture for drought tolerance on grain number per m² at maturity at different centres during *Kharif 2025*.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRRI	FZB	RPR	RAN	REWA	TTB		CRRI	FZB	RPR	RAN	REWA	TTB	
1	RFU101	48136	45772	44171	39915	38876	41521	43065	30900	26281	26043	22979	23815	34703	27454
2	RFU102	23431	26940	31040	35485	31898	27070	29311	19406	20762	22040	20421	21073	21214	20819
3	RFU103	31435	35152	41193	44080	37403	31085	36725	28237	28913	29255	26167	29220	26016	27968
4	RFU104	30739	35139	32686	36826	32590	27103	32514	24398	23394	23879	20871	20631	17888	21844
5	RFU106	31640	35678	38823	41042	36730	32858	36129	26453	26290	27458	24161	19654	16013	23338
6	RFU107	45034	45527	47069	45683	50687	52955	47826	30410	29264	27435	27496	33648	41033	31548
7	RFU108	25790	29990	32606	34343	32853	30890	31078	23012	21241	21179	18862	18029	17024	19891
8	RFU109	24832	29223	37438	42377	36697	34668	34206	20081	23487	25073	25187	26101	28813	24790
9	RFU110	50157	51345	53896	50130	37447	24550	44587	31911	31294	31587	30419	26525	32389	30688
10	RFU111	35354	39897	39339	40059	41215	41556	39570	45204	36461	35184	25283	27221	27596	32825
11	RFU112	41736	37446	35577	35758	31357	25972	34641	31545	28181	24809	19304	32528	45304	30278
12	RFU114	42111	40031	37213	36964	40814	48405	40923	29168	26176	25533	22900	27841	31724	27224
13	RFU115	28119	34804	42447	48925	42049	33587	38322	38319	31884	28443	28999	26393	27584	30270
14	RFU116	34596	38246	38092	41422	36332	30721	36568	36927	33506	30494	24191	24109	22050	28546
15	RFU117	35542	41053	40164	45945	37615	28672	38165	25081	27053	28194	28083	24387	19418	25369
16	RFU118	33919	33407	33869	34572	35723	35464	34492	27780	22698	23936	22025	36292	40878	28935
	Grand Mean	35161	37478	39102	40845	37518	34192	37383	29302	27305	26909		26092	28103	26987
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	3400**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	5200**													

Table 6.2.18. Screening for elite rice culture for drought tolerance on spikelet number per m² at maturity different centres during *Kharif 2025*.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRR1	FZB	RPR	RAN	REWA	TTB		CRR1	FZB	RPR	RAN	REWA	TTB	
1	RFU101	53590	47277	48480	55816	37329	29331	45304	38472	31335	52155	56613	34223	8845	36940
2	RFU102	28555	42877	27936	37073	30525	33611	33429	35698	28185	30893	37477	28408	8870	28255
3	RFU103	34823	52112	31580	38900	30064	26601	35680	37322	35287	28312	40438	27339	10881	29930
4	RFU104	33809	44553	27150	52342	36966	28942	37294	28724	28880	18540	53960	33949	10139	29032
5	RFU106	43989	49040	36134	43411	47914	18739	39871	37421	33170	17633	46799	44972	14207	32367
6	RFU107	57980	53627	83759	23857	35913	38830	48994	40054	36545	58657	24920	32822	6388	33231
7	RFU108	32900	41327	37128	38198	35046	38803	37234	28051	26525	20280	40292	30662	10761	26095
8	RFU109	33204	50723	37632	30104	31514	35606	36464	29237	34392	37571	31298	28222	5580	27717
9	RFU110	56143	58769	32092	47088	31638	34346	43346	49303	40804	37488	47757	28958	15293	36600
10	RFU111	40488	47531	51724	31824	28197	36674	39406	57181	34367	35726	31484	26478	15318	33425
11	RFU112	46755	43166	26878	36793	28311	28653	35093	40680	26875	67968	36495	25273	4675	33661
12	RFU114	47512	44865	59563	39265	46798	21606	43268	39966	31300	44726	39965	40454	12934	34891
13	RFU115	39971	57572	33078	56275	57608	32685	46198	48321	38875	31165	54613	54619	23163	41793
14	RFU116	41313	49347	33384	21716	41331		37418	46009	33210	32503	22933	38528		34637
15	RFU117	41635	53897	25117	35560	35457		38333	36651	37504	19832	36258	32674		32584
16	RFU118	35552	41564	40948	18960	34947		34394	34622	30375	71887	18311	30265		37092
	Grand Mean	41764	48640	39536	37949	36847	31110	39483	39232	32977	37834	38726	33615	11312	33016
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	3800**							LSD (Location x Treat x Variety)						
	LSD (Variety)	2450*							CV (%) Treat						
	LSD (Location x Variety)	5800**													

Table 6.2.19 screening for elite rice culture for drought tolerance on grain yield (g/m²) different centres during Kharif 2025.

Sr. No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRRI	FZB	RPR	RAN	REWA	TTB		CRRI	FZB	RPR	RAN	REWA	TTB	
1	RFU101	436.8	946.7	427.0	365.0	322.4	439.0	489	219.7	623.3	387.0	369.7	285.2	207.7	349
2	RFU102	302.2	821.7	534.0	463.3	314.4	468.3	484	338.8	558.3	311.0	478.7	261.3	209.7	360
3	RFU103	426.6	1075.0	705.0	380.0	379.9	424.0	565	454.0	703.3	363.0	389.0	275.7	264.0	408
4	RFU104	371.8	866.7	380.0	456.7	256.3	449.7	464	329.5	561.7	521.0	457.0	355.0	274.7	416
5	RFU106	321.2	981.7	324.0	448.3	519.3	421.0	503	257.7	661.7	325.0	449.0	461.3	306.0	410
6	RFU107	489.2	1105.0	236.0	43.3	421.3	559.3	476	252.4	753.3	253.0	49.0	364.7	185.0	310
7	RFU108	302.5	796.7	661.0	438.3	346.8	570.7	519	336.7	521.7	371.0	438.7	256.7	296.3	370
8	RFU109	364.3	1025.0	397.0	346.0	402.3	509.7	507	399.9	693.3	460.0	353.0	320.2	137.3	394
9	RFU110	409.1	1235.0	356.0	280.0	337.0	482.0	517	316.7	863.3	431.0	287.7	266.9	316.3	414
10	RFU111	288.7	951.7	383.0	346.7	315.9	497.3	464	325.1	700.0	374.0	343.0	260.8	303.3	384
11	RFU112	302.9	826.7	151.0	310.0	213.4	472.7	379	410.4	530.0	396.0	318.0	316.2	145.7	353
12	RFU114	457.8	871.7	293.0	206.7	590.6	505.3	488	220.7	623.3	290.0	185.0	520.0	220.3	343
13	RFU115	294.9	1211.7	198.0	671.0	519.5	523.0	570	246.4	815.0	529.0	643.3	503.1	454.0	532
14	RFU116	300.1	990.0	301.0	146.7	374.1		422	330.6	666.7	345.0	157.0	389.9		378
15	RFU117	346.3	1111.7	213.0	75.0	355.3		420	249.8	781.7	292.0	80.3	286.7		338
16	RFU118	447.1	801.7	342.0	390.0	398.5		476	402.5	615.0	526.0	435.0	353.2		466
	Grand Mean	366	976	369	335	379	486	484	318	667	386	340	342	255	389
	LSD (Treat)	28.4*							LSD (Treat x Variety)						
	LSD (Location x Treat)	67.2**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	99.8**													

Table 6.2.20. Screening for elite rice culture for drought tolerance on 1000-grain weight at different centres during Kharif 2025.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRRI	FZB	RPR	RAN	REWA	TTB		CRRI	FZB	RPR	RAN	REWA	TTB	
1	RFU101	12.2	23.8	15.1	12.6	12.1	16.6	15.4	14.8	22.1	14.2	12.4	11.5	8.4	13.9
2	RFU102	20.9	23.2	26.0	14.7	19.6	18.3	20.4	26.9	21.6	28.0	14.8	18.7	8.8	19.8
3	RFU103	21.8	24.5	22.8	16.8	12.9	14.6	18.9	22.1	22.8	22.9	16.0	11.8	9.4	17.5
4	RFU104	19.7	23.6	21.7	10.7	13.8	15.6	17.5	28.6	21.9	21.8	10.3	12.6	10.1	17.6
5	RFU106	16.2	24.0	19.2	15.7	12.9	10.5	16.4	16.7	22.4	19.7	14.6	11.9	12.1	16.2
6	RFU107	14.7	24.6	21.0	10.6	15.3	21.6	18.0	14.0	23.0	17.1	10.5	14.2	7.3	14.4
7	RFU108	19.4	23.1	27.8	19.7	12.6	24.4	21.2	25.7	21.3	27.4	18.1	11.4	9.2	18.8
8	RFU109	22.3	24.3	29.1	21.8	16.2	21.2	22.5	29.6	22.6	29.5	20.7	14.4	8.1	20.8
9	RFU110	14.8	25.2	15.6	10.6	14.0	18.7	16.5	17.7	23.8	17.0	10.4	12.8	14.2	16.0
10	RFU111	14.5	23.9	16.2	14.2	13.3	18.5	16.8	16.9	22.7	16.2	13.8	12.2	13.1	15.8
11	RFU112	21.3	23.3	21.7	20.3	16.7	17.1	20.1	18.5	21.4	18.8	20.5	15.5	8.3	17.2
12	RFU114	15.4	23.7	15.9	9.0	19.4	19.3	17.1	16.3	22.3	16.6	7.8	20.0	11.1	15.7
13	RFU115	19.5	25.1	25.4	58.4	12.5	22.4	27.2	434.5	23.5	24.2	54.6	11.4	16.2	94.1
14	RFU116	18.4	24.1	24.8	11.2	12.7		18.2	18.7	22.4	24.3	11.3	11.5		17.6
15	RFU117	17.2	24.7	20.6	3.5	13.4		15.9	15.6	23.2	22.6	3.7	12.2		15.5
16	RFU118	23.1	23.2	20.7	37.0	16.5		24.1	22.5	22.0	18.5	42.6	15.4		24.2
	Grand Mean	18.2	24.0	21.5	17.9	14.6	18.4	19.1	46.2	22.4	21.2	17.6	13.6	10.5	22.2
	LSD (Treat)								LSD (Treat x Variety)						
	LSD (Location x Treat)								ns						
	LSD (Variety)								LSD (Location x Treat x Variety)						
	LSD (Location x Variety)								CV (%) Treat						
									6.3**						
									5.6						

Table 6.2.21. Screening for elite rice culture for drought tolerance on harvest index (%) at different centres during Kharif 2025.

Sr.No	Entry	Control						Grand Mean	TREATED						Grand Mean
		CRR1	FZB	RPR	RAN	REWA	TTB		CRR1	FZB	RPR	RAN	REWA	TTB	
1	RFU101	0.48	44.05	34.37	13.70	44.61	38.16	29.23	0.26	37.69	34.67	13.48	38.99	32.07	26.19
2	RFU102	0.38	41.44	43.91	24.51	31.07	38.36	29.94	0.39	36.30	36.24	25.79	31.77	30.90	26.90
3	RFU103	0.40	47.15	38.27	11.55	41.60	37.85	29.47	0.35	39.51	26.43	11.73	35.52	38.37	25.32
4	RFU104	0.40	42.20	37.32	20.45	39.16	40.38	29.99	0.28	36.24	36.07	21.10	40.62	36.82	28.52
5	RFU106	0.34	44.95	25.01	21.38	46.14	43.79	30.27	0.29	38.84	19.90	20.75	46.09	41.13	27.83
6	RFU107	0.36	47.64	13.96	1.01	42.56	48.20	25.62	0.23	40.65	18.46	1.13	39.04	33.36	22.15
7	RFU108	0.40	41.44	37.72	20.89	34.54	49.07	30.68	0.26	35.25	29.93	20.39	32.99	45.27	27.35
8	RFU109	0.28	45.69	27.74	13.48	38.56	44.22	28.33	0.33	39.61	26.19	13.40	37.61	29.28	24.41
9	RFU110	0.37	49.73	26.59	7.96	36.87	40.21	26.96	0.33	43.10	30.73	8.02	32.35	40.46	25.83
10	RFU111	0.42	43.98	31.49	10.42	34.36	41.53	27.03	0.35	39.39	33.27	14.55	31.49	38.35	26.23
11	RFU112	0.29	41.60	13.46	12.01	39.78	42.11	24.88	0.36	35.63	20.93	12.42	39.03	36.24	24.10
12	RFU114	0.41	42.40	26.39	5.27	49.21	53.49	29.53	0.24	37.58	27.66	4.55	46.27	37.43	25.62
13	RFU115	0.36	49.26	16.71	32.49	50.19	46.15	32.53	0.30	42.02	42.24	30.54	48.36	46.93	35.07
14	RFU116	0.34	45.18	28.88	4.57	43.56		24.51	0.29	39.04	26.97	4.74	40.38		22.28
15	RFU117	0.28	47.74	19.83	2.74	35.64		21.25	0.23	41.25	23.35	2.88	33.34		20.21
16	RFU118	0.40	41.54	28.83	23.94	45.42		28.02	0.39	37.38	24.04	26.08	40.23		25.62
	Grand Mean	0.37	44.75	28.15	14.15	40.83	43.35	28.01	0.31	38.72	28.57	14.47	38.38	37.43	25.85
	LSD (Treat)				ns				LSD (Treat x Variety)						
	LSD (Location x Treat)				0.075*				LSD (Location x Treat x Variety)						
	LSD (Variety)				ns				CV (%) Treat						
	LSD (Location x Variety)				0.114*										

Table 6.2.22. Drought Tolerance Indices Table (based on grain yield g/m² from Table 6.2.14)The table below summarises key drought tolerance indices calculated from grand mean grain yield under control (Y_p, non-stress) and treated/drought (Y_s, stress) conditions across locations. Indices follow standard formulas:

Genotype	Y _p (Control)	Y _s (Treated)	SSI	TOL	MP	GMP	STI	YI
RFU101	489	349	1.460	140	419.0	413.1	0.729	0.897
RFU102	484	360	1.307	124	422.0	417.4	0.744	0.925
RFU103	565	408	1.417	157	486.5	480.1	0.984	1.049
RFU104	464	416	0.528	48	440.0	439.3	0.824	1.069
RFU106	503	410	0.943	93	456.5	454.1	0.881	1.054
RFU107	476	310	1.779	166	393.0	384.1	0.630	0.797
RFU108	519	370	1.464	149	444.5	438.2	0.820	0.951
RFU109	507	394	1.137	113	450.5	446.9	0.853	1.013
RFU110	517	414	1.016	103	465.5	462.6	0.914	1.064
RFU111	464	384	0.879	80	424.0	422.1	0.761	0.987
RFU112	379	353	0.350	26	366.0	365.8	0.571	0.907
RFU114	488	343	1.516	145	415.5	409.1	0.715	0.882
RFU115	570	532	0.340	38	551.0	550.7	1.295	1.367
RFU116	422	378	0.532	44	400.0	399.4	0.681	0.972
RFU117	420	338	0.996	82	379.0	376.8	0.606	0.869
RFU118	476	466	0.107	10	471.0	471.0	0.947	1.198

Mean Y_p = 483.94 g/m²; Mean Y_s = 389.06 g/m² (calculated across all 16 genotypes using provided grand means).Ranking of Rice Genotypes for Drought Tolerance Indices (Kharif 2025) SSI-Stress Susceptibility Index, TOL-Tolerance Index, MP-Mean Productivity, GMP-Geometric Mean Productivity, STI-Stress Tolerance Index and YI-Yield Index.

Table 6.2.23. Ranked primarily by STI (higher = better overall tolerance and productivity under drought). GMP ranking is identical in top positions.

Rank (STI)	Genotype	STI	GMP	Ys (Treated)	SSI	Key Remark
1	RFU115	1.295	550.7	532	0.340	Best overall
2	RFU103	0.984	480.1	408	1.417	High productivity
3	RFU118	0.947	471.0	466	0.107	Excellent stability
4	RFU110	0.914	462.6	414	1.016	Strong performer
5	RFU106	0.881	454.1	410	0.943	Good tolerance
6	RFU109	0.853	446.9	394	1.137	Balanced
7	RFU104	0.824	439.3	416	0.528	Low susceptibility
8	RFU108	0.820	438.2	370	1.464	Moderate
9	RFU111	0.761	422.1	384	0.879	Stable
10	RFU102	0.744	417.4	360	1.307	Average
11	RFU101	0.729	413.1	349	1.460	Average
12	RFU114	0.715	409.1	343	1.516	Average
13	RFU116	0.681	399.4	378	0.532	Low susceptibility
14	RFU107	0.630	384.1	310	1.779	Poor under stress
15	RFU117	0.606	376.8	338	0.996	Poor
16	RFU112	0.571	365.8	353	0.350	Worst overall

Table 6.2.24. Correlation Matrix of Drought Tolerance Indices Parameters

Parameter	SSI	TOL	MP	GMP	STI	YI
SSI	1.000	0.988	-0.221	-0.277	-0.297	-0.646
TOL	0.988	1.000	-0.097	-0.155	-0.178	-0.547
MP	-0.221	-0.097	1.000	0.998	0.995	0.886
GMP	-0.277	-0.155	0.998	1.000	0.997	0.911
STI	-0.297	-0.178	0.995	0.997	1.000	0.919
YI	-0.646	-0.547	0.886	0.911	0.919	1.000

6.3 Evaluation of rice genotypes for heat tolerance suitable for future climate

Locations: MTU, PNR, PTB, REWA, TTB & KAUL

Global warming has resulted in increase in atmospheric temperature. This has resulted in increasing events of the high temperatures stress to crops at various growth stages. Rice in particular is vulnerable to high temperatures stress at various stages especially at flowering stage. Therefore, high temperatures stress results in the serious adverse effects on rice production. Thus, understanding morpho-physiological parameters/mechanisms involved in mitigation/tolerance of high temperatures stress in rice is the way forward. The objectives of this trial is to phenotype rice cultivars for high temperature tolerance and to understand the impact of high temperature stress on rice. Therefore, a trial was conducted in 6 AICRIP centres with 15 entries from IVT-E-TP breeding trial. Heat stress was imposed by enclosing the field grown crop with transparent polyethylene sheet supported by metal or bamboo frame. Enclosing the field crop during reproductive phase with polythene sheet had resulted in significant increase in temperature. The temperature inside the polythene tunnel was recorded until the crop was harvested. 15 rice genotypes (HT-101 to HT-118) evaluated under control and heat-stress conditions across six AICRIP centres (Rewa, MTU, PNR, PTB, Kaul, and TTB) during the Kharif 2025 season. The experiment followed a split-plot RCBD design with treatments (Control and Heat) as the whole-plot factor and genotypes as the subplot factor.

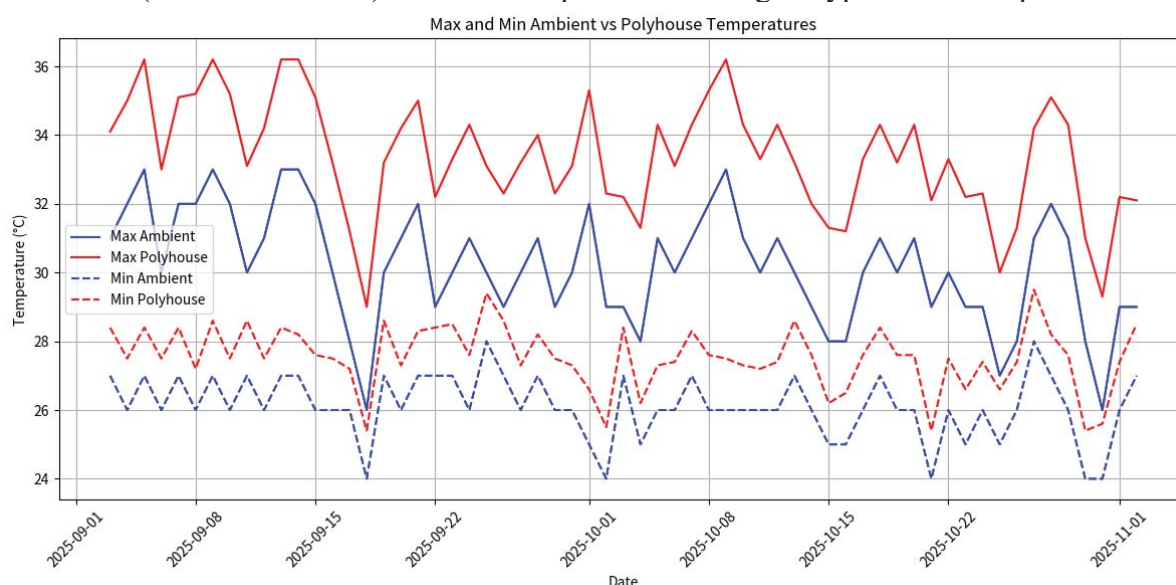


Fig 6.3.1. Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside of the polythene tunnel at RARS Maruteru during Kharif 2025.

Maximum temperatures in the polyhouse were consistently 2–4°C higher than ambient, with peaks reaching 36.2°C (vs 33°C ambient). Minimum temperatures showed a smaller but steady elevation inside the polyhouse. This temperature regime (elevated day and night temperatures) is ideal for studying heat stress effects on rice, as it mimics realistic field heat-stress conditions during the Kharif season. No extreme outliers were observed; the data show stable, controlled elevation inside the polyhouse throughout the experimental period. This weather dataset confirms that the polyhouse successfully imposed moderate to high heat stress, providing reliable environmental conditions for the multi-location heat-tolerance trial. The graph visually demonstrates the consistent temperature differential between ambient and polyhouse environments.

Mean Max Temperature: Ambient = 30.2°C, Polyhouse = 33.4°C (polyhouse +3.2°C higher on average). Mean Min Temperature: Ambient = 26.1°C, Polyhouse = 27.6°C (polyhouse +1.4°C higher on average). Overall Range: Ambient: Max 33°C, Min 24°C, Polyhouse: Max 36.2°C, Min 25.4°C. The polyhouse consistently maintained elevated temperatures, creating a realistic heat-stress environment (daily max difference often 3–4°C).

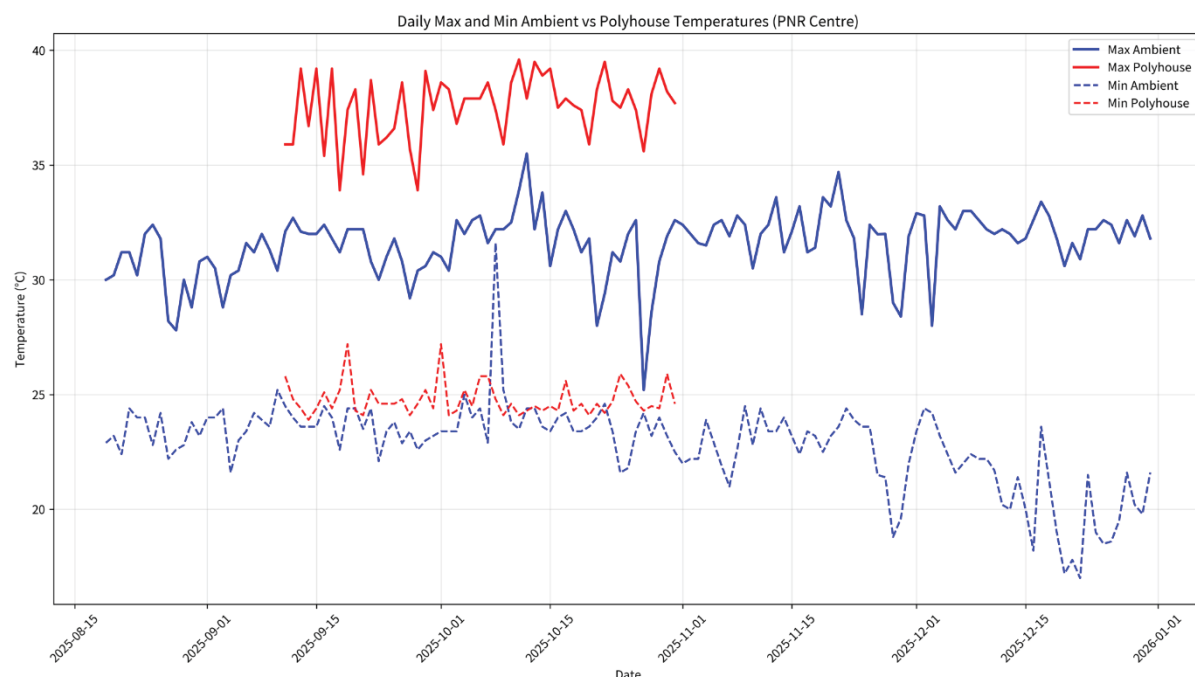


Fig 6.3.2. Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside of the polythene tunnel at Pantnagar during Kharif 2025.

Ambient temperature data is available for the entire period, while polyhouse (heat-stress enclosure) temperature data is available only for the last 73 days (starting from serial date 45899). Key Summary Statistics: Ambient Max Temperature: Mean = 29.9°C (range 12.8–39.6°C), Ambient Min Temperature: Mean = 20.0°C (range 5.5–30.9°C), Polyhouse Max Temperature: Mean = 43.1°C (range 32–49°C) and Polyhouse Min Temperature: Mean = 18.9°C (range 10–24°C) Fig 6.3.2.

The polyhouse maintained substantially higher temperatures than ambient conditions, with an average increase of ~13.2°C in daily maximum temperature during the overlapping period. The polyhouse lines are clearly and consistently elevated above the ambient lines, especially for maximum temperatures, confirming effective imposition of heat stress. The weather data from PNR centre shows that the polyhouse successfully created a strong heat-stress environment with maximum temperatures frequently reaching 43–49°C. This setup is suitable for evaluating heat tolerance in rice genotypes. The consistent temperature differential validates the experimental conditions for the heat tolerance trial.

Both ambient and polyhouse temperature data is available for the entire period (Fig 6.3.3). The important Summary Statistics: ambient Max Temperature: Mean = 30.75°C (range 24.2–35.8°C), ambient Min Temperature: Mean = 19.66°C (range 5.2–29.7°C), Polyhouse Max Temperature: Mean = 34.48°C (range 27.2–40.8°C) and Polyhouse Min Temperature: Mean = 21.33°C (range 5.8–32.5°C).

The polyhouse successfully imposed moderate heat stress, with maximum temperatures frequently reaching 35–40.8°C. Minimum temperatures inside the polyhouse were also

consistently higher than ambient. The polyhouse consistently maintained elevated temperatures, with an average increase of $\sim 3.7^{\circ}\text{C}$ in daily maximum temperature and $\sim 1.7^{\circ}\text{C}$ in daily minimum temperature. The graph shows clear daily trends and a sustained temperature differential throughout the experimental period, validating the heat-stress conditions for the rice trial at REWA centre. This weather dataset confirms that the polyhouse created realistic heat-stress conditions suitable for evaluating heat tolerance in rice genotypes. The consistent elevation in both maximum and minimum temperatures provides reliable environmental data for the multi-location trial.

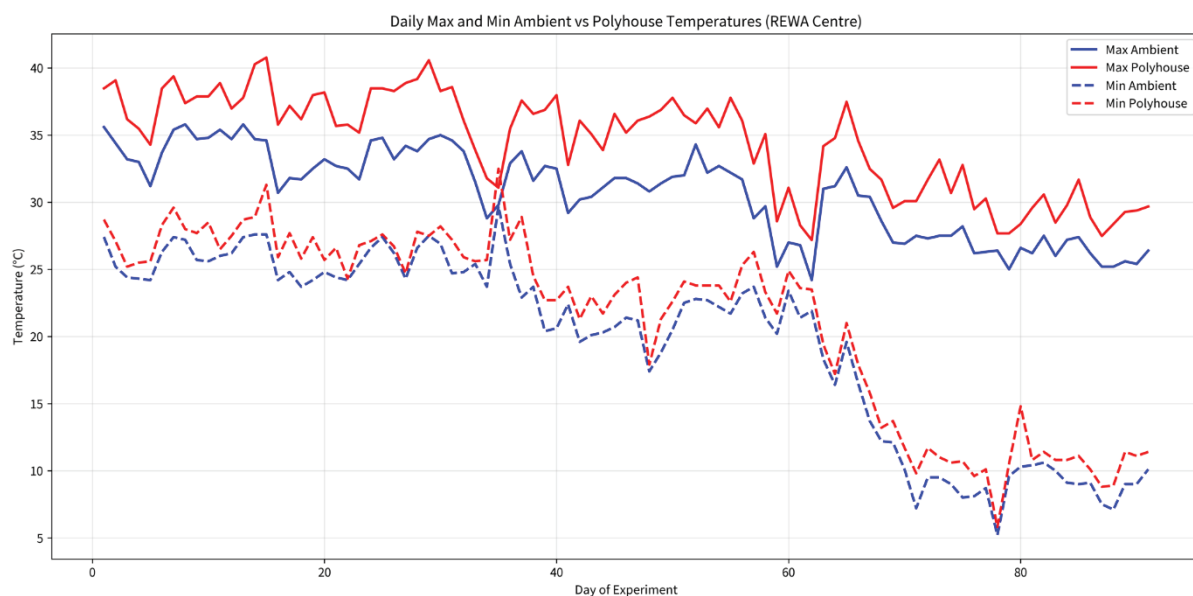


Fig 6.3.3. Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside of the polythene tunnel at Rewa during Kharif 2025.

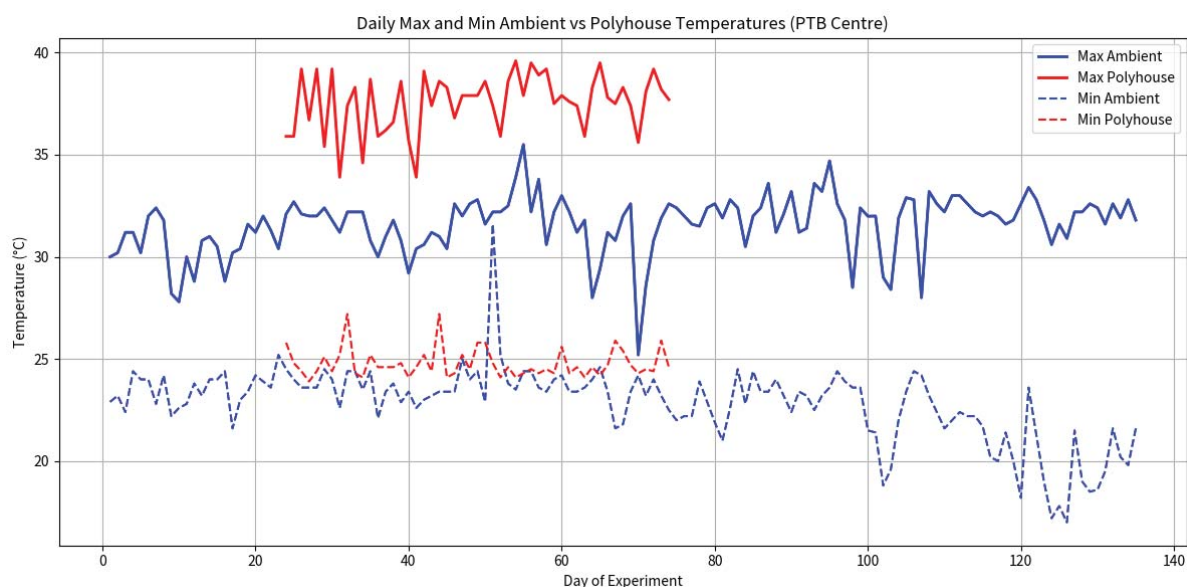


Fig 6.3.4. Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside of the polythene tunnel at Pattambi during Kharif 2025.

Out of total 136 days, ambient temperature data is available for the entire period, while polyhouse (heat-stress enclosure) temperature data is available only for the last 51 days (Fig 6.3.4). Key Summary Statistics: Ambient Max Temperature: Mean = 31.58°C (range 25.2–35.5°C), Ambient Min Temperature: Mean = 22.81°C (range 17.0–31.6°C), Polyhouse Max Temperature: Mean = 37.54°C (range 33.9–39.6°C) and Polyhouse Min Temperature: Mean = 24.78°C (range 23.9–27.2°C). The polyhouse successfully imposed a clear heat-stress environment, with daily maximum temperatures frequently reaching 37–39.6°C. Minimum temperatures inside the polyhouse were also elevated by ~2°C on average. The consistent temperature differential (especially in maximums) confirms that the polyhouse provided realistic and effective heat-stress conditions for the rice trial at PTB centre. The polyhouse consistently maintained ~6°C higher maximum temperatures than ambient conditions during the overlapping period. This weather dataset validates the experimental setup for evaluating heat tolerance in rice genotypes. The graph clearly illustrates the daily trends and the sustained elevation inside the polyhouse throughout the stress period.

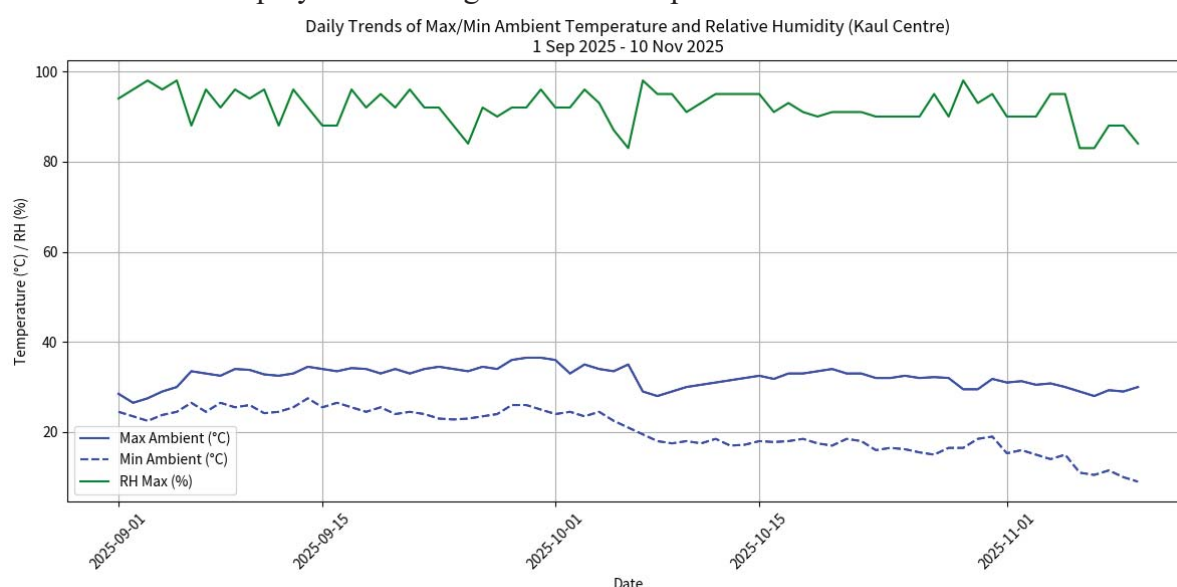


Fig 6.3.5. Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside of the polythene tunnel at Kaul during Kharif 2025.

The period from 1 September 2025 to 10 November 2025 (71 days) covers the main crop growth and reproductive stages of the rice trial (Fig 6.3.5). Key Summary Statistics (1 Sep – 10 Nov 2025) are -Maximum Ambient Temperature: Mean $\approx$ 31.2°C (range 26.5–35.5°C), Minimum Ambient Temperature: Mean $\approx$ 23.8°C (range 17.0–31.6°C) and Maximum Relative Humidity: Mean $\approx$ 91% (range 83–98%). Ambient maximum temperatures remained moderate to high (mostly 29–35°C), typical for the Kharif season at Kaul. Minimum temperatures showed a gradual cooling trend towards November (dropping to 17–20°C in late October–early November). Relative humidity was consistently very high (often >90%), creating humid conditions that can exacerbate heat stress effects on rice. The plot clearly shows the daily fluctuations and the overall seasonal cooling pattern during the highlighted period. This weather profile indicates warm, humid conditions during the critical flowering and grain-filling stages, which is ideal for evaluating heat tolerance in the rice genotypes. The sustained high humidity combined with daytime temperatures above 30°C likely contributed to the heat stress imposed in the trial.

Table 6.3.2: shows the Influence of Heat Stress on Days to 50% flowering at different AICRIP Centres during Kharif 2025. Heat stress significantly reduced DFF across all genotypes and locations (grand mean: Control = 99.9 days; Heat = 97.6 days; reduction of 2.3 days). The treatment effect was statistically significant (LSD for Treat = 2.39*, $p < 0.05$), indicating that elevated temperature accelerated flowering by a modest but consistent margin. The coefficient of variation for the treatment (CV = 3.33%) reflects good experimental precision. Genotypes did not differ significantly in overall DFF as the varieties did not differ significantly (LSD for Variety = ns), and the Treatment $\times$ Variety interaction was also non-significant (LSD for Treat $\times$ Variety interaction = ns). This suggests that the genotypes responded similarly to heat stress in terms of flowering time acceleration. However, grand-mean comparisons reveal clear numerical trends: Best-performing genotypes (earliest flowering under heat stress). Genotype HT-101 and HT-102 were the two earliest genotypes under heat stress, both recording a grand mean of 90.8 days. These lines maintained the shortest DFF across most centres and showed the least delay relative to control conditions, indicating superior earliness and heat responsiveness. On the other hand, genotypes flowering latest under heat stress such as HT-111 (grand mean = 104.1 days) and HT-118 (grand mean = 104.4 days). These entries consistently flowered later than the population mean, even under elevated temperature.

In terms of location specific responses, a significant Location $\times$ Treatment interaction (LSD for Location $\times$ Treat = 5.85*, $p < 0.05$) and a highly significant interaction between Location $\times$ Treatment $\times$ Variety (LSD for Location $\times$ Treat $\times$ Variety = 3.80, $p < 0.05$) highlight strong centre-specific responses to heat stress. Among centers, PTB showed the most contrasting behaviour: DFF under heat dropped sharply to 86.6 days (vs. 99.3 days in control), indicating pronounced acceleration of flowering under heat. Kaul and TTB were relatively stable, with minimal change between control (104.1–105.3 days) and heat (104.1–104.6 days). Rewa and MTU exhibited moderate responses, with heat stress causing slight acceleration or little change. The Location $\times$ Variety interaction was also significant (LSD for Location $\times$ Variety = 2.69), confirming that specific genotype–centre combinations performed differently. Heat stress accelerated days to 50% flowering by approximately 2.3 days across the tested genotypes and centres. Genotypes HT-101 and HT-102 emerged as the best performers (earliest flowering under heat), while HT-111 and HT-118 were the latest. The strong location-specific effects, particularly at PTB, underscore the importance of multi-location testing for heat-tolerance breeding. These early-flowering genotypes (HT-101 and HT-102) may be valuable donors for developing climate-resilient rice varieties suited to heat-prone environments, whereas late-flowering lines such as HT-111 and HT-118 may require targeted selection to mitigate heat-induced phenological shifts.

Table 6.3.2: shows the Influence of Heat Stress on Days to Maturity at Different AICRIP Centres during Kharif 2025. Heat stress significantly accelerated days to maturity. The grand mean DTM under Control was 131.86 days, which declined to 128.44 days under Heat stress (a reduction of approximately 3.42 days). This reduction was statistically significant as LSD for Treat = 2.31*). The coefficient of variation for Treatment was low (CV = 3.12%), indicating good experimental precision for the main effect. Significant Treatment $\times$ Variety interaction (LSD = 1.53*) and Location $\times$ Treatment interaction (LSD = 5.62*) were observed, suggesting differential genotypic and centre-specific responses to heat stress. The three-way interaction (Location $\times$ Treatment $\times$ Variety) was also significant (LSD = 3.74*), while the Variety main effect was significant (LSD for Variety = 1.08*) and Location $\times$ Variety interaction was significant (LSD = 2.64*).

Genotypes were compared primarily on the basis of their grand mean DTM under Heat stress (lower values indicate earlier maturity, which is generally desirable under heat stress to escape

terminal heat). Significance was judged using the appropriate LSD values. The earliest maturing genotypes under heat stress are HT-106 (Heat grand mean = 120.9 days lowest overall) and HT-102 (Heat grand mean = 121.1 days). These two genotypes matured significantly earlier than the overall Heat grand mean (128.44 days) and showed relatively stable performance across centres, with minimal delay under heat compared to Control. Genotypes HT-118 with grand mean under high temperature treatment is 134.8 days which is highest overall followed closely by HT-111 grand mean = 134.2 days under high temperature treatment. These genotypes exhibited significantly delayed maturity under heat stress, exceeding the grand mean and differing from the best genotypes by more than the LSD for Treat $\times$ Variety threshold. Most other genotypes fell between these extremes, with HT-101 (123.8 days) and HT-114 (125.1 days) showing intermediate performance. The significant Treatment $\times$ Variety interaction indicates that the heat-induced acceleration was not uniform across genotypes. Centre-wise response to heat stress varied markedly: Most accelerated (strongest reduction in DTM under heat): Rewa (121.44 days), MTU (121.38 days), and PTB (121.53 days) showed the earliest maturity under heat stress, indicating strong heat-induced acceleration.

Least accelerated or relatively delayed (contrasting stability or higher DTM): Kaul (136.96 days) and TTB (134.6 days) maintained higher DTM values under heat stress, showing weaker acceleration compared to other centres. PNR (134.76 days) was intermediate but still higher than Rewa/MTU/PTB. These differences were supported by the significant Location $\times$ Treatment interaction (LSD = 5.62*). PTB and Rewa emerged as the most stressful/contrasting centres for earliness under heat, while Kaul represented a more stable or delayed response environment.

Heat stress significantly hastened days to maturity across locations, with an average reduction of ~3.4 days. Genotypes HT-106 and HT-102 were the two best performers (earliest under heat stress), making them promising candidates for heat-tolerant breeding programmes where early maturity helps escape terminal heat. In contrast, HT-118 and HT-111 were the two worst performers (latest under heat stress) and may require further improvement for heat-prone environments. The strong genotype $\times$ environment interactions highlight the need for multi-location testing. Centres such as Rewa, MTU, and PTB imposed the strongest heat pressure on phenology, while Kaul and TTB were relatively milder or contrasting in response. This analysis of Table 6.3.2 provides clear evidence for genotypic selection and centre-specific adaptation strategies in rice under rising temperature scenarios.

Influence of Heat Stress on Plant Height (cm) at Different AICRIP Centres *Kharif* 2025 (Table 6.3.3). Heat stress had no significant overall effect on plant height. The grand mean plant height under Control was 107.5 cm, which remained almost unchanged at 107.8 cm under Heat stress (LSD for Treat = ns). However, the Location $\times$ Treatment interaction was significant (LSD = 7.68*), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 4.15*), and the Variety main effect was significant (LSD for Variety = 1.20*). The Location $\times$ Variety interaction was also significant (LSD = 2.93*). These interactions indicate that genotypic responses and centre-specific effects were modulated by heat stress, even though the average treatment effect was non-significant. The genotype HT-115 has recorded 116.3 cm height which is tallest under heat stress followed closely by HT-103 114.7 cm plant height under stress treatment. These two genotypes maintained significantly taller stature under heat stress compared to the overall Heat grand mean (107.8 cm) and differed from most other entries by more than the LSD for Variety is threshold. They also showed relatively stable performance across centres. Genotypes HT-107 recorded 98.4 cm (lowest overall) followed by HT-102

(100.4 cm) under stress treatment. These genotypes exhibited significantly shorter plant height under heat stress, falling well below the grand mean and differing from the best genotypes by more than the LSD thresholds. Most other genotypes fell in the intermediate range (e.g., HT-101 = 108.6 cm, HT-112 = 114.5 cm). The significant Treatment $\times$ Variety interaction (ns overall but supported by three-way interaction) and Variety main effect confirm differential genotypic responses to heat.

Centre-wise responses under Heat stress varied markedly due to the significant Location $\times$ Treatment interaction. Tallest under heat (least reduction or even slight increase): Rewa (115.2 cm) and MTU (116.2 cm) produced the tallest plants under heat stress. Shortest under heat (strongest reduction): Kaul recorded the lowest plant height under heat stress (86.4 cm), showing a drastic reduction compared to its Control mean. PNR (108.6 cm) and PTB (110.2 cm) were intermediate but still lower than Rewa/MTU. TTB (110 cm) was moderately affected. Kaul emerged as the most contrasting stressful centre for plant height reduction under heat, while Rewa and MTU were relatively favourable or stable environments. Although heat stress did not significantly alter the overall mean plant height, strong genotype $\times$ environment interactions revealed clear differential responses. Genotypes HT-115 and HT-103 were the two best performers (tallest under heat stress), making them promising lines for breeding programmes where maintained plant height under high temperature is desirable. In contrast, HT-107 and HT-102 were the two worst performers (shortest under heat stress). Centres such as Kaul imposed the strongest negative effect on height, while Rewa and MTU were contrasting favourable locations.

Table 6.3.4 shows influence of Heat Stress on Leaf Weight (g/m^2) at Flowering at Different AICRIP Centres *Kharif* 2025. Overall, heat stress substantially reduced leaf weight at flowering. The grand mean under Control was 259.6 g/m^2 , which declined to 189.4 g/m^2 under Heat stress (a reduction of approximately 27%). Although the main effect of Treatment was non-significant (LSD for Treat = ns), the Location $\times$ Treatment interaction was highly significant (LSD = 19.9^*), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 7.52^*), and the Location $\times$ Variety interaction was significant (LSD = 5.32^*). The Variety main effect was non-significant (LSD for Variety = ns). The coefficient of variation for Treatment was low (CV = 4.82%), indicating good experimental precision. These results show that the impact of heat stress on leaf weight was strongly modulated by location and genotype. Genotypes having highest leaf weight under stress treatment are HT-107 (232.4 g/m^2) followed by HT-111 (219.0 g/m^2). These two genotypes maintained significantly superior leaf weight under heat stress compared to the overall Heat grand mean (189.4 g/m^2) and outperformed most entries, differing by more than the LSD for Location $\times$ Treat $\times$ Variety threshold in key centres. Genotypes HT-118 has recorded the lowest leaf weight (134.0 g/m^2) under stress treatment followed by HT-117 (152.2 g/m^2). These genotypes exhibited the most severe reduction in leaf weight under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-103 = 218.8 g/m^2 , HT-102 = 210.5 g/m^2). The significant three-way interaction confirms that genotypic ranking varied across centres under heat stress.

Centre-wise leaf weight under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction. Highest under heat (least reduction / better maintained): Rewa (308.3 g/m^2) and PTB (204.6 g/m^2) recorded the highest leaf weight values under heat stress. Lowest under heat (strongest reduction): MTU (95.7 g/m^2) and TTB (135.8 g/m^2) showed drastic declines compared to their Control values. PNR (194.8 g/m^2) was intermediate. Rewa emerged as the most contrasting favourable/stable centre, while MTU and TTB represented the most stressful environments for leaf biomass accumulation under heat. Heat

stress markedly reduced leaf weight at flowering (from 259.6 to 189.4 g/m²), although the main Treatment effect was non-significant due to strong genotype $\times$ location interactions. Genotypes HT-107 and HT-111 were the two best performers (highest leaf weight under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and maintained vegetative biomass. In contrast, HT-118 and HT-117 were the two worst performers (lowest leaf weight under heat stress) and may require targeted improvement. Centres such as MTU and TTB imposed the strongest negative impact, while Rewa was relatively tolerant.

Table 6.3.5 shows the influence of Heat Stress on Stem Weight (g/m²) at Flowering at Different AICRIP Centres Kharif 2025. Overall, Heat Stress significantly reduced stem weight at flowering. The grand mean under Control was 443.3 g/m², which declined to 367.8 g/m² under Heat stress (a reduction of approximately 17%). This reduction was statistically significant (LSD for Treat = 8.95*). The coefficient of variation for Treatment was low (CV = 5.14%), indicating good experimental precision. The Treatment $\times$ Variety interaction was non-significant (LSD = ns), but the Location $\times$ Treatment interaction was significant (LSD = 21.9*), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 8.87*), the Variety main effect was significant (LSD for Variety = 2.57), and the Location $\times$ Variety interaction was significant (LSD = 6.28*). These results demonstrate that while heat stress caused an overall reduction in stem biomass, the response was strongly modulated by location and genotype. Genotype HT-108 recorded the highest stem weight (536.2 g/m²) under stress treatment followed by HT-103 (437.4 g/m²). These two genotypes maintained significantly superior stem weight under heat stress compared to the overall stress treatment grand mean (367.8 g/m²) and outperformed most entries, differing by more than the LSD thresholds. Genotypes HT-114 showed the lowest stem weight under stress treatment (322.6g/m²) followed by HT-102 326.2 g/m². These genotypes exhibited the most severe reduction in stem weight under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-115 = 421.3 g/m², HT-111 = 398.3 g/m²). The significant three-way interaction confirms that genotypic ranking varied across centres under heat stress.

Centre-wise stem weight under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction. Highest under stress treatment (least reduction / better maintained): PNR (473.2 g/m²) and PTB (489.3 g/m²) recorded the highest stem weight values under stress whereas lowest under stress treatment (strongest reduction): MTU (261.1 g/m²) and TTB (260.5 g/m²) showed drastic declines compared to their Control values. Rewa (354.9 g/m²) was intermediate. PNR and PTB emerged as the most contrasting favourable/stable centres, while MTU and TTB represented the most stressful environments for stem biomass accumulation under stress treatment. Heat stress significantly reduced stem weight at flowering (from 443.3 to 367.8 g/m²), with strong genotype $\times$ location interactions. Genotypes HT-108 and HT-103 were the two best performers (highest stem weight under heat stress), whereas genotypes HT-114 and HT-102 were the two worst performers (lowest stem weight under heat stress) and may require targeted improvement. Centres such as MTU and TTB imposed the strongest negative impact, while PNR and PTB were relatively tolerant.

Influence of Heat Stress on Panicle Weight (g/m²) at Flowering at Different AICRIP Centres Kharif 2025 (Table 6.3.6). Overall, effect of Heat Stress treatment reduced panicle weight at flowering. The grand mean under Control was 220.8 g/m², which declined to 174.7 g/m² under Heat stress (a reduction of approximately 21%). The main effect of Treatment was non-significant (LSD for Treat = ns), and the Treatment $\times$ Variety interaction was also non-

significant (LSD = ns). However, the Location $\times$ Treatment interaction was significant (LSD = 14.1*), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 4.98*), the Variety main effect was non-significant (LSD for Variety = ns), and the Location $\times$ Variety interaction was significant (LSD = 3.52*). The coefficient of variation for Treatment was 6.23%, indicating acceptable experimental precision. These results show that the impact of heat stress on panicle weight was strongly modulated by location and genotype. Genotype HT-103 recorded the highest Panicle Weight (g/m²) at flowering stage (236.0 g/m²) followed by HT-101 (231.6 g/m²). These two genotypes maintained significantly superior panicle weight under heat stress compared to the overall Heat grand mean (174.7 g/m²) and outperformed most entries, differing by more than the LSD for Location $\times$ Treat $\times$ Variety threshold in key centres. Genotype HT-116 showed the least Panicle Weight (120.0 g/m²) followed by HT-104 (139.0 g/m²). These genotypes exhibited the most severe reduction in panicle weight under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-115 = 200.2 g/m², HT-108 = 218.0 g/m²). The significant three-way interaction confirms that genotypic ranking varied across centres under heat stress.

Centre-wise panicle weight under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction. Highest under heat (least reduction / better maintained): PTB (345.1 g/m²) recorded by far the highest panicle weight under heat stress. Lowest under heat (strongest reduction): MTU (27.0 g/m²) showed an extremely drastic decline compared to its Control value. Rewa (141.8 g/m²) and TTB (170.2 g/m²) were intermediate; PNR (150.8 g/m²) was also relatively low. PTB emerged as the most contrasting favourable/stable centre, while MTU represented the most stressful environment for panicle biomass accumulation under heat. Heat stress substantially reduced panicle weight at flowering (from 220.8 to 174.7 g/m²), although the main Treatment effect was non-significant due to strong genotype $\times$ location interactions. Genotypes HT-103 and HT-101 were the two best performers (highest panicle weight under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and maintained reproductive biomass at flowering. In contrast, HT-116 and HT-104 were the two worst performers (lowest panicle weight under heat stress) and may require targeted improvement. Centres such as MTU imposed the strongest negative impact, while PTB was relatively tolerant.

Table 6.3.7 shows the influence of Heat Stress on Total Dry Matter (g/m²) at Flowering at Different AICRIP Centres Kharif 2025. Overall, heat stress substantially reduced total dry matter at flowering. The grand mean under Control was 1008.1 g/m², which declined to 727.7 g/m² under Heat stress (a reduction of approximately 28%). The main effect of Treatment was non-significant (LSD for Treat = ns), and the Treatment $\times$ Variety interaction was also non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 36.0**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 12.5**), the Variety main effect was significant (LSD for Variety = 3.61*), and the Location $\times$ Variety interaction was significant (LSD = 8.82**). The coefficient of variation for Treatment was low (CV = 5.68%), indicating good experimental precision. These results demonstrate that while the overall reduction due to heat stress was not statistically significant as a main effect, location and genotype strongly modulated the response.

Genotypes were compared primarily on the basis of their grand mean total dry matter under Heat stress (higher values indicate better maintenance of biomass accumulation under heat). Significance was judged using the appropriate LSD values, particularly LSD_{Variety} = 3.61* and the interaction LSDs. Best-performing genotypes (highest TDM under heat stress) is HT-108 recorded 1003.2 g/m². followed by HT-118 897.3

g/m². These two genotypes maintained significantly superior total dry matter under heat stress compared to the overall Heat grand mean (727.7 g/m²) and outperformed most entries, differing by more than the LSD for Location×Treat×Variety threshold in key centres. Genotype HT-114 recorded the lowest TDM of 540.5 g/m² under stress treatment followed by HT-117: 580.0 g/m². These genotypes exhibited the most severe reduction in total dry matter under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-103 = 875.1 g/m², HT-115 = 751.6 g/m²). The significant three-way interaction confirms that genotypic ranking varied across centres under heat stress.

Centre-wise TDM under Heat stress showed clear contrasts due to the significant Location × Treatment interaction. Highest under heat (least reduction / better maintained): PTB (965.9 g/m²) and Rewa (805.0 g/m²) recorded the highest total dry matter values under heat stress. Lowest under heat (strongest reduction): MTU (383.8 g/m²) and TTB (566.5 g/m²) showed drastic declines compared to their Control values. PNR (818.9 g/m²) was intermediate. PTB emerged as the most contrasting favourable/stable centre, while MTU represented the most stressful environment for biomass accumulation under heat. Heat stress markedly reduced total dry matter at flowering (from 1008.1 to 727.7 g/m²), although the main Treatment effect was non-significant due to strong genotype × location interactions. Genotypes HT-108 and HT-118 were the two best performers (highest TDM under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained vegetative growth. In contrast, HT-114 and HT-117 were the two worst performers (lowest TDM under heat stress) and may require targeted improvement. Centres such as MTU and TTB imposed the strongest negative impact, while PTB was relatively tolerant.

Table 6.3.7 shows the influence of Heat Stress on Total Dry Matter (g/m²) at Flowering at Different AICRIP Centres during Kharif 2025. Overall Effect of Heat Stress substantially reduced total dry matter at flowering. The grand mean under Control was 1008.1 g/m², which declined to 727.7 g/m² under stress treatment (a reduction of approximately 28%). The main effect of Treatment was non-significant (LSD for Treat = ns), and the Treatment × Variety interaction was also non-significant (LSD = ns). However, the Location × Treatment interaction was highly significant (LSD = 36.0**), the Location × Treatment × Variety three-way interaction was significant (LSD = 12.5**), the Variety main effect was significant (LSD for Variety = 3.61*), and the Location × Variety interaction was significant (LSD = 8.82**). The coefficient of variation for Treatment was low (CV = 5.68%), indicating good experimental precision. These results demonstrate that while the overall reduction due to heat stress was not statistically significant as a main effect, location and genotype strongly modulated the response. Genotypes were compared primarily on the basis of their grand mean total dry matter under Heat stress (higher values indicate better maintenance of biomass accumulation under heat). Significance was judged using the appropriate LSD values, particularly LSD for Variety = 3.61* and the interaction LSDs. Best-performing genotypes (highest TDM under heat stress is HT-108 with grand mean = 1003.2 g/m² (highest overall) followed by HT-118: Heat grand mean = 897.3 g/m². These two genotypes maintained significantly superior total dry matter under heat stress compared to the overall treatment grand mean (727.7 g/m²) and outperformed most entries, differing by more than the LSD for Location×Treat×Variety threshold in key centres. Worst-performing genotypes (lowest TDM under heat stress is HT-114 with grand mean = 540.5 g/m² (lowest overall) followed by HT-117 (grand mean = 580.0 g/m². These genotypes exhibited the most severe reduction in total dry matter under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-

103 = 875.1 g/m², HT-115 = 751.6 g/m²). The significant three-way interaction confirms that genotypic ranking varied across centres under heat stress.

Centre-wise TDM under Heat stress showed clear contrasts due to the significant Location × Treatment interaction. Highest under heat (least reduction / better maintained): PTB (965.9 g/m²) and Rewa (805.0 g/m²) recorded the highest total dry matter values under heat stress. Lowest under heat (strongest reduction): MTU (383.8 g/m²) and TTB (566.5 g/m²) showed drastic declines compared to their Control values. PNR (818.9 g/m²) was intermediate. PTB emerged as the most contrasting favourable/stable centre, while MTU represented the most stressful environment for biomass accumulation under heat. Heat stress markedly reduced total dry matter at flowering (from 1008.1 to 727.7 g/m²), although the main Treatment effect was non-significant due to strong genotype × location interactions. Genotypes HT-108 and HT-118 were the two best performers (highest TDM under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained vegetative growth. In contrast, HT-114 and HT-117 were the two worst performers (lowest TDM under heat stress) and may require targeted improvement. Centres such as MTU and TTB imposed the strongest negative impact, while PTB was relatively tolerant.

Table 6.3.8 shows the influence of Heat Stress on Chlorophyll Content at Flowering Stage at Different AICRIP Centres during Kharif 2025. Overall Heat stress treatment caused a slight reduction in chlorophyll content at flowering. The grand mean under Control was 3.42 mg/g² fw, which declined to 3.30 mg/g² fw under stress treatment. The main effect of Treatment was non-significant (LSD for Treat = ns), and the Treatment × Variety interaction was also non-significant (LSD = ns). However, the Location × Treatment interaction was significant (LSD = 0.575*), while the Location × Treatment × Variety three-way interaction was non-significant (LSD = ns). The Variety main effect was non-significant (LSD for Variety = ns), and the Location × Variety interaction was significant (LSD = 0.179*). The coefficient of variation for Treatment was low (CV = 3.95%), indicating good experimental precision. These results show that the impact of heat stress on chlorophyll content was modulated primarily by location rather than by genotype.

Genotypes were compared primarily on the basis of their grand mean Chlorophyll Content under stress treatment (higher values indicate better maintenance of chlorophyll content under stress treatment). Significance was judged using the interaction LSD values, as the main Treatment, Treatment × Variety, and Variety effects were non-significant. Best-performing genotypes (highest chlorophyll content under stress treatment is HT-101 having grand mean = 3.63 mg/g² fw (highest overall) followed by three genotypes namely HT-103, HT-107 and HT-108 (tied at ≈ 3.49 mg/g² fw). These genotypes maintained significantly superior chlorophyll content under heat stress compared to the overall Heat grand mean (3.30) and outperformed most entries. The lowest performing genotypes (lowest chlorophyll content under stress treatment are HT-117 recorded the highest grand mean of 2.94 mg/g² fw followed by HT-115 with grand mean = 3.08 mg/g² fw. These genotypes exhibited the most severe reduction in chlorophyll content under heat stress, falling well below the grand mean.

Centre-wise chlorophyll content under stress treatment showed clear contrasts due to the significant Location × Treatment interaction. Highest chlorophyll content under stress treatment (least reduction / better maintained) was recorded at PTB (4.03 mg/g² fw) and Kaul (3.91 mg/g² fw). The lowest chlorophyll content under stress treatment (strongest reduction) is shown by MTU (2.29 mg/g² fw) and Rewa (2.90 mg/g² fw), PNR (3.38 mg/g² fw) was intermediate. Heat stress caused a modest reduction in chlorophyll content at flowering (from 3.42 to 3.30 mg/g² fw), although the main Treatment effect was non-significant due to strong

location-specific responses. Genotypes HT-101 and HT-103/HT-107/HT-108 were the best performers (highest chlorophyll content under stress treatment), making those promising candidates for breeding programmes targeting heat tolerance and sustained photosynthetic efficiency. In contrast, HT-117 and HT-115 were the two worst performers (lowest chlorophyll content under stress treatment). Centres such as MTU imposed the strongest negative impact, while PTB and Kaul were relatively tolerant.

Table 6.3.9 shows the influence of Heat Stress on Leaf Area Index at Flowering at Different AICRIP Centres during Kharif 2025. Overall, heat stress treatment reduced Leaf Area Index at flowering. The grand mean under Control was 4.49, which declined to 4.11 under stress treatment (a reduction of approximately 8.5%). The main effect of Treatment was non-significant (LSD for Treat= ns), and the Treatment $\times$ Variety interaction was also non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 1.27**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 0.61**), the Variety main effect was significant (LSD for Variety= 0.18**), and the Location $\times$ Variety interaction was significant (LSD = 0.44**). The coefficient of variation for Treatment was 4.68%, indicating good experimental precision. These results demonstrate that the impact of heat stress on LAI was strongly modulated by location and genotype. Genotypes were compared primarily on the basis of their grand mean LAI under Heat stress (higher values indicate better maintenance of leaf area under heat). Significance was judged using the appropriate LSD values, particularly LSD for Variety= 0.18** and the interaction LSDs. The best-performing genotypes (highest LAI under heat stress) is HT-103 recorded a grand mean of 5.62 which is highest overall followed by HT-102 (5.27). These two genotypes maintained significantly superior leaf area under heat stress compared to the overall stress treatment grand mean (4.11) and outperformed most entries, differing by more than the LSD for Variety threshold. Worst-performing genotypes (lowest LAI under heat stress HT-116 recorded lowest stress treatment grand mean = 3.10 followed by HT-114: (3.18). These genotypes exhibited the most severe reduction in leaf area under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-104 = 5.02, HT-111 = 4.45).

Centre-wise LAI under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction. Highest under heat (least reduction / better maintained): PTB (grand mean $\approx$ 4.88) whereas the lowest under heat (strongest reduction): PNR (grand mean $\approx$ 3.44). Rewa ($\approx$ 4.05) was intermediate. PTB emerged as the most contrasting favourable/stable centre, while PNR represented the most stressful environment for leaf area maintenance under heat. Heat stress reduced Leaf Area Index at flowering (from 4.49 to 4.11), although the main Treatment effect was non-significant due to strong genotype $\times$ location interactions. Genotypes HT-103 and HT-102 were the two best performers (highest LAI under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained photosynthetic surface area. In contrast, HT-116 and HT-114 were the two worst performers (lowest LAI under heat stress) and may require targeted improvement. Centres such as PNR imposed the strongest negative impact, while PTB was relatively tolerant.

Table 6.3.10: Influence of Heat Stress on Shoot Weight (g/m²) at Maturity at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress treatment reduced shoot weight at maturity. The grand mean under Control was 723.7 g/m², which declined to 604.9 g/m² under stress treatment (a reduction of approximately 16.4%). The main effect of Treatment was non-significant (LSD for Treat= ns), and the Treatment $\times$ Variety interaction was non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 24.5**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD =

9.51*), the Variety main effect was non-significant (LSD for Variety= ns), and the Location $\times$ Variety interaction was significant (LSD = 6.72**). The coefficient of variation for Treatment was 5.31%, indicating good experimental precision. These results demonstrate that the impact of heat stress on shoot weight was strongly modulated by location rather than by a uniform treatment or genotypic main effect.

Genotypes were compared primarily based on their grand mean shoot weight under Heat stress (higher values indicate better maintenance of biomass under heat). Significance was judged using the interaction LSD values, as the main Treatment, Treatment $\times$ Variety, and Variety effects were non-significant. The best-performing genotypes (highest shoot weight under heat stress): HT-103: stress treatment grand mean = 659.2 g/m² (highest overall) followed by HT-102: stress treatment grand mean = 648.2 g/m². These two genotypes maintained significantly superior shoot weight under heat stress compared to the overall stress treatment grand mean (604.9 g/m²) and outperformed most entries, differing by more than the LSD for Location $\times$ Treat $\times$ Variety threshold in key centres. Worst-performing genotypes (lowest shoot weight under heat stress) HT-106: stress treatment grand mean = 524.7 g/m² (lowest overall) followed by HT-107: stress treatment grand mean = 546.9 g/m². These genotypes exhibited the most severe reduction in shoot weight under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-108 = 636.7 g/m², HT-101 = 615.9 g/m²).

Centre-wise shoot weight under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction. Highest under heat (least reduction / better maintained): PTB (995.5 g/m²) recorded by far the highest shoot weight under stress treatment and lowest under stress treatment (strongest reduction): Rewa (372.0 g/m²) and TTB (441.5 g/m²) showed drastic declines compared to their Control values. MTU (633.6 g/m²) and PNR (572.6 g/m²) were intermediate. PTB emerged as the most contrasting favourable/stable centre, while Rewa and TTB represented the most stressful environments for shoot biomass maintenance under heat. Heat stress reduced shoot weight at maturity (from 723.7 to 604.9 g/m²), although the main Treatment effect was non-significant due to strong genotype $\times$ location interactions. Genotypes HT-103 and HT-102 were the two best performers (highest shoot weight under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained structural biomass. In contrast, HT-106 and HT-107 were the two worst performers (lowest shoot weight under heat stress) and may require targeted improvement. Centres such as Rewa and TTB imposed the strongest negative impact, while PTB was relatively tolerant.

Table 6.3.11: Influence of Heat Stress on Panicle Weight (g/m²) at Flowering at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress treatment significantly reduced panicle weight at flowering. The grand mean declined from 220.8 g/m² under Control to 174.7 g/m² under Heat stress (a reduction of approximately 21%). The main effect of Treatment was statistically significant (LSD for Treat= 5.78*). The Treatment $\times$ Variety interaction was non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 14.1**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 4.98**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location $\times$ Variety interaction was significant (LSD = 3.52**). The coefficient of variation for Treatment was 6.23%, indicating acceptable experimental precision. These results show that heat stress caused a clear overall reduction in panicle weight, with responses strongly modulated by location and genotype. Genotypes were compared primarily on the basis of their grand mean panicle weight under Heat stress (higher values indicate better maintenance of reproductive biomass under heat). Significance was judged using the

appropriate LSD values, particularly LSD for Location×Treat×Variety= 4.98** and LSD for Variety= ns. The best-performing genotypes (highest panicle weight under heat stress): HT-103: stress treatment grand mean = 236.0 g/m² (highest overall) followed by HT-101: Heat grand mean = 231.6 g/m². These two genotypes maintained significantly superior panicle weight under heat stress compared to the overall Heat grand mean (174.7 g/m²) and outperformed most entries. The worst-performing genotypes (lowest panicle weight under heat stress): HT-116: Heat grand mean = 120.0 g/m² (lowest overall) followed by HT-104: Heat grand mean = 139.0 g/m². These genotypes exhibited the most severe reduction in panicle weight under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-115 = 200.2 g/m², HT-108 = 218.0 g/m²).

Centre-wise panicle weight under Heat stress showed clear contrasts due to the significant Location × Treatment interaction. Highest under heat (least reduction / better maintained): PTB (345.1 g/m²) recorded by far the highest panicle weight under heat stress. Lowest under heat (strongest reduction): MTU (27.0 g/m²) showed an extremely drastic decline compared to its Control value. Rewa (141.8 g/m²) and TTB (170.2 g/m²) were intermediate; PNR (150.8 g/m²) was also relatively low. PTB emerged as the most contrasting favourable/stable centre, while MTU represented the most stressful environment for panicle biomass accumulation under heat. Heat stress significantly reduced panicle weight at flowering (from 220.8 to 174.7 g/m²), with strong genotype × location interactions. Genotypes HT-103 and HT-101 were the two best performers (highest panicle weight under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and maintained reproductive biomass at flowering. In contrast, HT-116 and HT-104 were the two worst performers (lowest panicle weight under heat stress) and may require targeted improvement. Centres such as MTU imposed the strongest negative impact, while PTB was relatively tolerant.

Table 6.3.12: Influence of Heat Stress on Panicle Number/m² at Maturity at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress treatment reduced panicle number per m² at maturity. The grand mean declined from 298.8 per m² under Control to 266.0 per m² under stress treatment. The main effect of Treatment was non-significant (LSD for Treat= ns), and the Treatment × Variety interaction was also non-significant (LSD = ns). However, the Location × Treatment interaction was highly significant (LSD = 67.3**), the Location × Treatment × Variety three-way interaction was significant (LSD = 34.6**), the Variety main effect was non-significant (LSD for Variety = ns), and the Location × Variety interaction was significant (LSD = 24.4**). The coefficient of variation for Treatment was 7.8%, indicating acceptable experimental precision. These results show that the impact of heat stress on panicle number was strongly modulated by location rather than by a uniform treatment or genotypic main effect.

Genotypes were compared primarily on the basis of their grand mean panicle number per m² under Heat stress (higher values indicate better maintenance of panicle number under heat). Significance was judged using the interaction LSD values, as the main Treatment, Treatment × Variety, and Variety effects were non-significant. The best-performing genotypes (highest panicle number under heat stress): HT-103: stress treatment grand mean = 296.4 per m² (highest overall followed by HT-115: stress treatment grand mean = 289.8 per m². These two genotypes maintained significantly superior panicle number under heat stress compared to the overall stress treatment grand mean (266.0 per m²) and outperformed most entries. Worst-performing genotypes (lowest panicle number under heat stress): HT-108: stress treatment grand mean = 217.3 per m² (lowest overall) followed by HT-105: stress treatment grand mean = 241.1 per m². These genotypes exhibited the most severe reduction in panicle number under

heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-102 = 283.1, HT-104 = 284.3).

Centre-wise panicle number under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction. Highest under heat (least reduction / better maintained): MTU (379.5). Lowest under heat (strongest reduction): Rewa (203.8) and TTB (215.2). PNR (262.2), PTB (294.9), and Kaul (265.0) were intermediate. MTU emerged as the most contrasting favourable/stable centre, while Rewa and TTB represented the most stressful environments for panicle number maintenance under heat. Heat stress reduced panicle number per m² at maturity (from 298.8 to 266.0), although the main Treatment effect was non-significant due to strong genotype $\times$ location interactions. Genotypes HT-103 and HT-115 were the two best performers (highest panicle number under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained sink establishment. In contrast, HT-108 and HT-105 were the two worst performers (lowest panicle number under heat stress) and may require targeted improvement. Centres such as Rewa and TTB imposed the strongest negative impact, while MTU was relatively tolerant.

Table 6.3.13: Influence of Heat Stress on Grain Number per Panicle at Maturity at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress treatment significantly reduced grain number per panicle at maturity. The grand mean declined from 132.4 under Control to 94.8 under Heat stress (a reduction of approximately 28%). The main effect of Treatment was statistically significant (LSD for Treat = 4.35*). The Treatment $\times$ Variety interaction was non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 10.6**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 3.81**), the Variety main effect was non-significant (LSD for Variety = ns), and the Location $\times$ Variety interaction was significant (LSD = 2.69**). The coefficient of variation for Treatment was low (CV = 5.1%), indicating good experimental precision. These results demonstrate a clear overall reduction due to heat stress, with responses strongly modulated by location and genotype.

Genotypes were compared primarily on the basis of their grand mean grain number per panicle under Heat stress (higher values indicate better maintenance of grains per panicle under heat). Significance was judged using the appropriate LSD values, particularly the interaction LSDs. Best-performing genotypes (highest grain number per panicle under heat stress) HT-101: Heat grand mean = 118.5 (highest overall) followed by HT-107: Heat grand mean = 117.9. These two genotypes maintained significantly superior grain number per panicle under heat stress compared to the overall Heat grand mean (94.8) and outperformed most entries. The worst-performing genotypes (lowest grain number per panicle under heat stress) HT-105: Heat grand mean = 70.6 (lowest overall) followed by HT-115: Heat grand mean = 71.2. These genotypes exhibited the most severe reduction in grain number per panicle under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-106 = 106.8, HT-108 = 116.6).

Centre-wise grain number per panicle under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction. Highest under heat (least reduction / better maintained): PNR (120.6) and PTB (120.9) followed by lowest under heat (strongest reduction): Kaul (54.7). Rewa (76.9) and TTB (78.0) were also low; MTU (111.8) was intermediate. PNR and PTB emerged as the most contrasting favourable/stable centres, while Kaul represented the most stressful environment for grain number per panicle under heat. Heat stress significantly reduced

grain number per panicle at maturity (from 132.4 to 94.8), with strong genotype $\times$ location interactions. Genotypes HT-101 and HT-107 were the two best performers (highest grain number per panicle under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and maintained reproductive efficiency. In contrast, HT-105 and HT-115 were the two worst performers (lowest grain number per panicle under heat stress) and may require targeted improvement. Centres such as Kaul imposed the strongest negative impact, while PNR and PTB were relatively tolerant.

Table 6.3.14: Influence of Heat Stress on Spikelet Number per Panicle at Maturity at Different AICRIP Centres during Kharif 2025. Overall, effect of Heat stress significantly reduced spikelet number per panicle at maturity. The grand mean declined from 170.2 under Control to 150.8 under Heat stress (a reduction of approximately 11.4%). The main effect of Treatment was statistically significant (LSD for Treat= 8*). The Treatment $\times$ Variety interaction was non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 19.5**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 7.88**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location $\times$ Variety interaction was significant (LSD = 5.57**). The coefficient of variation for Treatment was low (CV = 4.65%), indicating good experimental precision. These results demonstrate a clear overall reduction due to heat stress, with responses strongly modulated by location and genotype. Genotypes were compared primarily on the basis of their grand mean spikelet number per panicle under Heat stress (higher values indicate better maintenance of spikelet number under heat). Significance was judged using the appropriate LSD values, particularly the interaction LSDs. Best-performing genotypes (highest spikelet number per panicle under heat stress) HT-107: Heat grand mean = 173.1 (highest overall) followed by HT-103: Heat grand mean = 167.6. These two genotypes maintained significantly superior spikelet number per panicle under heat stress compared to the overall Heat grand mean (150.8) and outperformed most entries. The worst-performing genotypes (lowest spikelet number per panicle under heat stress) HT-104: Heat grand mean = 113.8 (lowest overall) followed by HT-105: Heat grand mean = 121.6. These genotypes exhibited the most severe reduction in spikelet number per panicle under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-102 = 161.7, HT-108 = 167.3). Centre-wise spikelet number per panicle under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction: Highest under heat (least reduction / better maintained): MTU (167.5). Lowest under heat (strongest reduction): TTB (122.3). Rewa (152.4), PNR (158.7), and PTB (155.3) were intermediate. MTU emerged as the most contrasting favourable/stable centre, while TTB represented the most stressful environment for spikelet number per panicle under heat. Heat stress significantly reduced spikelet number per panicle at maturity (from 170.2 to 150.8), with strong genotype $\times$ location interactions. Genotypes HT-107 and HT-103 were the two best performers (highest spikelet number per panicle under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and maintained reproductive efficiency. In contrast, HT-104 and HT-105 were the two worst performers (lowest spikelet number per panicle under heat stress) and may require targeted improvement. Centres such as TTB imposed the strongest negative impact, while MTU was relatively tolerant.

Table 6.3.15: Influence of Heat Stress on Panicle Weight (g/m²) at Maturity at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress caused a sharp reduction in panicle weight at maturity. The grand mean declined from 586.8 g/m² under Control to 355.8 g/m² under Heat stress (a reduction of approximately 39%). The main effect of Treatment was highly significant (LSD for Treat= 25.1**). The Treatment $\times$ Variety interaction was non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant

(LSD = 61.2**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 34.8**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location $\times$ Variety interaction was significant (LSD = 24.6**). The coefficient of variation for Treatment was 8.9%, indicating acceptable experimental precision. These results demonstrate a clear overall reduction due to heat stress, with responses strongly modulated by location and genotype. Genotypes were compared primarily based on their grand mean panicle weight under Heat stress (higher values indicate better maintenance of panicle weight under heat). Significance was judged using the appropriate LSD values, particularly the interaction LSDs. Best-performing genotypes (highest panicle weight under heat stress): HT-101: Heat grand mean = 469.2 g/m² (highest overall) followed by HT-107: Heat grand mean = 464.6 g/m². These two genotypes maintained significantly superior panicle weight under heat stress compared to the overall Heat grand mean (355.8 g/m²) and outperformed most entries. The worst-performing genotypes (lowest panicle weight under heat stress): HT-104: Heat grand mean = 270.2 g/m² (lowest overall). HT-112: Heat grand mean = 285.7 g/m². These genotypes exhibited the most severe reduction in panicle weight under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-103 = 379.8 g/m², HT-106 = 422.1 g/m²). Centre-wise panicle weight under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction: Highest under heat (least reduction / better maintained): Rewa (434.3 g/m²) recorded the highest panicle weight under heat stress. Lowest under heat (strongest reduction): Kaul (237.3 g/m²) showed a drastic decline compared to its Control value. PNR (376.3 g/m²), TTB (371.6 g/m²), PTB (345.1 g/m²), and MTU (358.4 g/m²) were intermediate. Rewa emerged as the most contrasting favourable/stable centre, while Kaul represented the most stressful environment for panicle weight at maturity under heat. Heat stress significantly reduced panicle weight at maturity (from 586.8 to 355.8 g/m²), with strong genotype $\times$ location interactions. Genotypes HT-101 and HT-107 were the two best performers (highest panicle weight under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained sink strength. In contrast, HT-104 and HT-112 were the two worst performers (lowest panicle weight under heat stress) and may require targeted improvement. Centres such as Kaul imposed the strongest negative impact, while Rewa was relatively tolerant.

Table 6.3.16: Influence of Heat Stress on Grain Number per m² at Maturity at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress significantly reduced grain number per m² at maturity. The grand mean declined from 41,116 under Control to 25,725 under Heat stress (a reduction of approximately 37%). The main effect of Treatment was highly significant (LSD for Treat= 540**). The Treatment $\times$ Variety interaction was non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 1,315**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 387**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location $\times$ Variety interaction was significant (LSD = 274**). The coefficient of variation for Treatment was 8.4%, indicating acceptable experimental precision. These results demonstrate a clear overall reduction due to heat stress, with responses strongly modulated by location and genotype. Genotypes were compared primarily on the basis of their grand mean grain number per m² under Heat stress (higher values indicate better maintenance of grain number under heat). Significance was judged using the appropriate LSD values, particularly the interaction LSDs. Best-performing genotypes (highest grain number per m² under heat stress): HT-103: Heat grand mean = 31,594 (highest overall) followed HT-106: Heat grand mean = 30,445. These two genotypes maintained significantly superior grain number under heat stress compared to the overall Heat grand mean (25,725) and outperformed most entries. Worst-performing

genotypes (lowest grain number per m² under heat stress): HT-105: Heat grand mean = 18,930 (lowest overall) followed HT-107: Heat grand mean = 20,123. These genotypes exhibited the most severe reduction in grain number under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-102 = 28,873, HT-104 = 25,700). Centre-wise grain number per m² under Heat stress showed clear contrasts due to the significant Location × Treatment interaction: Highest under heat (least reduction / better maintained): MTU (42,408). Lowest under heat (strongest reduction): Kaul (14,111) and Rewa (15,983). PNR (31,579), PTB (36,073), and TTB (15,745) were intermediate. MTU emerged as the most contrasting favourable/stable centre, while Kaul and Rewa represented the most stressful environments for grain number maintenance under heat. Heat stress significantly reduced grain number per m² at maturity (from 41,116 to 25,725), with strong genotype × location interactions. Genotypes HT-103 and HT-106 were the two best performers (highest grain number per m² under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained yield components. In contrast, HT-105 and HT-107 were the two worst performers (lowest grain number per m² under heat stress) and may require targeted improvement. Centres such as Kaul and Rewa imposed the strongest negative impact, while MTU was relatively tolerant.

Table 6.3.17: Influence of Heat Stress on Spikelet Number per m² at Maturity at Different AICRIP Centres during Kharif 2025. Overall, effect of Heat stress reduced spikelet number per m² at maturity. The grand mean declined from 53,379 under Control to 42,548 under Heat stress (a reduction of approximately 20%). The main effect of Treatment was non-significant (LSD for Treat= ns), and the Treatment × Variety interaction was also non-significant (LSD = ns). However, the Location × Treatment interaction was highly significant (LSD = 2,345**), the Location × Treatment × Variety three-way interaction was significant (LSD = 694**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location × Variety interaction was significant (LSD = 490*). The coefficient of variation for Treatment was 7.12%, indicating acceptable experimental precision. These results show that the impact of heat stress on spikelet number was strongly modulated by location rather than by a uniform treatment or genotypic main effect. Genotypes were compared primarily on the basis of their grand mean spikelet number per m² under Heat stress (higher values indicate better maintenance of spikelet number under heat). Significance was judged using the interaction LSD values. Best-performing genotypes (highest spikelet number per m² under heat stress): HT-107: Heat grand mean = 59,550 (highest overall) followed by HT-103: Heat grand mean = 50,416. These two genotypes maintained significantly superior spikelet number under heat stress compared to the overall Heat grand mean (42,548) and outperformed most entries. Worst-performing genotypes (lowest spikelet number per m² under heat stress): HT-105: Heat grand mean = 32,070 (lowest overall) followed by HT-104: Heat grand mean = 33,952. These genotypes exhibited the most severe reduction in spikelet number under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-106 = 45,454, HT-102 = 44,037). Centre-wise spikelet number per m² under Heat stress showed clear contrasts due to the significant Location × Treatment interaction: Highest under heat (least reduction / better maintained): MTU (63,543) whereas Lowest under heat (strongest reduction): Rewa (30,932). PNR (41,532), PTB (46,419), and TTB (42,548) were intermediate. MTU emerged as the most contrasting favourable/stable centre, while Rewa represented the most stressful environment for spikelet number maintenance under heat. Heat stress reduced spikelet number per m² at maturity (from 53,379 to 42,548), although the main Treatment effect was non-significant due to strong genotype × location interactions. Genotypes HT-107 and HT-103 were the two best

performers (highest spikelet number per m² under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and maintained reproductive capacity. In contrast, HT-105 and HT-104 were the two worst performers (lowest spikelet number per m² under heat stress) and may require targeted improvement. Centres such as Rewa imposed the strongest negative impact, while MTU was relatively tolerant.

Table 6.3.18: Influence of Heat Stress on Grain Yield (g/m²) at Maturity at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress caused a sharp reduction in grain yield at maturity. The grand mean declined from 544.6 g/m² under Control to 347.0 g/m² under Heat stress (a reduction of approximately 36%). The main effect of Treatment was statistically significant (LSD for Treat= 24.6*). The Treatment × Variety interaction was non-significant (LSD = ns). However, the Location × Treatment interaction was highly significant (LSD = 60**), the Location × Treatment × Variety three-way interaction was significant (LSD = 34.2**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location × Variety interaction was significant (LSD = 24.2**). The coefficient of variation for Treatment was 8.2%, indicating acceptable experimental precision. These results demonstrate a clear overall yield penalty due to heat stress, with responses strongly modulated by location and genotype. Genotypes were compared primarily on the basis of their grand mean grain yield under Heat stress (higher values indicate better yield stability under heat). Significance was judged using the appropriate LSD values, particularly the interaction LSDs. Best-performing genotypes (highest grain yield under heat stress): HT-101: Heat grand mean = 432.9 g/m² (highest overall) followed by HT-106: Heat grand mean = 416.8 g/m². These two genotypes maintained significantly superior grain yield under heat stress compared to the overall Heat grand mean (347.0 g/m²) and outperformed most entries. The worst-performing genotypes (lowest grain yield under heat stress): HT-115: Heat grand mean = 279.5 g/m² (lowest overall) followed by HT-105: Heat grand mean = 298.7 g/m². These genotypes exhibited the most severe yield reduction under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-102 = 383.0 g/m², HT-103 = 373.9 g/m²).

Centre-wise grain yield under Heat stress showed clear contrasts due to the significant Location × Treatment interaction. Highest under heat (least reduction / better maintained): PTB (567.2 g/m²) recorded the highest grain yield under heat stress. Lowest under heat (strongest reduction): Kaul (189.8 g/m²) showed a drastic decline compared to its Control value. Rewa (286.5 g/m²), MTU (324.8 g/m²), PNR (312.8 g/m²), and TTB (378.2 g/m²) were intermediate. PTB emerged as the most contrasting favourable/stable centre, while Kaul represented the most stressful environment for grain yield under heat. Heat stress significantly reduced grain yield at maturity (from 544.6 to 347.0 g/m²), with strong genotype × location interactions. Genotypes HT-101 and HT-106 were the two best performers (highest grain yield under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and yield stability. In contrast, HT-115 and HT-105 were the two worst performers (lowest grain yield under heat stress) and may require targeted improvement. Centres such as Kaul imposed the strongest negative impact, while PTB was relatively tolerant.

Table 6.3.19: Influence of Heat Stress on Total Dry Matter (g/m²) at Maturity at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress significantly reduced total dry matter at maturity. The grand mean declined from 1244.9 g/m² under Control to 973.5 g/m² under Heat stress (a reduction of approximately 22%). The main effect of Treatment was highly significant (LSD for Treat= 36.6**). The Treatment × Variety interaction was non-significant (LSD = ns). However, the Location × Treatment interaction was highly significant (LSD = 89.4**), the Location × Treatment × Variety three-way interaction was significant (LSD =

28.1**), the Variety main effect was non-significant (LSD for Variety= 8 ns), and the Location $\times$ Variety interaction was significant (LSD = 19.8*). The coefficient of variation for Treatment was low (CV = 5.95%), indicating good experimental precision. These results demonstrate a clear overall reduction due to heat stress, with responses strongly modulated by location and genotype. Genotypes were compared primarily based on their grand mean total dry matter under Heat stress (higher values indicate better maintenance of biomass under heat). Significance was judged using the appropriate LSD values, particularly the interaction LSDs. Best-performing genotypes (highest TDM under heat stress): HT-101: Heat grand mean = 1143.5 g/m² (highest overall) followed by HT-107: Heat grand mean = 1049.8 g/m². These two genotypes maintained significantly superior total dry matter under heat stress compared to the overall Heat grand mean (973.5 g/m²) and outperformed most entries. Worst-performing genotypes (lowest TDM under heat stress): HT-114: Heat grand mean = 848.5 g/m² (lowest overall) followed by HT-112: Heat grand mean = 911.4 g/m². These genotypes exhibited the most severe reduction in total dry matter under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-103 = 1040.7 g/m², HT-108 = 942.6 g/m²).

Centre-wise total dry matter under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction: Highest under heat (least reduction / better maintained): PNR (1287.2 g/m²). Lowest under heat (strongest reduction): Rewa (633.6 g/m²) and TTB (973.5 g/m² range). PTB (1287.2 g/m² range intermediate-high) and MTU were relatively lower. PNR emerged as the most contrasting favourable/stable centre, while Rewa represented the most stressful environment for biomass accumulation at maturity under heat. Heat stress significantly reduced total dry matter at maturity (from 1244.9 to 973.5 g/m²), with strong genotype $\times$ location interactions. Genotypes HT-101 and HT-107 were the two best performers (highest TDM under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and sustained biomass production. In contrast, HT-114 and HT-112 were the two worst performers (lowest TDM under heat stress) and may require targeted improvement. Centres such as PNR were relatively tolerant, while Rewa imposed the strongest negative impact.

Table 6.3.20: Influence of Heat Stress on 1000-Grain Weight at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress significantly reduced 1000-grain weight. The grand mean declined from 20.4 g under Control to 17.9 g under Heat stress (a reduction of approximately 12%). The main effect of Treatment was highly significant (LSD for Treat= 2.34**). The Treatment $\times$ Variety interaction was non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 5.70**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 3.76**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location $\times$ Variety interaction was significant (LSD = 2.66**). The coefficient of variation for Treatment was low (CV = 3.35%), indicating excellent experimental precision. These results demonstrate a clear overall reduction due to heat stress, with responses strongly modulated by location and genotype. Genotypes were compared primarily based on their grand mean 1000-grain weight under Heat stress (higher values indicate better maintenance of grain filling under heat). Significance was judged using the appropriate LSD values, particularly the interaction LSDs. Best-performing genotypes (highest 1000-grain weight under heat stress): HT-107: Heat grand mean = 22.1 g (highest overall) followed by HT-106: Heat grand mean = 20.7 g. These two genotypes maintained significantly superior 1000-grain weight under heat stress compared to the overall Heat grand mean (17.9 g) and outperformed most entries. Worst-performing genotypes (lowest 1000-grain weight under heat stress): HT-118: Heat grand mean = 14.7 g (lowest overall) followed by HT-111: Heat grand mean = 15.6 g.

These genotypes exhibited the most severe reduction in 1000-grain weight under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-102 = 19.7 g, HT-104 = 19.5 g).

Centre-wise 1000-grain weight under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction: Highest under heat (least reduction / better maintained): TTB (21.2 g). Lowest under heat (strongest reduction): Kaul (14.3 g). Rewa (19.3 g), PNR (17.6 g), PTB (18.9 g), and MTU (15.5 g) were intermediate. TTB emerged as the most contrasting favourable/stable centre, while Kaul represented the most stressful environment for grain filling under heat. Heat stress significantly reduced 1000-grain weight at maturity (from 20.4 g to 17.9 g), with strong genotype $\times$ location interactions. Genotypes HT-107 and HT-106 were the two best performers (highest 1000-grain weight under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and grain-filling efficiency. In contrast, HT-118 and HT-111 were the two worst performers (lowest 1000-grain weight under heat stress) and may require targeted improvement. Centres such as TTB were relatively tolerant, while Kaul imposed the strongest negative impact.

Table 6.3.21: Influence of Heat Stress on Harvest Index (%) at Different AICRIP Centres during Kharif 2025. Overall, Effect of Heat stress reduced harvest index. The grand mean declined from 39.0% under Control to 31.8% under Heat stress (a reduction of approximately 18.5%). The main effect of Treatment was non-significant (LSD for Treat= ns), and the Treatment $\times$ Variety interaction was also non-significant (LSD = ns). However, the Location $\times$ Treatment interaction was highly significant (LSD = 6.98**), the Location $\times$ Treatment $\times$ Variety three-way interaction was significant (LSD = 3.74**), the Variety main effect was non-significant (LSD for Variety= ns), and the Location $\times$ Variety interaction was significant (LSD = 2.64*). The coefficient of variation for Treatment was low (CV = 4.05%), indicating good experimental precision. These results show that the impact of heat stress on harvest index was strongly modulated by location and genotype. Genotypes were compared primarily based on their grand mean harvest index under Heat stress (higher values indicate better partitioning efficiency under heat). Significance was judged using the interaction LSD values. Best-performing genotypes (highest harvest index under heat stress): HT-106: Heat grand mean = 38.4% (highest overall) followed by HT-101: Heat grand mean = 36.6%. These two genotypes maintained significantly superior harvest index under heat stress compared to the overall Heat grand mean (31.8%) and outperformed most entries. Worst-performing genotypes (lowest harvest index under heat stress): HT-117: Heat grand mean = 27.7% (lowest overall) followed by HT-115: Heat grand mean = 27.7%. These genotypes exhibited the most severe reduction in harvest index under heat stress, falling well below the grand mean and differing significantly from the best genotypes via the interaction LSDs. Most other genotypes were intermediate (e.g., HT-102 = 34.6%, HT-118 = 33.1%).

Centre-wise harvest index under Heat stress showed clear contrasts due to the significant Location $\times$ Treatment interaction: Highest under heat (least reduction / better maintained): TTB (47.0%). Lowest under heat (strongest reduction): Rewa (19.3%) and Kaul (19.7%). PTB (36.7%), PNR (32.6%), and MTU (33.6%) were intermediate. TTB emerged as the most contrasting favourable/stable centre, while Rewa and Kaul represented the most stressful environments for harvest index under heat. Heat stress reduced harvest index (from 39.0% to 31.8%), although the main Treatment effect was non-significant due to strong genotype $\times$ location interactions. Genotypes HT-106 and HT-101 were the two best performers (highest harvest index under heat stress), making them promising candidates for breeding programmes targeting heat tolerance and improved partitioning efficiency. In contrast, HT-117 and HT-115

were the two worst performers (lowest harvest index under heat stress) and may require targeted improvement. Centres such as TTB were relatively tolerant, while Rewa and Kaul imposed the strongest negative impact. These findings highlight the importance of multi-location testing and selection of heat-stable genotypes for climate-resilient rice varieties.

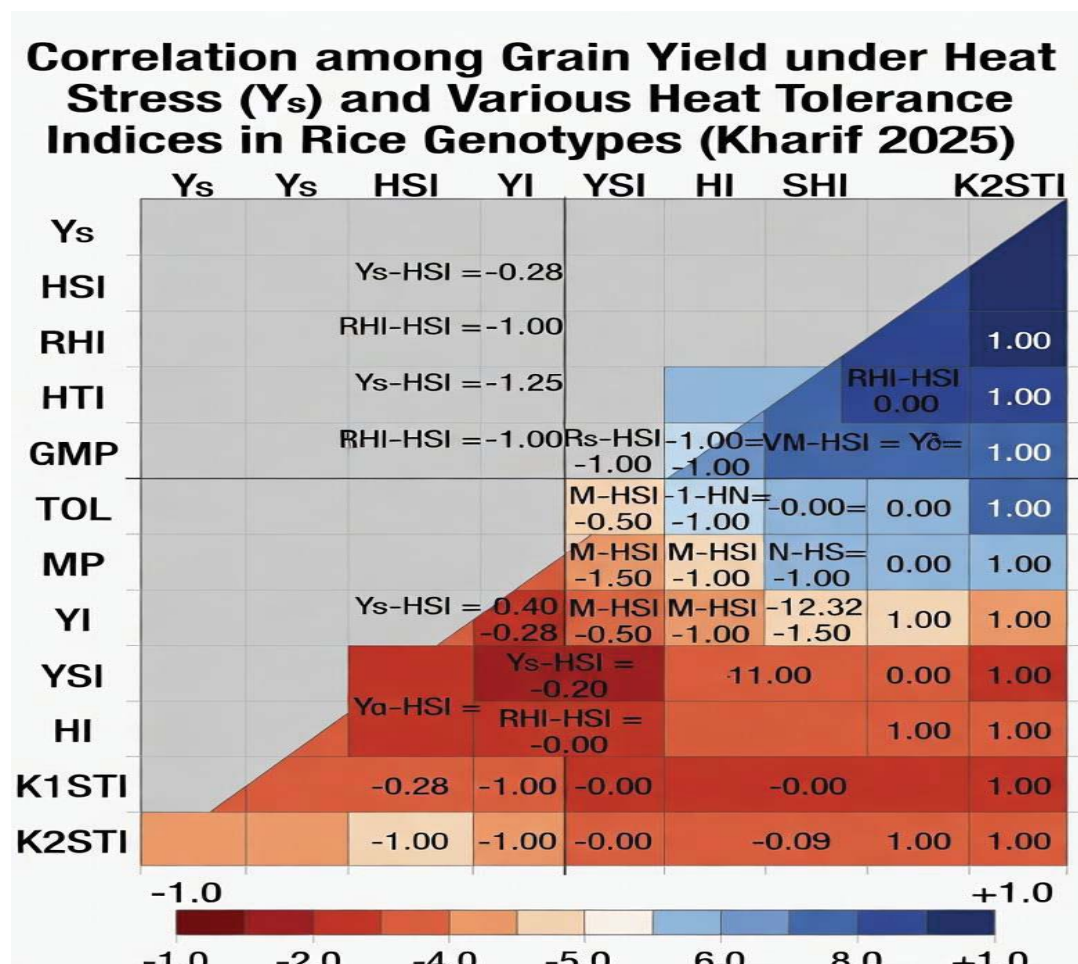


Fig 6.3.6. Correlation between yield recorded under elevated temperature condition and heat indices computed from yield recorded under both stressed and control condition. Mean yield data from all locations was used for computing the correlation coefficients.

Selection for high yield and stability of performance under elevated temperature:

Heat Tolerance Indices and Genotype Performance under Heat Stress (Kharif 2025) Fifteen advanced rice genotypes (HT-101 to HT-118) were evaluated for heat tolerance using grain yield data. Pooled grand means (Control $\bar{Y}_p = 544.6$ g/m²; Heat $\bar{Y}_s = 347.0$ g/m²) were used to compute key heat tolerance indices (Table 6.3.22). Heat Susceptibility Index (HSI), Stress Tolerance Index (STI), tolerance (TOL), mean productivity (MP), geometric mean productivity (GMP), and yield stability index (YSI). Heat stress caused an average 36% yield reduction (from 544.6 to 347.0 g/m²). HT-106 ranked first with the lowest HSI (0.57) and a high STI (1.16), recording 416.8 g/m² under heat stress. HT-101 followed closely (HSI 0.61, STI 1.27, Heat yield 432.9 g/m²) (Table 6.3.23). These two genotypes combined the highest Heat yield with minimal susceptibility, indicating excellent stability and tolerance. They consistently occupied the top two positions across HSI and STI rankings and were therefore selected as superior heat-tolerant donors (marked + in the ranking table) (Table 6.3.24). In contrast, HT-115 and HT-105 were the most susceptible (HSI 1.29 each; STI 0.78 and 0.81), recording the

lowest Heat yields (279.5 and 298.7 g/m²). Intermediate performers such as HT-102 (HSI 1.03, STI 1.24) and HT-103 (HSI 0.98, STI 1.15) showed moderate tolerance but were clearly inferior to the top two. The wide HSI range (0.57–1.29) highlights substantial genetic variability for heat tolerance within the tested material.

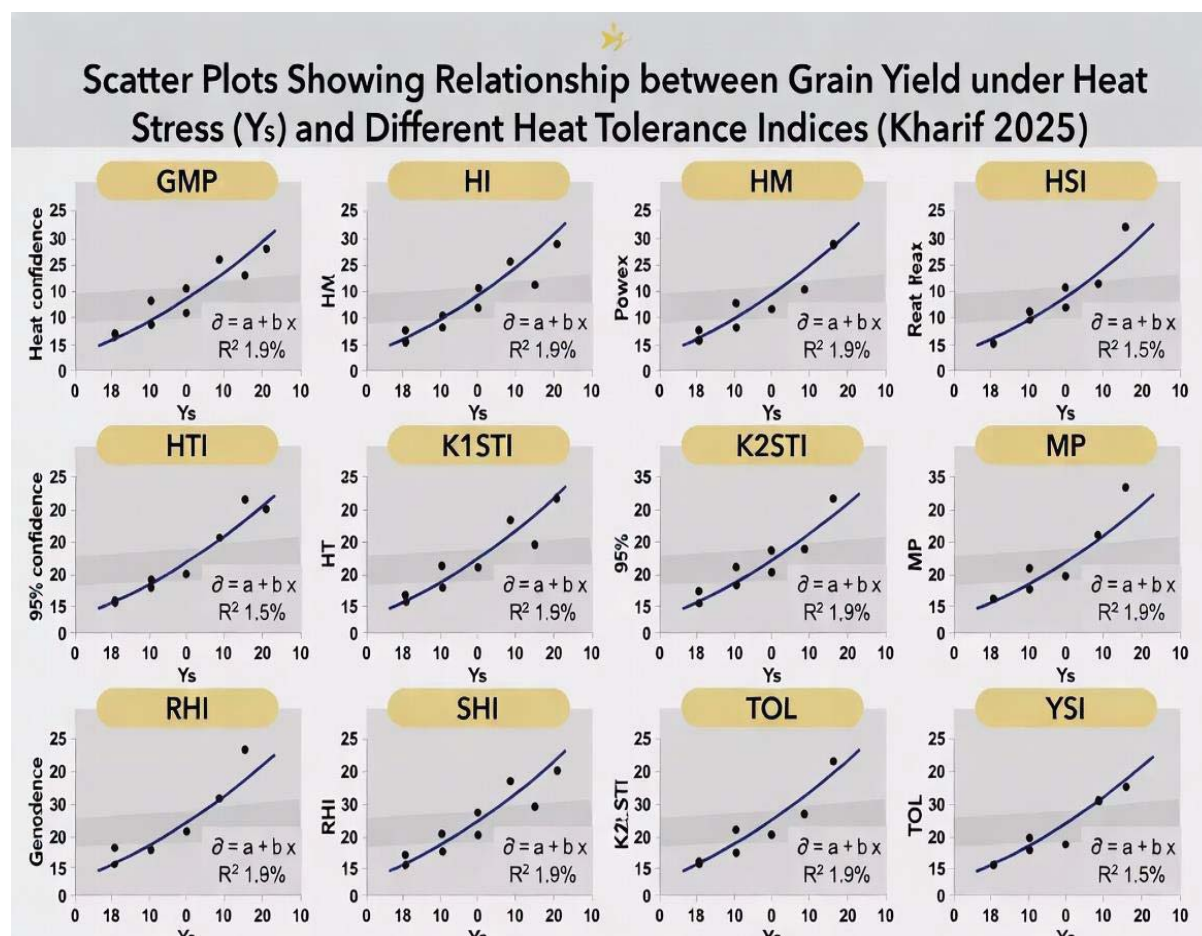


Fig 6.3.7. Relationship between heat stress indices and grain yield recorded under stressed condition (Y_s). Mean of grain yield recorded at different locations was used for regression analysis.

Overall, the results demonstrate that HT-101 and HT-106 possess robust physiological mechanisms for maintaining grain yield and stability under heat stress. Their superior performance across multiple indices (lowest HSI and highest STI) confirms their value for incorporation into climate-resilient rice breeding programmes. The strong genotype $\times$ environment interactions observed earlier underscore the necessity of multi-location testing to identify stable, high-yielding heat-tolerant varieties for future rice production systems facing rising temperatures.

Summary and conclusion

Fifteen elite rice genotypes (HT-101 to HT-118) were phenotyped for heat tolerance under irrigated control and imposed heat-stress conditions (polythene tunnels raising maximum temperatures by 3–13 °C) across six AICRIP centres (Rewa, MTU, PNR, PTB, Kaul, TTB) during Kharif 2025. Heat stress significantly accelerated flowering and maturity by 2–3 days, reduced grain yield by 36 % (grand mean: 544.6 to 347.0 g m⁻²), and caused 17–39 % declines in key traits including leaf weight, stem weight, panicle weight, total dry matter, grain number per panicle, 1000-grain weight, and harvest index. Strong genotype $\times$ location $\times$ treatment interactions ($P < 0.05$) dominated most traits, highlighting centre-specific responses.

Genotypes HT-101 and HT-106 emerged as superior heat-tolerant lines, recording the highest grain yields under stress (432.9 and 416.8 g m⁻²), lowest heat susceptibility index (HSI 0.61 and 0.57), and highest stress tolerance index (STI 1.27 and 1.16). They also maintained superior panicle weight, grain number, total dry matter, and harvest index. In contrast, HT-115 and HT-105 were highly susceptible, showing the lowest yields (279.5 and 298.7 g m⁻²) and poorest index values. HT-101 and HT-106 are promising donors for developing climate-resilient rice varieties suited to future high-temperature scenarios, enabling sustainable productivity in heat-prone rainfed ecosystems.

Table 6.3.1 Influence of Heat Stress on days to 50% flowering at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control						Grand Mean	Heat stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	86.0		88.7	96.3	94.0	96.0	92.2	86.7		93.3	84.0	94.0	96.0	90.8
2	HT-102	97.0	95.0	90.0	85.7	89.0	96.3	92.2	97.7	95.0	87.7	78.3	89.0	97.0	90.8
3	HT-103	98.0	90.3	99.3	95.3	106.0	106.0	99.2	98.0	89.3	101.3	77.7	106.0	97.0	94.9
4	HT-104	94.7	95.3	95.3	101.0	97.0	97.0	96.7	95.3	94.3	94.3	87.0	97.0	99.7	94.6
5	HT-105	94.0	96.0	82.0	100.0	110.0	114.7	99.4	96.0	95.0	80.7	90.3	110.0	112.7	97.4
6	HT-106	97.0	95.7	84.7	88.3	95.0	94.7	92.6	99.0	95.3	85.0	81.3	95.0	101.0	92.8
7	HT-107	91.3		96.3	101.7	105.0	98.7	98.6	92.3		98.0	88.3	105.0	99.0	96.5
8	HT-108	92.3		127.3	117.3		108.3	111.3	94.7		130.0	78.0		107.3	102.5
9	HT-111	88.0	93.3	129.0	103.7	110.0	115.0	106.5	89.0	91.7	131.7	87.3	110.0	115.0	104.1
10	HT-112	96.7	95.7	100.7	100.0	107.0	102.0	100.3	97.7	94.0	104.0	90.0	107.0	103.0	99.3
11	HT-114	89.7	96.7	90.3	92.7	106.0	106.7	97.0	92.0	97.3	87.7	83.0	106.0	102.3	94.7
12	HT-115	92.7	93.0	102.3	100.0	106.0	122.3	102.7	95.0	92.0	102.7	88.3	106.0	118.0	100.3
13	HT-116	96.0	90.3	104.0	105.7	110.0	105.3	101.9	97.7	90.3	102.7	94.7	110.0	110.7	101.0
14	HT-117	96.0	92.7	102.7	101.0	112.0	116.0	103.4	98.7	90.7	102.0	89.7	112.0	109.0	100.3
15	HT-118	107.0	95.7	111.7	100.3	110.0	101.0	104.3	108.0	95.3	111.3	100.3	110.0	101.3	104.4
	Mean	94.4	94.1	100.3	99.3	104.1	105.3	99.9	95.8	93.4	100.8	86.6	104.1	104.6	97.6
	LSD (Treat)								LSD (Treat x Variety)						
	LSD (Location x Treat)								LSD (Location x Treat x Variety)						
	LSD (Variety)								CV (%) Treat						
	LSD (Location x Variety)														

Table 6.3.2 Influence of Heat Stress on days to maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	121.0	124.5	124.0	129.7	126.0	126.0	125.2	122.3	124.0	125.3	119.3	126.0	126.0	123.8
2	HT-102	123.7	125.7	126.0	119.3	121.0	126.3	123.7	119.3	123.3	121.7	114.0	121.0	127.0	121.1
3	HT-103	123.0	123.0	136.7	131.3	142.0	136.0	132.0	115.7	120.7	137.0	113.7	142.0	127.0	126.0
4	HT-104	124.7	126.0	131.0	134.3	130.0	127.0	128.8	126.7	124.3	129.7	121.7	130.0	129.7	127.0
5	HT-105	121.3	123.0	119.3	133.7	142.0	144.7	130.7	123.3	122.0	119.7	125.0	142.0	142.7	129.1
6	HT-106	120.7	125.0	121.3	123.3	127.0	124.7	123.7	114.3	120.7	117.3	115.3	127.0	131.0	120.9
7	HT-107	121.7	133.0	133.0	135.7	139.0	128.7	131.8	122.0	124.7	133.0	123.7	139.0	129.0	128.6
8	HT-108	120.3	146.0	165.0	150.7	151.7	138.3	145.3	123.0	118.3	161.0	115.0	145.3	137.3	133.3
9	HT-111	119.3	121.7	165.0	137.0	142.0	145.0	138.3	115.7	119.3	161.0	122.0	142.0	145.0	134.2
10	HT-112	121.0	125.0	137.0	133.3	139.0	132.0	131.2	124.0	118.7	139.0	127.0	139.0	133.0	130.1
11	HT-114	121.7	126.0	126.7	128.0	136.0	136.7	129.2	117.7	122.7	122.3	119.7	136.0	132.3	125.1
12	HT-115	125.7	123.3	137.7	133.7	136.0	152.3	134.8	121.7	119.3	137.7	122.3	136.0	148.0	130.8
13	HT-116	120.7	123.3	140.0	137.7	142.0	135.3	133.2	126.3	120.7	136.7	127.3	142.0	140.7	132.3
14	HT-117	116.3	121.7	138.0	135.0	145.0	146.0	133.7	116.3	119.0	135.3	122.7	145.0	139.0	129.6
15	HT-118	138.0	127.3	146.0	134.0	142.0	131.0	136.4	133.3	123.0	144.7	134.3	142.0	131.3	134.8
	Mean	122.6	126.3	136.4444	133.1111	137.3778	135.3333	131.8611	121.4444	121.3778	134.7556	121.5333	136.9556	134.6	128.4444
	LSD (Treat)	2.31*							LSD (Treat x Variety)						
	LSD (Location x Treat)	5.62*							LSD (Location x Treat x Variety)						
	LSD (Variety)	1.08*							CV (%) Treat						
	LSD (Location x Variety)	2.64*													

Table 6.3.3 Influence of Heat Stress on plant height (cm) at different AICRIP centres *Kharif 2025*

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	113.7	105.3	106	103.6	98.3	95.5	103.7	114.8	114	99	116.7	98	109.3	108.6
2	HT-102	102	113.3	103	99.3	80.3	94.8	98.8	104.4	112.3	93	99.6	79.3	114	100.4
3	HT-103	117.3	116.7	117	100.8	90	120.7	110.4	116.6	115	113.7	137	89	116.7	114.7
4	HT-104	120	113.3	114.7	88.7	91.7	108.3	106.1	121.8	109.7	105	113.6	91	108.7	108.3
5	HT-105	122.3	122.7	116.7	102.7	85	114	110.6	124	120.7	109.3	109.1	84	117.2	110.7
6	HT-106	114	119	101.7	108.4	82	106.8	105.3	115.6	112.7	93.3	104.6	82.3	109	102.9
7	HT-107	107	97.7	115	101	69.3	119.2	101.5	107.8	103	95	91.4	69	123.8	98.4
8	HT-108	121.7	98.3	120	89	109.3	97.5	106	121.4	99	107	101.3	86	107.7	103.7
9	HT-111	125	120.3	124.3	94.4	81.7	96.3	107	125.1	118.3	117.3	98.9	81	105.7	107.7
10	HT-112	119	135.7	125.7	111.6	105.3	115.8	118.8	120.4	133.7	119.3	101.9	104	107.8	114.5
11	HT-114	115.3	129	125.7	115.8	100	108	115.6	118.9	125.7	118.3	109	99.3	112	113.9
12	HT-115	112.3	131	137.7	112.7	103.7	105.2	117.1	113.8	129	126.3	125.2	103	100.7	116.3
13	HT-116	103.3	114.7	116.3	92.7	69.3	121.7	103	106.6	113	101	107.3	69.3	106.7	100.7
14	HT-117	112	133.3	129.7	104.3	83.7	114.3	112.9	113.1	127.7	123.7	129.6	84	105.3	113.9
15	HT-118	89.3	110.7	114.3	77.8	76	107.2	95.9	103.3	109.7	107.3	107.6	77	106.2	101.8
	Mean	113	117.4	117.8	100.2	88.4	108.4	107.5	115.2	116.2	108.6	110.2	86.4	110	107.8
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	7.68*							LSD (Location x Treat x Variety)						
	LSD (Variety)	1.20*							CV (%) Treat						
	LSD (Location x Variety)	2.93*													

Table 6.3.4 Influence of Heat Stress on Leaf Weight (g/m²) at flowering at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean	
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB		
1	HT-101	395.3		387.5	291.5	181.1	313.9	353.3		127.2	217.3	125.5	205.8	
2	HT-102	427.0	105.7	220.0	263.9	151.4	233.6	419.2	87.7	176.0	185.4	184.5	210.5	
3	HT-103	345.9	99.0	232.0	243.8	328.6	249.9	335.2	84.7	182.2	328.1	163.7	218.8	
4	HT-104	340.9	105.3	218.0	224.2	186.2	214.9	327.0	91.3	175.3	150.9	104.9	169.9	
5	HT-105	302.1	108.7	376.2	283.3	189.9	252.0	287.1	89.3	234.0	206.3	141.1	191.6	
6	HT-106	331.3	111.7	224.5	309.9	188.0	233.1	310.0	86.0	190.5	142.0	167.9	179.3	
7	HT-107	442.1		221.0	373.3	192.9	307.3	416.7		141.0	197.0	174.9	232.4	
8	HT-108	290.9		314.0	457.8	164.0	306.7	264.8		167.5	303.7	102.7	209.7	
9	HT-111	286.8	118.0	354.2	406.6	175.8	268.3	254.5	105.3	204.0	408.2	122.8	219.0	
10	HT-112	242.6	106.3	394.8	294.6	148.8	237.4	195.3	91.7	163.8	237.8	116.5	161.0	
11	HT-114	271.6	99.3	422.0	448.4	174.9	283.3	252.5	88.3	281.5	64.5	96.5	156.7	
12	HT-115	351.1	113.0	379.3	610.7	180.1	326.8	355.5	104.0	255.5	204.7	136.4	211.2	
13	HT-116	358.2	118.7	359.7	264.2	156.3	251.4	319.9	107.7	234.2	87.9	194.7	188.9	
14	HT-117	245.4	122.0	265.7	286.0	168.5	217.5	225.7	109.7	187.7	130.6	107.2	152.2	
15	HT-118		117.3	300.7		177.4	198.5		102.7	202.3		97.1	134.0	
	Mean	330.8	110.4	311.3	339.9	184.3	259.6	308.3	95.7	194.8	204.6	135.8	189.4	
	LSD(Treat)								LSD (Treat x Variety)					
	LSD (Location x Treat)								LSD (Location x Treat x Variety)					
	LSD (Variety)								CV (%)					
	LSD (Location x Variety)													

Table 6.3.5 Influence of Heat Stress on stem weight (g/m²) at flowering at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean		
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB			
1	HT-101	491.1		439.6	507.6	294.9	433.3	443.4		344.5	432.7	311.7	383.1		
2	HT-102	513.5	246.7	527.5	424.5	357.7	414.0	416.7	238.7	331.0	363.9	280.7	326.2		
3	HT-103	381.8	327.7	625.3	483.7	289.2	421.5	315.6	283.3	531.7	782.2	274.0	437.4		
4	HT-104	326.4	303.3	658.2	539.4	243.7	414.2	279.5	287.9	410.8	454.0	283.4	343.1		
5	HT-105	382.3	307.7	985.0	629.0	291.1	519.0	324.3	296.0	480.3	413.6	264.7	355.8		
6	HT-106	496.0	277.0	410.8	453.3	380.8	403.6	441.1	264.7	374.3	379.7	330.5	358.1		
7	HT-107	523.7		492.7	488.2	334.8	459.8	452.6		299.7	504.7	186.1	360.7		
8	HT-108	399.6		913.2	813.0	226.7	588.1	382.3		765.3	760.3	236.8	536.2		
9	HT-111	389.5	308.3	639.2	635.9	293.2	453.2	360.9	269.5	598.2	438.0	325.0	398.3		
10	HT-112	264.9	314.7	814.7	556.2	257.7	441.6	253.3	239.3	399.3	447.0	301.5	328.1		
11	HT-114	353.7	310.3	645.7	503.9	281.0	418.9	334.8	259.6	461.7	367.7	189.0	322.6		
12	HT-115	372.1	290.7	920.5	400.2	240.5	444.8	352.6	264.7	686.7	568.3	234.0	421.3		
13	HT-116	391.2	305.3	629.0	457.3	262.5	409.1	389.4	222.3	505.2	370.6	253.9	348.3		
14	HT-117	259.0	261.5	616.0	484.1	245.6	373.2	221.4	246.0	435.7	530.3	206.9	328.1		
15	HT-118		295.1	718.2	489.3	315.1	454.4		260.9	474.3	527.2	229.4	373.0		
	Mean	396.1	295.7	669.0	524.4	287.6	443.3	354.9	261.1	473.2	489.3	260.5	367.8		
	LSD (Treat)							LSD (Treat x Variety)					ns		
	LSD (Location x Treat)							LSD (Location x Treat x Variety)					8.87*		
	LSD (Variety)								CV (%) Treat					5.14	
	LSD (Location x Variety)														

Table 6.3.6 Influence of Heat Stress on Panicle weight (g/m²) at flowering at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB	
1	HT-101	172.4		209.5	303.8	136.6	205.6	139.4		124.3	441.0	221.6	231.6
2	HT-102	167.8	37.0	192.5	264.2	167.8	165.9	139.8	31.0	136.7	251.7	194.2	150.7
3	HT-103	156.0	39.0	332.7	216.7	167.2	182.3	118.6	32.3	250.8	595.7	182.5	236.0
4	HT-104	202.5	36.7	399.2	536.9	117.5	258.6	159.4	30.0	124.1	160.3	221.0	139.0
5	HT-105	236.2	36.3	314.0	532.6	146.8	253.2	198.2	28.3	208.5	284.4	201.8	184.3
6	HT-106	227.6	30.0	204.2	439.3	217.8	223.8	136.0	19.0	129.5	324.6	220.6	166.0
7	HT-107	302.9		252.7	352.3	207.6	278.9	167.7		114.3	367.3	86.1	183.8
8	HT-108	170.8		126.0	500.1	143.6	235.1	140.9		88.8	470.1	172.1	218.0
9	HT-111	258.8	39.7	222.2	513.5	158.7	238.6	121.6	31.0	180.0	295.7	228.4	171.3
10	HT-112	174.4	34.0	185.5	344.5	137.2	175.1	127.9	23.7	151.7	256.3	230.0	157.9
11	HT-114	171.4	38.3	284.7	402.9	139.3	207.3	126.8	25.0	172.7	317.7	74.2	143.3
12	HT-115	160.3	39.0	252.5	291.1	163.5	181.3	131.5	29.7	113.2	594.4	132.3	200.2
13	HT-116	187.5	35.3	301.2	303.8	217.6	209.1	156.9	26.3	138.8	146.0	132.1	120.0
14	HT-117	193.7	32.7	344.8	278.2	165.9	203.1	120.8	24.0	210.2	304.9	101.6	152.3
15	HT-118		33.7	403.0	503.7	239.4	294.9		24.0	119.3	367.1	154.9	166.3
	Mean	198.7	36.0	268.3	385.6	168.4	220.8	141.8	27.0	150.8	345.1	170.2	174.7
	LSD (Treat)				ns			LSD (Treat x Variety)			ns		
	LSD (Location x Treat)				14.1*			LSD (Location x Treat x Variety)			4.98*		
	LSD (Variety)				ns			CV (%) Treat			6.23		
	LSD (Location x Variety)				3.52*								

Table 6.3.7 Influence of Heat Stress on total dry matter (g/m2) at flowering at different AICRIP centres *Kharif* 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB	
1	HT-101	1058.9		1036.6	1549.8	612.6	1064.5	936.1		596.0	947.5	658.8	784.6
2	HT-102	1108.3	389.3	940.0	1110.3	676.9	845.0	975.7	357.3	643.7	706.8	659.4	668.6
3	HT-103	883.7	465.7	1190.0	1331.8	785.1	931.2	769.4	400.3	964.6	1620.7	620.2	875.1
4	HT-104	869.8	445.3	1275.3	1381.0	547.4	903.8	765.9	409.3	710.3	560.0	609.3	610.9
5	HT-105	920.5	452.7	1675.2	1611.6	627.8	1057.6	809.7	413.7	922.8	919.3	607.6	734.6
6	HT-106	1054.9	418.7	839.5	1812.4	786.6	982.4	887.2	369.7	694.3	636.0	719.0	661.2
7	HT-107	1268.7		966.3	1480.8	735.3	1112.8	1037.0		554.9	954.5	447.1	748.4
8	HT-108	861.4		1353.2	2212.3	534.3	1240.3	788.0		1021.7	1691.6	511.6	1003.2
9	HT-111	935.2	466.0	1215.5	2316.2	627.7	1112.1	737.0	405.9	982.2	1311.1	676.3	822.5
10	HT-112	682.0	455.0	1395.0	1690.2	543.8	953.2	576.5	354.6	714.8	836.4	648.0	626.1
11	HT-114	796.8	448.0	1352.3	1679.0	595.2	974.2	714.1	373.0	915.8	339.8	359.6	540.5
12	HT-115	883.5	442.7	1552.3	1749.2	584.1	1042.4	839.6	398.4	1055.3	962.1	502.7	751.6
13	HT-116	937.0	459.3	1289.8	1222.9	636.5	909.1	866.1	356.3	878.2	375.4	580.7	611.4
14	HT-117	698.1	416.2	1226.5	1357.2	580.0	855.6	568.0	379.7	833.5	702.9	415.7	580.0
15	HT-118		446.1	1421.8	1952.6	731.9	1138.1		387.5	795.9	1924.3	481.4	897.3
	Mean	925.6	442.1	1248.6	1630.5	640.3	1008.1	805.0	383.8	818.9	965.9	566.5	727.7
	LSD (Treat)	ns						LSD (Treat x Variety)					
	LSD (Location x Treat)	36.0**						LSD (Location x Treat x Variety)					
	LSD (Variety)	3.61*						CV (%) Treat					
	LSD (Location x Variety)	8.82**											

Table 6.3.8 Influence of Heat Stress on Chlorophyll content (mg/g² fw) at flowering stage at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean
		Rewa	MTU	PNR	PTB	Kaul		Rewa	MTU	PNR	PTB	Kaul	
1	HT-101	2.93	3.27	3.60	3.60	3.81	3.44	2.80	3.80	3.40	4.30	3.84	3.63
2	HT-102	3.63	2.21	4.03	3.95	3.40	3.44	3.51	1.74	3.77	3.80	3.35	3.24
3	HT-103	3.22	2.76	3.69	3.36	4.20	3.45	3.06	2.48	3.32	4.36	4.22	3.49
4	HT-104	2.85	2.57	3.83	3.26	3.70	3.24	2.68	2.28	3.45	3.67	3.74	3.16
5	HT-105	2.79	2.46	4.68	3.59	3.74	3.45	2.71	2.17	3.78	4.61	3.81	3.42
6	HT-106	3.14	2.19	3.66	4.44	3.34	3.35	3.04	1.75	3.27	4.50	3.42	3.20
7	HT-107	2.71	3.73	3.85	3.88	4.08	3.65	2.60	3.13	3.38	4.24	4.12	3.49
8	HT-108	2.94	3.71	3.76	4.43	3.09	3.59	2.78	3.43	3.24	4.42	3.56	3.49
9	HT-111	3.27	2.50	3.84	4.65	4.14	3.68	3.12	2.25	3.45	3.90	4.28	3.40
10	HT-112	3.42	2.36	3.81	3.07	3.90	3.31	3.22	1.72	3.59	4.03	3.81	3.27
11	HT-114	3.25	2.43	4.08	3.53	4.14	3.49	3.08	1.96	3.14	4.17	4.20	3.31
12	HT-115	3.10	2.38	3.26	2.85	4.14	3.15	2.97	1.77	3.17	3.44	4.07	3.08
13	HT-116	2.76	2.18	3.67	3.77	3.73	3.22	2.66	1.72	3.40	4.37	3.86	3.20
14	HT-117	2.63	2.47	3.66	3.99	4.16	3.38	2.37	2.00	3.25	2.84	4.23	2.94
15	HT-118	3.44	2.64	3.58	3.89	4.06	3.52	2.85	2.12	3.14	3.80	4.12	3.21
	Mean	3.07	2.66	3.80	3.75	3.84	3.42	2.90	2.29	3.38	4.03	3.91	3.30
	<i>LSD (Treat)</i>	ns						<i>LSD (Treat x Variety)</i>					
	<i>LSD (Location x Treat)</i>	0.575*						<i>LSD (Location x Treat x Variety)</i>					
	<i>LSD (Variety)</i>	ns						<i>CV (%) Treat</i>					
	<i>LSD (Location x Variety)</i>	0.179*											

Table 6.3.9 Influence of Heat Stress on Leaf Area Index at flowering at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control			Grand Mean	Heat Stress			Grand Mean
		Rewa	PNR	PTB		Rewa	PNR	PTB	
1	HT-101	5.53	3.33	5.53	4.80	3.84	3.33	5.53	4.24
2	HT-102	5.68	5.04	6.72	5.81	4.06	5.04	6.72	5.27
3	HT-103	6.21	4.84	6.86	5.97	5.17	4.84	6.86	5.62
4	HT-104	5.12	4.55	6.02	5.23	4.48	4.55	6.02	5.02
5	HT-105	6.02	4.30	5.25	5.19	4.69	4.30	5.25	4.75
6	HT-106	4.48	4.06	4.45	4.33	2.84	4.06	4.45	3.78
7	HT-107	5.81	3.44	4.15	4.47	4.11	3.44	4.15	3.90
8	HT-108	4.28	2.76	5.32	4.12	2.87	2.76	5.32	3.65
9	HT-111	6.00	2.04	6.56	4.87	4.76	2.04	6.56	4.45
10	HT-112	5.68	3.01	4.4	4.51	4.83	3.01	4.84	4.23
11	HT-114	4.74	3.34	2.43	3.51	3.76	3.34	2.43	3.18
12	HT-115	5.89	3.24	3.67	4.27	4.56	3.24	3.67	3.82
13	HT-116	4.23	2.58	3.35	3.39	3.36	2.58	3.35	3.10
14	HT-117	4.19	2.60	4.02	3.60	3.40	2.60	4.02	3.34
15	HT-118		2.41	4.05	3.23		2.41	4.05	3.23
	Mean	5.28	3.44	4.88	4.49	4.05	3.44	4.88	4.11
	LSD (Treat)	ns				LSD (Treat x Variety)			ns
	LSD (Location x Treat)	1.27**				LSD (Location x Treat x Variety)			0.61**
	LSD (Variety)	0.18**				CV (%) Treat			4.68
	LSD (Location x Variety)	0.44**							

Table 6.3.10 Influence of Heat Stress on Shoot weight (g/m²) at maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean	
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB		
1	HT-101	495.0		750.0	1026.7	487.0	689.7	471.2		515.7	777.3	533.2	615.9	
2	HT-102	494.5	749.0	1006.0	1015.7	537.4	760.5	470.1	553.0	921.7	781.0	520.1	648.2	
3	HT-103	375.3	810.0	1102.2	979.0	523.6	758.0	360.5	747.7	425.8	1221.0	480.9	659.2	
4	HT-104	324.1	796.7	613.0	997.3	504.7	647.2	310.5	580.3	561.7	1334.7	569.0	645.3	
5	HT-105	379.2	822.0	902.6	1103.7	574.9	756.5	343.4	801.3	544.3	935.0	472.4	586.8	
6	HT-106	498.0	759.0	636.0	729.7	574.3	639.4	438.6	610.0	458.0	685.7	579.8	524.7	
7	HT-107	513.5		842.5	938.7	540.2	708.7	456.5		371.0	766.3	356.9	546.9	
8	HT-108	422.2		1329.3	905.7	368.0	756.3	391.7		834.0	1019.3	179.3	636.7	
9	HT-111	412.3	774.0	1036.2	1067.0	357.2	729.3	360.9	507.7	689.3	1213.7	534.6	635.0	
10	HT-112	292.5	775.0	1358.5	971.7	428.6	765.3	254.7	664.0	517.6	1054.2	553.9	587.5	
11	HT-114	367.7	860.3	916.5	1309.0	423.5	775.4	340.1	710.3	642.0	810.3	327.7	591.7	
12	HT-115	389.2	761.0	974.8	1030.3	410.0	713.1	383.2	634.3	566.0	1158.7	344.1	591.7	
13	HT-116	415.1	758.3	743.2	997.3	455.6	673.9	398.1	547.0	425.4	1023.0	436.7	566.6	
14	HT-117	266.6	765.3	820.0	1059.7	310.6	644.4	228.4	634.3	518.1	1177.0	278.1	608.9	
15	HT-118		831.7	890.2	1100.0	526.9	837.2		613.3	599.0	975.3	456.4	628.8	
	Mean	403.2	788.5	928.1	1015.4	468.2	723.7	372.0	633.6	572.6	995.5	441.5	604.9	
	LSD (Treat)	ns							LSD (Treat x Variety)					ns
	LSD (Location x Treat)	24.5**							LSD (Location x Treat x Variety)					9.51*
	LSD (Variety)	ns							CV (%) Treat					5.31
	LSD (Location x Variety)	6.72**												

Table 6.3.11 Influence of Heat Stress on Panicle weight (g/m²) at flowering at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB	
1	HT-101	172.4		209.5	303.8	136.6	205.6	139.4		124.3	441.0	221.6	231.6
2	HT-102	167.8	37.0	192.5	264.2	167.8	165.9	139.8	31.0	136.7	251.7	194.2	150.7
3	HT-103	156.0	39.0	332.7	216.7	167.2	182.3	118.6	32.3	250.8	595.7	182.5	236.0
4	HT-104	202.5	36.7	399.2	536.9	117.5	258.6	159.4	30.0	124.1	160.3	221.0	139.0
5	HT-105	236.2	36.3	314.0	532.6	146.8	253.2	198.2	28.3	208.5	284.4	201.8	184.3
6	HT-106	227.6	30.0	204.2	439.3	217.8	223.8	136.0	19.0	129.5	324.6	220.6	166.0
7	HT-107	302.9		252.7	352.3	207.6	278.9	167.7		114.3	367.3	86.1	183.8
8	HT-108	170.8		126.0	500.1	143.6	235.1	140.9		88.8	470.1	172.1	218.0
9	HT-111	258.8	39.7	222.2	513.5	158.7	238.6	121.6	31.0	180.0	295.7	228.4	171.3
10	HT-112	174.4	34.0	185.5	344.5	137.2	175.1	127.9	23.7	151.7	256.3	230.0	157.9
11	HT-114	171.4	38.3	284.7	402.9	139.3	207.3	126.8	25.0	172.7	317.7	74.2	143.3
12	HT-115	160.3	39.0	252.5	291.1	163.5	181.3	131.5	29.7	113.2	594.4	132.3	200.2
13	HT-116	187.5	35.3	301.2	303.8	217.6	209.1	156.9	26.3	138.8	146.0	132.1	120.0
14	HT-117	193.7	32.7	344.8	278.2	165.9	203.1	120.8	24.0	210.2	304.9	101.6	152.3
15	HT-118		33.7	403.0	503.7	239.4	294.9		24.0	119.3	367.1	154.9	166.3
	Mean	198.7	36.0	268.3	385.6	168.4	220.8	141.8	27.0	150.8	345.1	170.2	174.7
	LSD (Treat)							LSD (Treat x Variety)					
	LSD (Location x Treat)							LSD (Location x Treat x Variety)					
	LSD (Variety)							CV (%) Treat					
	LSD (Location x Variety)												

Table 6.3.12 Influence of Heat Stress on Panicle number/m² at maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	193.3		350.0	308.0	224.0	257.0	266.5	181.0		300.0	243.8	223.0	328.7	255.3
2	HT-102	251.7	418.0	433.3	330.0	264.0	439.0	356.0	236.0	363.0	366.7	375.8	263.3	93.7	283.1
3	HT-103	221.0	429.0	300.0	205.3	287.7	474.0	319.5	196.0	374.0	216.7	370.3	286.3	335.0	296.4
4	HT-104	175.3	451.0	283.3	256.7	293.0	272.0	288.6	150.3	385.0	266.7	432.7	292.0	179.3	284.3
5	HT-105	198.7	462.0	316.7	264.0	236.0	324.7	300.3	198.7	429.0	283.3	146.7	234.0	154.7	241.1
6	HT-106	201.3	506.0	300.0	209.0	253.0	456.0	320.9	201.3	396.0	266.7	192.5	255.0	345.0	276.1
7	HT-107	194.3		300.0	181.5	236.7	428.3	268.2	187.3		216.7	192.5	238.0	570.3	281.0
8	HT-108	251.0		400.0	293.3		243.7	297.0	226.0		283.3	264.0		95.7	217.3
9	HT-111	290.7	473.0	283.3	242.0	223.3	263.3	295.9	275.7	418.0	250.0	258.5	225.3	102.0	254.9
10	HT-112	240.0	484.0	266.7	183.3	246.3	340.7	293.5	223.0	407.0	233.3	291.5	249.3	131.7	256.0
11	HT-114	197.7	429.0	316.7	143.0	261.3	166.0	252.3	189.7	363.0	266.7	357.5	259.1	128.3	260.7
12	HT-115	245.0	451.0	233.3	231.0	294.7	307.0	293.7	226.0	396.0	216.7	421.7	293.0	185.3	289.8
13	HT-116	181.3	451.0	366.7	229.2	296.0	335.3	309.9	178.7	352.0	233.3	295.2	295.3	256.0	268.4
14	HT-117	191.0	451.0	416.7	308.0	291.3	203.7	310.3	184.0	341.0	250.0	313.5	288.7	155.0	255.4
15	HT-118		451.0	333.3	249.3	308.3	206.0	309.6		330.0	283.3	267.7	307.7	167.0	271.1
	Mean	216.6	454.7	326.7	242.2	265.4	314.4	298.8	203.8	379.5	262.2	294.9	265.0	215.2	266.0
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	67.3**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	24.4**													

Table 6.3.13 Influence of Heat Stress on Grain number per panicle at maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean		
		Rewa	MTU	PNR	PTB	Kaul		TTB	Rewa	MTU	PNR	PTB		Kaul	TTB
1	HT-101	147.3		115.0	148.8	133.5	86.7	126.3	117.0		110.7	129.0	116.5	119.3	118.5
2	HT-102	188.3	166.0	107.3	100.7	113.4	185.0	143.5	90.0	103.3	101.3	111.5	103.8	86.7	99.4
3	HT-103	118.3	182.0	124.3	174.2	141.0	171.3	151.9	65.3	137.0	115.3	143.0	24.1	119.0	100.6
4	HT-104	108.0	150.7	104.7	100.2	108.1	75.7	107.9	52.3	113.7	98.7	100.3	86.7	41.0	82.1
5	HT-105	126.7	149.3	126.3	88.0	127.6	110.0	121.3	57.3	111.0	103.7	102.0	23.7	26.0	70.6
6	HT-106	144.3	153.3	115.0	89.7	86.3	151.7	123.4	103.3	108.3	99.7	93.5	76.8	159.3	106.8
7	HT-107	115.0		117.3	127.7	115.2	118.3	118.7	67.0		107.0	125.3	90.7	199.7	117.9
8	HT-108	157.7		206.0	141.7		51.3	139.2	91.7		193.0	149.2		32.7	116.6
9	HT-111	129.0	176.0	156.0	117.2	125.9	171.3	145.9	97.3	130.3	116.0	115.0	22.8	36.7	86.4
10	HT-112	121.3	183.7	139.0	155.2	137.7	145.7	147.1	94.7	101.0	124.0	133.0	24.0	123.3	100.0
11	HT-114	143.0	208.0	226.3	105.8	228.3	38.3	158.3	38.0	126.7	142.7	124.7	100.7	36.0	94.8
12	HT-115	109.7	126.0	133.3	103.5	142.2	85.3	116.7	53.0	92.7	105.0	105.2	24.6	46.7	71.2
13	HT-116	106.0	161.7	170.0	120.2	145.9	144.0	141.3	90.3	113.3	128.7	119.3	24.5	67.3	90.6
14	HT-117	118.7	120.0	182.0	116.2	123.1	40.7	116.8	58.7	79.3	144.7	123.2	22.5	37.0	77.6
15	HT-118		178.3	129.7	137.2	148.7	47.0	128.2		125.0	118.7	139.5	24.9	39.0	89.4
	Mean	131.0	162.9	143.5	121.7	134.1	108.2	132.4	76.9	111.8	120.6	120.9	54.7	78.0	94.8
	LSD (Treat)	4.35*						LSD (Treat x Variety)					ns		
	LSD (Location x Treat)	10.6**						LSD (Location x Treat x Variety)					3.81**		
	LSD (Variety)	ns						CV (%) Treat					5.1		
	LSD (Location x Variety)	2.69**													

Table 6.3.14 Influence of Heat Stress on spikelet number per panicle at maturity at different AICRIP centres *Kharif 2025*

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB	
1	HT-101	167.3		154.7	168.7	183.0	168.4	136.7		131.0	145.3	148.7	140.4
2	HT-102	211.3	181.3	126.7	122.3	255.0	179.3	193.0	172.7	121.7	136.5	184.7	161.7
3	HT-103	180.0	189.7	152.7	197.5	249.0	193.8	172.0	184.3	141.0	187.5	153.0	167.6
4	HT-104	137.3	165.3	132.7	117.8	169.3	144.5	109.3	155.7	118.0	113.2	72.7	113.8
5	HT-105	145.3	163.7	200.7	105.0	174.7	157.9	103.3	155.3	162.0	134.5	53.0	121.6
6	HT-106	174.3	164.3	139.3	104.7	185.3	153.6	122.3	151.0	121.7	112.0	260.3	153.5
7	HT-107	157.3		158.3	153.2	145.3	153.5	143.3		132.0	145.8	271.3	173.1
8	HT-108	216.3		261.7	161.0	110.7	187.4	168.3		241.7	209.0	50.3	167.3
9	HT-111	245.3	196.0	196.3	142.8	241.7	204.4	237.3	184.7	146.0	158.7	64.0	158.1
10	HT-112	202.3	200.0	176.0	189.7	175.7	188.7	154.3	192.0	146.3	179.8	154.3	165.4
11	HT-114	178.0	224.3	260.3	143.3	63.7	173.9	153.0	203.7	240.3	152.3	55.0	160.9
12	HT-115	229.3	138.7	159.3	122.8	185.0	167.0	185.3	134.0	143.0	152.2	76.0	138.1
13	HT-116	125.3	177.7	225.0	155.8	233.0	183.4	108.7	168.7	204.7	149.8	166.7	159.7
14	HT-117	172.0	130.7	215.7	134.2	65.7	143.6	147.0	125.3	179.3	191.2	62.3	141.0
15	HT-118		189.3	187.0	162.7	74.3	153.3		183.0	152.0	162.2	62.3	139.9
	Mean	181.5	176.8	183.1	145.4	167.4	170.2	152.4	167.5	158.7	155.3	122.3	150.8
	LSD (Treat)	8*						LSD (Treat x Variety)					
	LSD (Location x Treat)	19.5**						LSD (Location x Treat x Variety)					
	LSD (Variety)	ns						CV (%) Treat					
	LSD (Location x Variety)	5.57**											

Table 6.3.15 Influence of Heat Stress on panicle weight g/m² at maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	797.0		649.8	303.8	712.6	478.5	588.3	581.2		499.3	441.0	422.6	401.9	469.2
2	HT-102	799.0	559.0	912.5	264.2	720.4	600.2	642.6	447.0	324.7	446.5	251.7	656.2	194.9	386.8
3	HT-103	615.3	609.0	686.3	216.7	684.0	645.1	576.0	338.7	511.7	312.0	595.7	68.6	452.0	379.8
4	HT-104	592.0	613.3	435.8	536.9	541.5	474.8	532.4	315.1	352.0	216.3	160.3	383.3	194.4	270.2
5	HT-105	718.7	656.7	370.0	532.6	728.1	554.3	593.4	446.7	565.0	310.2	284.4	63.1	210.4	313.3
6	HT-106	783.7	546.7	497.0	439.3	554.0	680.0	583.5	597.8	331.7	346.8	324.6	452.7	479.0	422.1
7	HT-107	742.3		532.3	352.3	523.2	608.2	551.7	499.2		210.0	367.3	438.0	808.5	464.6
8	HT-108	775.0		591.2	500.1		452.9	579.8	470.2		252.8	470.1		196.6	347.4
9	HT-111	812.0	613.3	755.3	513.5	771.0	488.0	658.8	544.9	372.0	624.8	295.7	66.9	168.0	345.4
10	HT-112	641.3	593.3	719.5	344.5	698.7	598.6	599.3	483.3	323.3	331.0	256.3	62.2	257.8	285.7
11	HT-114	670.7	601.7	882.0	402.9	946.8	351.2	642.6	263.1	337.0	451.5	317.7	421.5	270.1	343.5
12	HT-115	569.3	590.7	456.3	291.1	887.9	483.0	546.4	327.5	282.0	250.2	594.4	76.3	303.2	305.6
13	HT-116	601.3	628.7	623.7	303.8	727.9	589.6	579.2	441.8	297.7	509.5	146.0	73.9	505.2	329.0
14	HT-117	663.0	600.3	713.0	278.2	611.5	386.6	542.1	324.4	254.0	511.8	304.9	59.6	807.0	376.9
15	HT-118		629.0	649.2	503.7	758.3	388.7	585.8		350.3	371.5	367.1	76.6	324.6	298.0
	Mean	698.6	603.5	631.6	385.6	704.7	518.6	586.8	434.3	358.4	376.3	345.1	237.3	371.6	355.8
	LSD (Treat)	25.1**							LSD (Treat x Variety)						
	LSD (Location x Treat)	61.2**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	24.6**													

Table 6.3.16 Influence of Heat Stress on grain number per m² at maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	28500		40217	45881	29909	22268	33355	21204		33200	31422	25884	39219	30186
2	HT-102	47412	70092	46317	33304	29866	81235	51371	21221	37433	37250	41965	27242	8129	28873
3	HT-103	26174	77869	38383	35789	40427	81233	49979	12810	50952	25267	53786	6877	39873	31594
4	HT-104	18989	68178	29733	25718	31644	20572	32472	7900	43846	26183	43637	25285	7350	25700
5	HT-105	25179	68684	40217	23496	30084	35769	37238	11421	47619	29433	15541	5532	4034	18930
6	HT-106	29093	77880	34267	18715	21881	69150	41831	20816	42724	26617	18219	19349	54944	30445
7	HT-107	22367		35017	24206	27303	50702	31919	13043		23267	26040	21601	16664	20123
8	HT-108	39609		81850	41444		12511	43854	20725		54450	38742		3120	29259
9	HT-111	37523	83182	44633	27738	28072	45145	44382	26864	54516	28817	29845	5138	3741	24820
10	HT-112	29129	88616	37100	28487	33731	49642	44451	21120	40931	29050	38822	5960	16242	25354
11	HT-114	28289	88242	71667	15798	59332	6351	44946	7230	46046	37600	48081	26118	4620	28283
12	HT-115	26912	56771	31300	23335	41843	26214	34396	11973	36696	22833	45100	7208	8678	22081
13	HT-116	19250	72765	62250	28625	42992	48303	45697	16632	39820	29867	34419	7240	17229	24201
14	HT-117	22685	54076	75483	34463	35784	8280	38462	10802	27060	36383	37879	6473	5825	20737
15	HT-118		79948	43100	33497	45677	9677	42380		41250	33467	37591	7648	6513	25294
	Mean	28651	73859	47436	29366	35610	37803	41116	15983	42408	31579	36073	14111	15745	25725
	LSD (Treat)								LSD (Treat x Variety)						
		540**							ns						
	LSD (Location x Treat)								LSD (Location x Treat x Variety)						
		1315**							387**						
	LSD (Variety)								CV (%) Treat						
		ns							8.4						
	LSD (Location x Variety)														
		274**													

Table 6.3.17 Influence of Heat Stress on spikelet number per m² at maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB	
1	HT-101	32346		54283	51937	47001	46392	24031		39300	35331	48857	36880
2	HT-102	53211	76505	54750	38980	111968	67083	43999	62733	44750	51394	17311	44037
3	HT-103	39804	81191	45717	40761	118038	65102	32963	68464	30700	68682	51270	50416
4	HT-104	24102	74712	37850	30492	46064	42644	16049	60071	31400	49218	13022	33952
5	HT-105	28884	75328	63167	27047	56706	50226	18783	66638	46117	20594	8216	32070
6	HT-106	35128	83446	41583	21773	84509	53288	23568	59576	32350	22014	89760	45454
7	HT-107	30585		47767	29285	62249	42471	25954		28483	29057	154707	59550
8	HT-108	54330		104817	47344	26957	58362	37524		68500	55506	4791	41580
9	HT-111	71302	92587	55750	33726	63674	63408	62928	77165	36417	41489	6530	44906
10	HT-112	48540	96536	47250	34793	59828	57389	33373	78078	34133	52278	20314	43635
11	HT-114	35224	95128	82300	21377	10554	48917	28375	74272	64250	57686	7065	46330
12	HT-115	56230	62491	37417	27491	56810	48088	42239	53064	30800	66248	14097	41290
13	HT-116	22729	79959	82433	37173	78145	60088	16893	59290	48017	43165	42675	42008
14	HT-117	32876	58916	89833	38621	13406	46730	26368	42779	44767	59518	9725	36631
15	HT-118		84986	62083	39615	15310	50499		60390	43000	44108	10414	39478
	Mean	40378	80149	60467	34694	56748	53379	30932	63543	41532	46419	33250	42548
	LSD (Treat)	ns						LSD (Treat x Variety)					
	LSD (Location x Treat)	2345**						LSD (Location x Treat x Variety)					
	LSD (Variety)	ns						CV (%) Treat					
	LSD (Location x Variety)	490*											

Table 6.3.18 Influence of Heat Stress on grain yield g/m² at maturity at different AICRIP centres *Kharif 2025*

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	619.7		563.5	550.0	570.1	473.0	555.2	461.5		388.2	465.7	338.1	511.0	432.9
2	HT-102	627.0	508.7	743.8	529.8	576.3	685.0	611.8	307.3	292.0	370.5	482.2	525.0	321.0	383.0
3	HT-103	453.3	559.0	611.6	627.0	547.2	689.0	581.2	224.4	468.3	283.7	705.8	54.9	506.0	373.9
4	HT-104	382.7	562.7	370.0	663.7	433.2	452.7	477.5	160.7	321.7	184.1	621.5	306.6	352.7	324.5
5	HT-105	478.7	602.0	328.9	568.3	582.4	523.7	514.0	222.8	517.7	233.2	507.8	50.5	260.3	298.7
6	HT-106	550.0	496.3	438.4	619.7	443.2	611.3	526.5	437.0	304.7	289.7	496.8	362.2	610.3	416.8
7	HT-107	435.3		400.4	663.7	418.5	594.7	502.5	299.5		154.3	500.5	350.4	383.7	337.7
8	HT-108	600.3		505.2	667.3		401.3	543.6	340.1		210.7	566.5		210.7	332.0
9	HT-111	548.0	561.0	638.3	524.3	616.8	483.3	562.0	415.1	335.0	554.9	579.3	53.5	236.0	362.3
10	HT-112	461.7	546.0	630.0	601.3	559.0	492.7	548.4	349.5	293.0	245.0	682.0	49.7	444.0	343.9
11	HT-114	493.7	553.0	756.2	619.7	757.5	329.7	584.9	127.2	308.7	393.2	443.7	337.2	262.3	312.1
12	HT-115	402.7	549.0	408.0	586.7	710.3	493.7	525.0	190.8	266.7	215.5	599.5	61.1	343.3	279.5
13	HT-116	410.3	579.0	530.3	559.2	582.3	502.7	527.3	275.1	265.7	390.3	562.8	59.2	471.7	337.5
14	HT-117	465.3	593.3	657.3	671.0	489.2	331.3	534.6	200.3	229.3	455.9	606.8	47.6	362.3	317.0
15	HT-118		585.3	616.7	715.0	606.6	345.0	573.7		294.3	323.0	687.5	61.3	397.3	352.7
	Mean	494.9	557.9	546.6	611.1	563.8	493.9	544.6	286.5	324.8	312.8	567.2	189.8	378.2	347.0
	LSD (Treat)	24.6*							LSD (Treat x Variety)						
	LSD (Location x Treat)	60**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	24.2**													

Table 6.3.19 Influence of Heat Stress on TDM g/m² at maturity at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control					Grand Mean	Heat Stress					Grand Mean
		Rewa	MTU	PNR	PTB	TTB		Rewa	MTU	PNR	PTB	TTB	
1	HT-101	1660.9		1399.8	1308.5	965.5	1333.7	1405.6		1014.9	1218.3	935.2	1143.5
2	HT-102	1719.4	749.0	1918.5	1271.1	1137.6	1359.1	1336.3	553.0	1368.2	1010.7	715.0	996.6
3	HT-103	1344.5	810.0	1788.4	1195.7	1168.7	1261.5	1034.5	747.7	737.8	1750.7	932.9	1040.7
4	HT-104	1274.3	796.7	1048.8	1523.2	979.5	1124.5	952.7	580.3	778.0	1494.9	763.4	913.9
5	HT-105	1372.6	822.0	1272.6	1548.3	1129.1	1228.9	1077.2	801.3	854.4	1131.4	682.8	909.4
6	HT-106	1555.2	759.0	1133.0	1169.0	1254.3	1174.1	1346.4	610.0	804.8	1010.3	1058.8	966.1
7	HT-107	1664.2		1374.8	1225.0	1148.3	1353.1	1372.4		581.0	1080.6	1165.4	1049.8
8	HT-108	1443.5		1920.4	1405.7	820.9	1397.6	1126.8		1086.8	1181.0	375.9	942.6
9	HT-111	1457.9	774.0	1791.5	1580.5	845.1	1289.8	1160.3	507.7	1314.0	1509.3	702.5	1038.8
10	HT-112	1154.3	775.0	2078.0	1294.2	1027.2	1265.7	933.3	664.0	848.6	1299.2	811.7	911.4
11	HT-114	1272.3	860.3	1798.5	1700.9	774.7	1281.3	855.7	710.3	1093.5	985.0	597.8	848.5
12	HT-115	1318.6	761.0	1431.1	1321.4	892.9	1145.0	1066.2	634.3	816.2	1643.1	647.3	961.4
13	HT-116	1355.1	758.3	1366.8	1273.7	1045.2	1159.8	1159.8	547.0	934.9	1169.0	941.9	950.5
14	HT-117	1164.0	765.3	1533.0	1337.9	697.1	1099.5	778.5	634.3	1029.9	1481.9	1085.1	1002.0
15	HT-118		831.7	1539.3	1515.7	915.7	1200.6		613.3	970.5	1342.4	781.0	926.8
	Mean	1411.2	788.5	1559.6	1378.0	986.8	1244.9	1114.7	633.6	948.9	1287.2	813.1	973.5
	LSD (Treat)	36.6**						LSD (Treat x Variety)					
	LSD (Location x Treat)	89.4**						LSD (Location x Treat x Variety)					
	LSD (Variety)	8ns						CV (%) Treat					
	LSD (Location x Variety)	19.8*											

Table 6.3.20 Influence of Heat Stress on 1000 grains weight at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	24.2		23.5	20.2	23.8	18.7	22.1	22.1		18.4	19.2	16.3	21.5	19.5
2	HT-102	16.1	19.0	24.2	23.8	24.1	28.0	22.5	14.8	15.5	22.1	22.4	24.1	19.0	19.7
3	HT-103	20.4	18.1	18.2	19.0	17.0	26.1	19.8	18.1	17.5	15.1	18.6	10.0	20.5	16.6
4	HT-104	25.9	21.0	22.9	21.2	17.1	20.4	21.4	21.6	19.5	20.9	20.4	15.2	19.6	19.5
5	HT-105	22.2	14.9	27.6	26.1	24.2	21.4	22.7	20.2	13.7	23.4	25.9	11.4	17.0	18.6
6	HT-106	23.6	14.4	24.4	22.6	25.4	24.6	22.5	21.5	11.5	19.5	21.8	23.4	26.7	20.7
7	HT-107	24.8		22.5	21.0	19.2	22.9	22.1	23.5		17.1	21.3	20.3	28.1	22.1
8	HT-108	18.9		14.9	16.2		17.9	17.0	16.7		17.0	16.4		17.9	17.0
9	HT-111	17.9	16.2	17.3	14.6	27.5	20.2	18.9	15.8	15.4	14.8	15.2	13.0	19.7	15.6
10	HT-112	18.4	17.3	17.7	15.1	20.8	21.3	18.4	17.0	14.9	16.1	14.6	10.4	22.6	15.9
11	HT-114	21.2	16.7	20.1	16.1	16.0	20.2	18.4	18.7	14.5	14.4	14.6	16.2	18.2	16.1
12	HT-115	18.4	18.9	22.5	22.1	21.2	21.0	20.7	16.4	15.4	18.0	20.7	10.6	21.5	17.1
13	HT-116	25.3	19.5	17.2	14.0	16.9	22.2	19.2	22.9	17.6	13.3	14.1	10.2	22.6	16.8
14	HT-117	23.6	22.1	23.2	21.7	17.1	24.3	22.0	20.7	18.0	21.3	21.4	9.2	21.5	18.7
15	HT-118		13.9	17.9	16.9	16.6	23.7	17.8		12.2	12.5	16.2	10.0	22.4	14.7
	Mean	21.5	17.7	20.9	19.4	20.5	22.2	20.4	19.3	15.5	17.6	18.9	14.3	21.2	17.9
	LSD (Treat)	2.34**							LSD (Treat x Variety)						
	LSD (Location x Treat)	5.70**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	2.66**													

Table 6.3.21 Influence of Heat Stress on harvest index (%) at different AICRIP centres Kharif 2025

Sr. No.	Entry	Control						Grand Mean	Heat Stress						Grand Mean
		Rewa	MTU	PNR	PTB	Kaul	TTB		Rewa	MTU	PNR	PTB	Kaul	TTB	
1	HT-101	32.8		40.2	35.0	42.9	49.0	40.0	22.1		38.1	37.2	30.9	54.7	36.6
2	HT-102	23.0	40.5	38.7	34.5	48.2	60.2	40.8	14.8	35.4	27.0	39.2	46.2	44.9	34.6
3	HT-103	21.7	40.8	34.2	40.3	44.1	59.0	40.0	18.1	38.4	38.5	36.8	7.4	54.5	32.3
4	HT-104	16.8	41.6	35.2	40.0	41.6	46.3	36.9	21.6	35.5	23.6	31.8	34.0	46.2	32.1
5	HT-105	20.7	42.3	26.0	33.6	47.1	47.0	36.1	20.2	39.2	27.2	35.8	7.3	38.1	28.0
6	HT-106	32.5	39.8	38.9	45.4	43.2	48.7	41.4	21.5	33.0	36.0	42.5	39.5	57.6	38.4
7	HT-107	21.8		29.0	41.4	45.1	51.8	37.8	23.5		27.1	40.7	41.5	32.9	33.1
8	HT-108	30.2		26.3	42.4		49.4	37.1	16.7		19.5	36.0		56.2	32.1
9	HT-111	35.8	42.0	35.6	32.5	45.7	57.2	41.5	15.8	40.1	42.2	31.7	6.9	33.6	28.4
10	HT-112	37.5	41.3	30.4	38.1	40.8	48.0	39.3	17.0	30.6	28.8	39.0	5.9	54.7	29.3
11	HT-114	14.8	39.1	42.1	32.1	45.4	42.6	36.0	18.7	30.3	36.0	34.9	27.4	43.9	31.9
12	HT-115	17.8	42.0	28.5	37.3	44.8	55.3	37.6	16.4	29.4	26.5	34.2	6.7	53.0	27.7
13	HT-116	23.7	43.2	38.8	36.4	45.1	48.1	39.2	22.9	32.7	41.7	35.2	7.8	50.1	31.7
14	HT-117	25.7	43.8	42.9	39.3	43.1	47.6	40.4	20.7	26.6	44.3	33.8	7.1	33.4	27.7
15	HT-118		41.4	40.1	39.3	46.0	37.8	40.9		32.3	33.2	41.1	8.1	51.0	33.1
	Mean	25.3	41.5	35.1	37.8	44.5	49.9	39.0	19.3	33.6	32.6	36.7	19.7	47.0	31.8
	LSD (Treat)	ns							LSD (Treat x Variety)						
	LSD (Location x Treat)	6.98**							LSD (Location x Treat x Variety)						
	LSD (Variety)	ns							CV (%) Treat						
	LSD (Location x Variety)	2.64*													

Table 6.3.22 Heat Tolerance Indices of Rice Genotypes for AICRPR Kharif 2025

Genotype	Yp (Control)	Ys (Heat)	TOL	MP	GMP	STI	HSI	YSI
HT-101	555.2	432.9	122.3	494.05	490.25	1.27	0.61	0.78
HT-102	611.8	383.0	228.8	497.40	484.07	1.24	1.03	0.63
HT-103	581.2	373.9	207.3	477.55	466.17	1.15	0.98	0.64
HT-104	477.5	324.5	153.0	401.00	393.64	0.82	0.88	0.68
HT-105	514.0	298.7	215.3	406.35	391.83	0.81	1.15	0.58
HT-106	526.5	416.8	109.7	471.65	468.45	1.16	0.57	0.79
HT-107	502.5	337.7	164.8	420.10	411.94	0.90	0.90	0.67
HT-108	543.6	332.0	211.6	437.80	424.82	0.96	1.07	0.61
HT-111	562.0	362.3	199.7	462.15	451.23	1.08	0.98	0.64
HT-112	548.4	343.9	204.5	446.15	434.27	1.00	1.03	0.63
HT-114	584.9	312.1	272.8	448.50	427.26	0.97	1.29	0.53
HT-115	525.0	279.5	245.5	402.25	383.06	0.78	1.29	0.53
HT-116	527.3	337.5	189.8	432.40	421.86	0.94	0.99	0.64
HT-117	534.6	317.0	217.6	425.80	411.67	0.90	1.12	0.59
HT-118	573.7	352.7	221.0	463.20	449.83	1.07	1.06	0.61

$\bar{Y}_p$ (Control mean) = 544.6 g/m² $\bar{Y}_s$ (Heat mean) = 347.0 g/m²

Table 6.3.23 Ranking of Rice Genotypes for Heat Tolerance Indices for AICRPR Kharif 2025

Rank (HSI)	Genotype	HSI (lower = more tolerant)	STI (higher = more tolerant)	Rank (STI)
1	HT-106	0.57	1.16	3
2	HT-101	0.61	1.27	1
3	HT-104	0.88	0.82	13
4	HT-107	0.90	0.90	11
5	HT-103	0.98	1.15	4
6	HT-111	0.98	1.08	5
7	HT-116	0.99	0.94	10
8	HT-102	1.03	1.24	2
9	HT-112	1.03	1.00	7
10	HT-118	1.06	1.07	6
11	HT-108	1.07	0.96	9
12	HT-117	1.12	0.90	12
13	HT-105	1.15	0.81	14
14	HT-114	1.29	0.97	8
15	HT-115	1.29	0.78	15

Table 6.3.24 Heat Tolerance Indices and Genotype Ranking for AICRPR Kharif 2025

S.No.	Genotype	Mean Yield (g/m ²)	Yield Rank (Yn)	Adj-rank	Adjustment to Yield Rank (Yn)	Stability Variance (σ^2)	Stability Rating	YSi = (Y+S)
1	HT-101	432.9	1	1	0	-	-	1
2	HT-106	416.8	2	2	0	-	-	2
3	HT-102	383.0	3	3	0	-	-	3
4	HT-103	373.9	4	4	0	-	-	4
5	HT-118	352.7	5	5	0	-	-	5
6	HT-111	362.3	6	6	0	-	-	6
7	HT-112	343.9	7	7	0	-	-	7
8	HT-116	337.5	8	8	0	-	-	8
9	HT-107	337.7	9	9	0	-	-	9
10	HT-108	332.0	10	10	0	-	-	10
11	HT-117	317.0	11	11	0	-	-	11
12	HT-104	324.5	12	12	0	-	-	12
13	HT-114	312.1	13	13	0	-	-	13
14	HT-105	298.7	14	14	0	-	-	14
15	HT-115	279.5	15	15	0	-	-	15
	Yield Mean = 347.0 g/m ²							
	YS Mean = 4.39							
	LSD (0.05): 24.6							

Selected genotypes (+): HT-101 and HT-106 (top yield + lowest HSI from previous analysis)

6.4. Screening of Rice Genotypes for Submergence Tolerance

Locations: CBT, PTB, KRK, MTU, TTB, and CRRI

The production potential of rice is increasingly threatened by the frequent occurrence of multiple abiotic stresses, which are linked to global climate change. Among these, the excess water stress, such as stagnant flooding, waterlogging, and submergence are highly detrimental for plant growth and productivity and has garnered the attention of many researchers, leading to extensive research to explore the underlying mechanisms to improve tolerance to excess water stress. Complete submergence stress is characterized by the complete immersion of the plant canopy under water. On the contrary, under waterlogging or stagnant flooding conditions, only a part of the plant canopy remains under water, while a significant upper plant part remains exposed to air above the water surface. To cope with submergence stress, rice plant adapts strategies such as quiescence or escape. Quiescence strategy involves the suppression of internode elongation and conservation of energy, while the escape strategy involves rapid internode elongation to re-establish contact with the air above water surface. With this perspective, a complete submergence trial was conducted during *Kharif 2025*, where promising rice genotypes were subjected to 14 days of complete submergence stress.

The submergence trial was conducted at six different AICRP centers, namely Coimbatore (CBT), Tamil Nadu; Patambi (PTB), Kerala; Karaikal (KRK), Tamil Nadu; Maruteru (MTU), Andhra Pradesh; Titabar (TTB), Assam; and Cuttack (CTC), Odisha. In this experiment, 35 rice lines, including two tolerant (FR 13A and Swarna Sub1) and two susceptible checks (Naveen and Swarna), were subjected to 14 days of complete submergence stress. After de-submergence, these lines were evaluated for some key tolerance traits such as survival rate (%), elongation ability (%), plant height (cm), and leaf starch content (mg g^{-1} DW). Significant variation was observed among the genotypes for all the traits. However, the observations recorded in MTU centre were not included in the analysis as the genotypes were subjected to submergence stress three days after transplanting due to heavy rains. Observations from TTB were excluded from the study as the experiment was not conducted properly (plant height decreased after de-submergence). Among the 35 lines, CRAC-6466-18 was excluded from the analysis as it failed to germinate in all the studied locations. Across the locations, the average survival rate ranged from a lowest value of 26.42% in KRK to a highest of 58.43% in PTB. The tolerant checks FR13A and Swarna Sub1 recorded a high survival rate of 84.08% and 71.11% across all locations. Among the tested entries, AC 42088 recorded the highest survival of 90.56%, which was even higher than FR13A. Another promising accession AC 1996 (84.44%), showed similar survival as FR13A across all locations. In addition, six lines, NICRA 20 (72.53%), AC 34300 (72.96%), AC 1303 (78.04%), CBMAS22063 (63.16%), NICRA 19 (64.39%), and MTU 2795-86-1-1-1 (62.92%) showed a high survival rate of more than 60% (**Figure 6.4.1**).

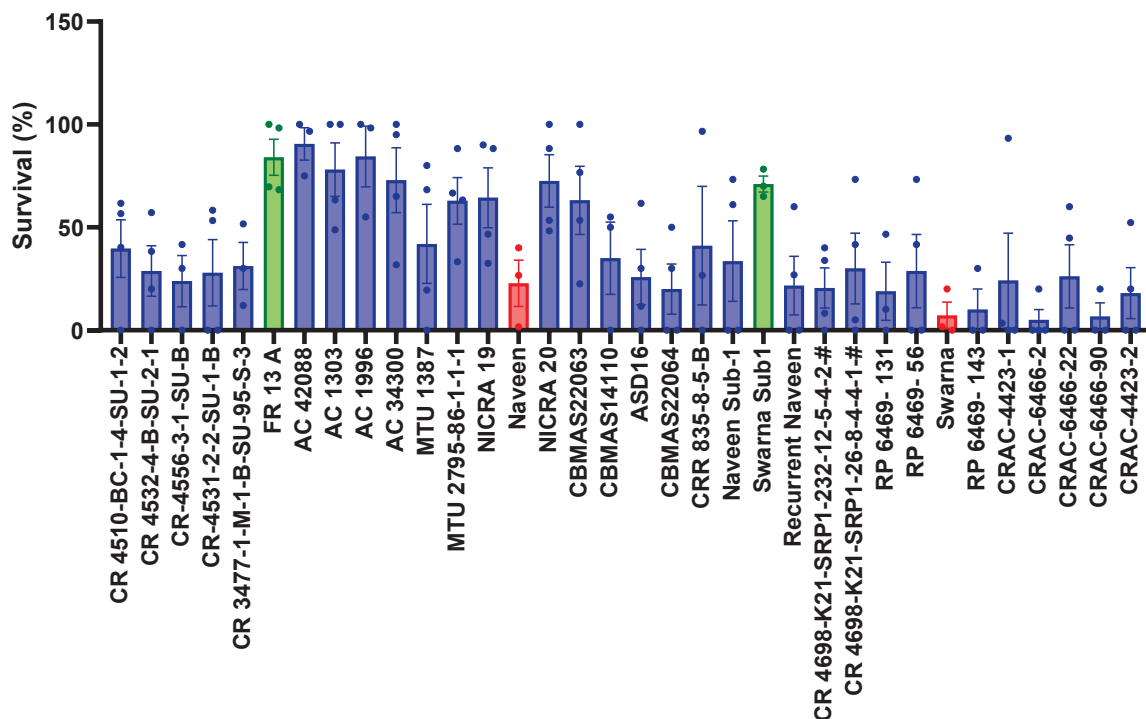


Fig. 6.4.1 Mean survival rate (%) of rice genotypes under 14 days of complete submergence stress. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual locations.

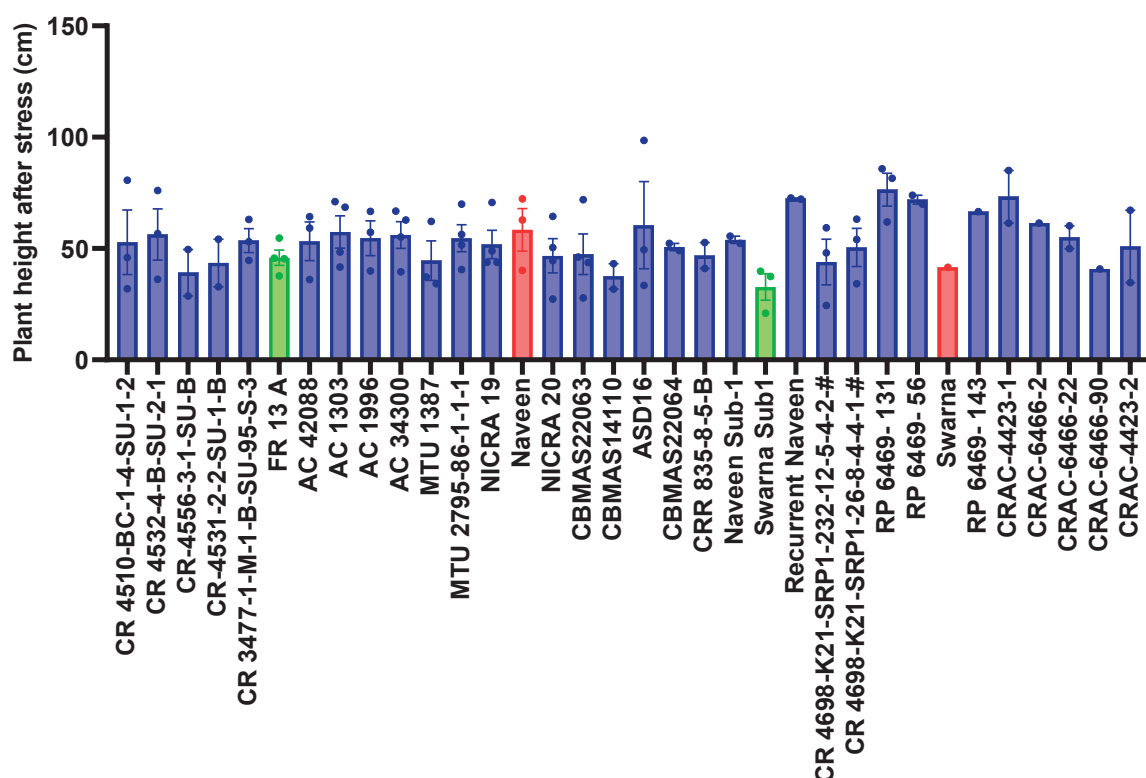


Fig. 6.4.2 Mean plant height (cm) of rice genotypes under 14 days of complete submergence tested across different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual locations.

Elongation ability (EA) varied significantly among the tested lines across the locations, with an overall mean of 38.60%. The susceptible checks Naveen and Swarna recorded a high EA of about 73.31% and 63.50%, respectively. On the contrary, the tolerant checks FR13A and Swarna Sub1 reported the EA of 20.50% and 25.23%, respectively. Among the tested entries, CRR 835-8-5-B recorded the lowest EA of 21.93%, which was even lower than the tolerant check Swarna Sub1. This was followed by CRAC-4423-2 and AC 34300 with EA of 26.88% and 27.66% respectively. AC 34300 showed a high survival rate with low EA. The elongation ability of elite lines with high survival ability (>60%) ranged from 20.54% to 40.10% (**Figure 6.4.3**).

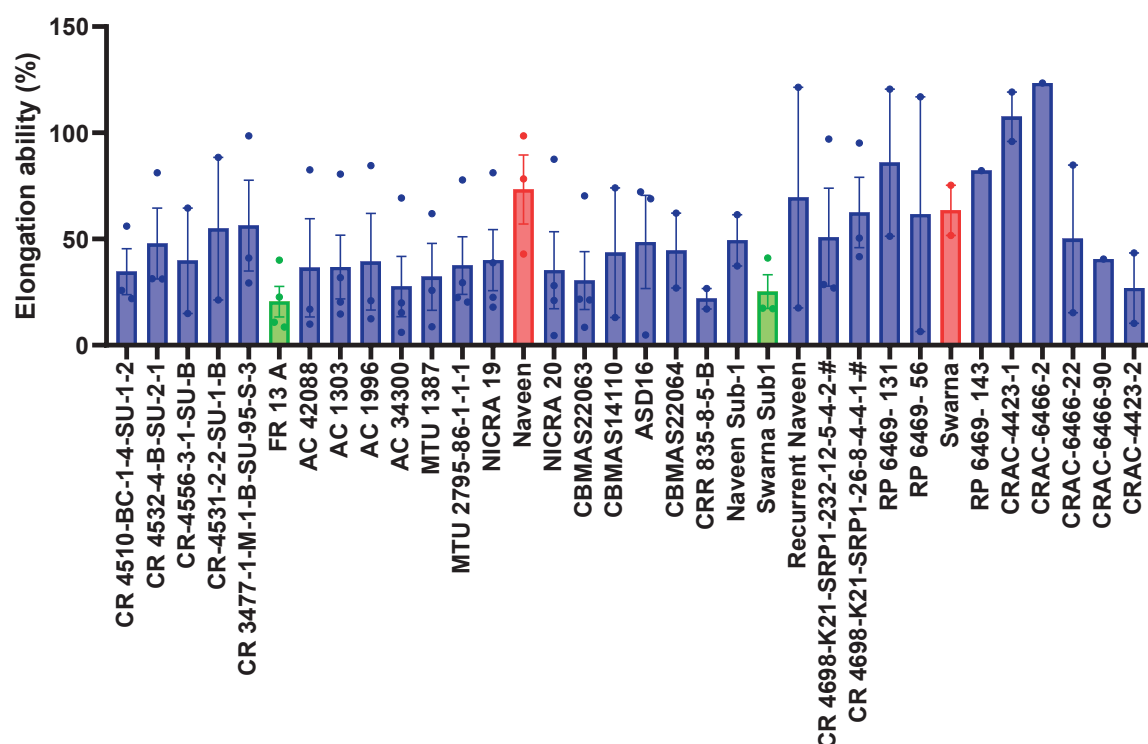


Fig. 6.4.3 Mean elongation ability (%) of rice genotypes under 14 days of complete submergence tested across different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual locations.

Leaf starch content and its depletion under submergence stress are other important factor that determines the submergence tolerance of rice genotypes. The genotypes with the *SUB1A* gene generally conserve starch during submerged condition which is utilized to resume growth post submergence stress. The starch content depletion of these genotypes is comparatively lower. Among the tested entries, highest leaf starch content was noted in Naveen Sub-1 (75.36 mg g⁻¹ DW), CBMAS22063 (72.15 mg g⁻¹ DW), CBMAS22064 (70.69 mg g⁻¹ DW), ASD16 (69.33 mg g⁻¹ DW), CBMAS14110 (67.00 mg g⁻¹ DW), AC 42088 (66.98 mg g⁻¹ DW), AC 1996 (63.27 mg g⁻¹ DW), AC 1303 (60.78 mg g⁻¹ DW), NICRA 20 (59.51 mg g⁻¹ DW), MTU 2795-86-1-1-1 (59.13 mg g⁻¹ DW), AC 34300 (58.99 mg g⁻¹ DW) which was even higher than the tolerant check Swarna Sub-1 (58.43 mg g⁻¹ DW). Whereas, the lowest starch content was noted in Swarna (29.60 mg g⁻¹ DW), followed by RP 6469-131 (30.69 mg g⁻¹ DW) (**Figure 6.4.4**). As per data obtained from different locations, the survival rate of rice lines was found to be

significantly (P value < 0.01) and positively ($R^2 = 0.216$) associated with leaf starch content (Figure 6.4.5).

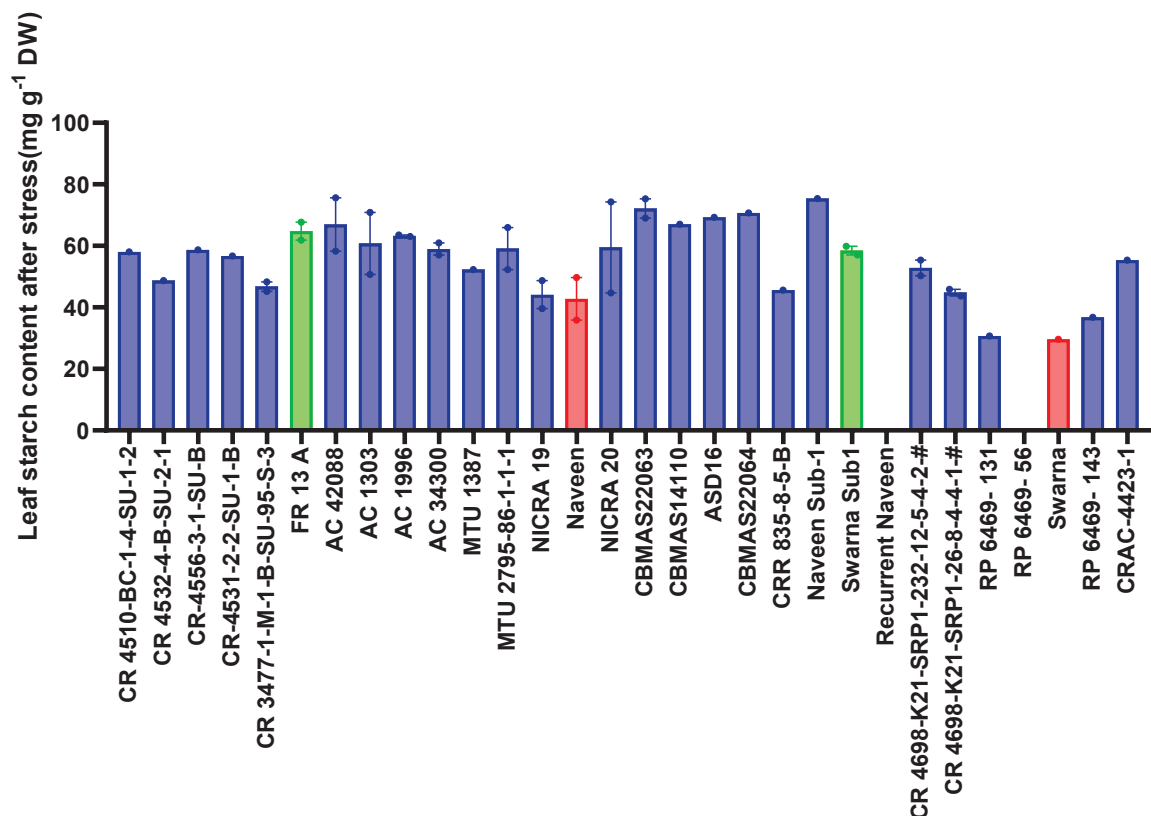


Fig. 6.4.4 Mean starch content (mg g^{-1} DW) of rice genotypes under 14 days of complete submergence tested across different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual locations.

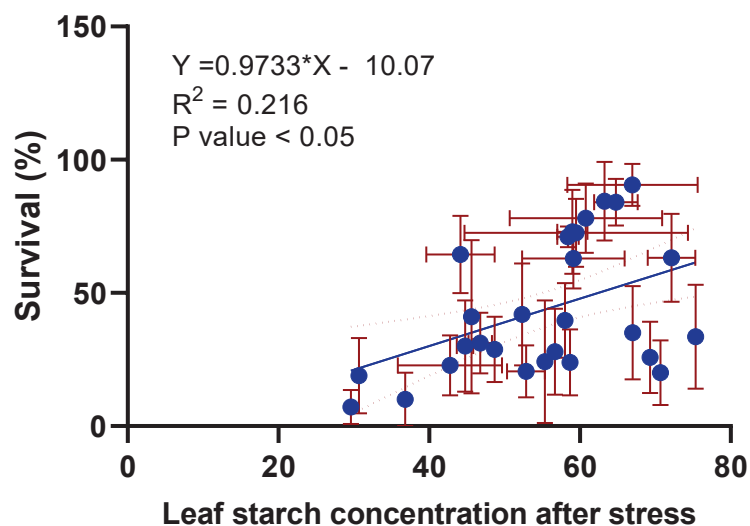


Fig. 6.4.5 An XY-scatter plot showing simple linear regression between survival rate and leaf starch content of rice genotypes under 14 days of complete submergence tested across different locations. Error bars representing SE (mean) of all locations.

Summary & Conclusion:

The submergence trial was conducted across different locations (*CBT*, *PTB*, *KRK*, *MTU*, *TTB*, and *CTC*) using 35 rice genotypes. Across the locations highest survival rate was noted in *PTB* (58.43%) and the lowest in *KRK* (26.42%), with an overall mean of 38.29%. As per the observations recorded from different locations, two tested entries, AC 42088 and AC 1996, were found to be highly tolerant to submergence stress with high survival ability of 90.56% and 84.44%, respectively, across different locations, which was even higher than the tolerant check FR 13A (84.08%) and Swarna Sub1 (71.11%). Apart from this, six more lines (NICRA 20, AC 34300, AC 1303, CBMAS22063, NICRA 19, and MTU 2795-86-1-1-1) with survival ability >60% were considered to be tolerant to complete submergence stress as per multilocation data. From the result obtained from the multilocation trial, it was found that the high tolerance and survival ability of some tested entries under submergence condition attributed to the lower internode elongation and conservation of high leaf starch content during the stress period.

Table 6.4.1 Effect of 14 days of complete submergence stress on survival rate (%) on rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	CBT	PTB	KRK	CRRI	Mean
1	CR 4510-BC-1-4-SU-1-2	61.67	56.67	40.27	0.00	39.65
2	CR 4532-4-B-SU-2-1	38.33	20.00	57.14	0.00	28.87
3	CR-4556-3-1-SU-B	41.67	30.00		0.00	23.89
4	CR-4531-2-2-SU-1-B	58.33	53.33	0.00	0.00	27.92
5	CR 3477-1-M-1-B-SU-95-S-3	51.67	30.00		12.07	31.25
6	FR 13 A	68.33	100.00	69.65	98.33	84.08
7	AC 42088	75.00	100.00		96.67	90.56
8	AC 1303	63.33	100.00	48.82	100.00	78.04
9	AC 1996	55.00	100.00		98.31	84.44
10	AC 34300	65.00	100.00	31.82	95.00	72.96
11	MTU 1387	68.33	80.00	19.53	0.00	41.97
12	MTU 2795-86-1-1-1	66.67	63.33	33.33	88.33	62.92
13	NICRA 19	88.33	90.00	32.57	46.67	64.39
14	Naveen	22.00	26.67		1.72	16.79
15	NICRA 20	88.33	100.00	48.33	53.45	72.53
16	CBMAS22063	76.67	100.00	22.53	53.45	63.16
17	CBMAS14110	55.00	50.00		0.00	35.00
18	ASD16	61.67	30.00	11.65	0.00	25.83
19	CBMAS22064	0.00	30.00	0.00	50.00	20.00
20	CRR 835-8-5-B	0.00	26.67		96.67	41.11
21	Naveen Sub-1	0.00	73.33	0.00	61.02	33.59
22	Swarna Sub1	65.00	70.00		78.33	71.11
23	Recurrent Naveen	0.00	30.00	26.88	0.00	14.22
24	CR 4698-K21-SRP1-232-12-5-4-2-#	8.33	40.00	0.00	33.90	20.56
25	CR 4698-K21-SRP1-26-8-4-4-1-#	5.00	73.33	0.00	41.67	30.00
26	RP 6469- 131	0.00	46.67		10.17	18.95
27	RP 6469- 56	0.00	73.33	41.67	0.00	28.75
28	Swarna	0.00	20.00		1.67	7.22
29	RP 6469- 143	0.00	30.00		0.00	10.00
30	CRAC-4423-1	0.00	93.33	0.00	3.39	24.18
31	CRAC-6466-2	0.00	20.00	0.00	0.00	5.00
32	CRAC-6466-22	0.00	60.00	44.75	0.00	26.19
33	CRAC-6466-90	0.00	20.00		0.00	6.67
34	CRAC-4423-2	0.00	20.00	52.29	0.00	18.07
	Mean	35.34	58.43	26.42	32.96	38.29
	LSD (Genotype)					11.77
	LSD (Location × Genotype)					23.53
	CV (Residual) %					37.11

Table 6.4.2 Effect of 14 days of submergence stress on plant height (in cm after stress) on rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	CBT	PTB	KRK	CRRI	Mean
1	CR 4510-BC-1-4-SU-1-2	31.93	45.97	80.68		52.86
2	CR 4532-4-B-SU-2-1	36.20	56.67	76.09		56.32
3	CR-4556-3-1-SU-B	28.70	49.56			39.13
4	CR-4531-2-2-SU-1-B	32.80	54.22			43.51
5	CR 3477-1-M-1-B-SU-95-S-3	44.63	63.11		53.00	53.58
6	FR 13 A	45.63	37.67	54.73	45.44	45.87
7	AC 42088	36.10	59.22		64.33	53.22
8	AC 1303	41.73	48.44	68.57	71.00	57.44
9	AC 1996	39.97	57.33		66.67	54.66
10	AC 34300	39.60	55.22	62.80	66.78	56.10
11	MTU 1387	34.23	37.17	62.20		44.53
12	MTU 2795-86-1-1-1	40.60	51.56	69.89	56.33	54.60
13	NICRA 19	43.80	43.78	70.74	48.89	51.80
14	Naveen	40.13	62.78		72.33	58.41
15	NICRA 20	27.37	50.44	64.45	44.56	46.71
16	CBMAS22063	27.77	43.67	71.89	46.22	47.39
17	CBMAS14110	31.80	43.22			37.51
18	ASD16	33.43	49.44	98.56		60.48
19	CBMAS22064		49.11		52.33	50.72
20	CRR 835-8-5-B		41.06		52.67	46.86
21	Naveen Sub-1		52.33		55.56	53.94
22	Swarna Sub1	20.90	37.39		39.78	32.69
23	Recurrent Naveen		72.22	72.69		72.46
24	CR 4698-K21-SRP1-232-12-5-4-2-#	24.47	59.33		48.00	43.93
25	CR 4698-K21-SRP1-26-8-4-4-1-#	34.20	63.22		54.00	50.47
26	RP 6469- 131		81.61	85.78	61.89	76.43
27	RP 6469- 56		73.89	69.89		71.89
28	Swarna		41.56			41.56
29	RP 6469- 143		66.61			66.61
30	CRAC-4423-1		85.11		61.44	73.28
31	CRAC-6466-2		61.44			61.44
32	CRAC-6466-22		49.89	60.17		55.03
33	CRAC-6466-90		40.78			40.78
34	CRAC-4423-2		34.67	67.15		50.91
	Mean	35.05	53.52	67.44	55.49	53.03
	LSD (Genotype)					6.99
	LSD (Location × Genotype)					13.98
	CV (Residual) %					16.67

Table 6.4.3 Effect of 14 days of submergence stress on elongation ability (%) on rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	CBT	PTB	KRK	CRRI	Mean
1	CR 4510-BC-1-4-SU-1-2	21.88	56.11	25.77		34.59
2	CR 4532-4-B-SU-2-1	31.16	81.17	31.29		47.87
3	CR-4556-3-1-SU-B	14.95	64.58			39.76
4	CR-4531-2-2-SU-1-B	21.33	88.42			54.87
5	CR 3477-1-M-1-B-SU-95-S-3	41.10	98.60		29.27	56.32
6	FR 13 A	8.56	40.08	22.67	10.84	20.54
7	AC 42088	9.95	82.53		16.97	36.48
8	AC 1303	31.79	80.54	14.73	20.34	36.85
9	AC 1996	12.48	84.62		20.97	39.35
10	AC 34300	19.88	69.34	6.08	15.36	27.66
11	MTU 1387	25.86	61.99	8.68		32.17
12	MTU 2795-86-1-1-1	29.44	77.78	20.33	22.46	37.50
13	NICRA 19	38.75	81.15	17.94	22.56	40.10
14	Naveen	42.99	98.59		78.36	73.31
15	NICRA 20	4.59	87.60	21.09	28.12	35.35
16	CBMAS22063	8.46	70.28	21.30	21.64	30.42
17	CBMAS14110	13.03	74.05			43.54
18	ASD16	4.81	68.88	72.17		48.62
19	CBMAS22064		62.20		26.95	44.58
20	CRR 835-8-5-B		17.12		26.74	21.93
21	Naveen Sub-1		61.47		37.36	49.41
22	Swarna Sub1	17.42	41.09		17.18	25.23
23	Recurrent Naveen		121.47	17.57		69.52
24	CR 4698-K21-SRP1-232-12-5-4-2-#	26.99	97.05		28.57	50.87
25	CR 4698-K21-SRP1-26-8-4-4-1-#	41.71	95.20		50.46	62.46
26	RP 6469- 131		120.57		51.33	85.95
27	RP 6469- 56		116.97	6.40		61.68
28	Swarna		51.72		75.28	63.50
29	RP 6469- 143		82.22			82.22
30	CRAC-4423-1		119.17		95.94	107.56
31	CRAC-6466-2		123.43			123.43
32	CRAC-6466-22		84.77	15.28		50.02
33	CRAC-6466-90		40.61			40.61
34	CRAC-4423-2		43.45	10.32		26.88
	Mean	22.24	77.79	20.77	33.58	38.60
	LSD (Genotype)					13.95
	LSD (Location × Genotype)					27.91
	CV (Residual) %					37.87

Table 6.4.4 Effect of 14 days of submergence stress on leaf starch concentration (mg g⁻¹ leaf dry weight) on rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	CBT	CRR1	Mean
1	CR 4510-BC-1-4-SU-1-2	58.00		58.00
2	CR 4532-4-B-SU-2-1	48.67		48.67
3	CR-4556-3-1-SU-B	58.67		58.67
4	CR-4531-2-2-SU-1-B	56.67		56.67
5	CR 3477-1-M-1-B-SU-95-S-3	48.33	45.23	46.78
6	FR 13 A	67.67	61.90	64.78
7	AC 42088	58.33	75.62	66.98
8	AC 1303	50.67	70.90	60.78
9	AC 1996	63.00	63.54	63.27
10	AC 34300	57.00	60.98	58.99
11	MTU 1387	52.33		52.33
12	MTU 2795-86-1-1-1	52.33	65.92	59.13
13	NICRA 19	48.67	39.61	44.14
14	Naveen	49.67	35.86	42.76
15	NICRA 20	74.33	44.69	59.51
16	CBMAS22063	69.00	75.30	72.15
17	CBMAS14110	67.00		67.00
18	ASD16	69.33		69.33
19	CBMAS22064		70.69	70.69
20	CRR 835-8-5-B		45.63	45.63
21	Naveen Sub-1		75.36	75.36
22	Swarna Sub1	57.00	59.86	58.43
23	Recurrent Naveen			
24	CR 4698-K21-SRP1-232-12-5-4-2-#	50.33	55.36	52.85
25	CR 4698-K21-SRP1-26-8-4-4-1-#	43.67	45.86	44.76
26	RP 6469- 131		30.69	30.69
27	RP 6469- 56			
28	Swarna		29.60	29.60
29	RP 6469- 143		36.81	36.81
30	CRAC-4423-1		55.37	55.37
31	CRAC-6466-2			
32	CRAC-6466-22			
33	CRAC-6466-90			
34	CRAC-4423-2			
	Mean	57.17	54.51	55.84
	LSD (Genotype)	8.59		
	LSD (Location × Genotype)	12.15		
	CV (Residual) %	13.40		

6.5. Physiological Characterization of selected rice genotypes for multiple abiotic stress tolerance

Locations: CBT, CRRI, FZB, KJT, KRK, MTU, PNR, PTB, TTB, KAUL

The increasing occurrence of extreme weather events poses a serious threat to agricultural productivity around the world. As rice is grown in a diverse ecosystem, it is frequently exposed to various environmental crises. Major abiotic stresses such as drought, flood, etc., severely affect the growth and productivity of rice. However, the high genetic diversity of rice enables researchers to identify superior rice genotypes showing tolerance to multiple abiotic stresses, which can be used as donors to increase rice yield. In light of this, an experiment was conducted to identify and characterize the rice genotypes tolerant to multiple abiotic stresses. In the current experiment, a panel of 35 rice genotypes were exposed to three different abiotic stress *viz.* (i) anaerobic condition (8-10 cm of standing water above the soil surface) after direct sowing of the seeds, (ii) salinity (equivalent to 12 dS m⁻¹ of NaCl) at early seedling stage, and (iii) osmotic or dehydration stress (1 and 2% mannitol solution equivalent to -3.0 to -5.0 bars osmotic potential) at early seedling stage. Salinity and osmotic stress experiments were conducted using the hydroponic technique using Yoshida's nutrient media, following the method described by Gregory *et al.* (1997). Rice plants of 3-4-leaf stage were exposed to salinity stress and osmotic stress independently by supplementation of NaCl and mannitol solutions, respectively. Separate sets of plants were maintained as controls by growing in normal Yoshida's solution. The anaerobic germination experiment was conducted in a plastic tray filled with 5 cm of soil. An anoxic condition was created by filling the tray with 10 cm of water after the seeds were sown. Seeds were allowed to germinate under water in anoxic conditions, while another set was maintained as a control, allowing seeds to germinate under aerobic conditions without water. A panel of 35 rice accessions was subjected to three different abiotic stress conditions, *viz.* anaerobic stress, salinity stress, and osmotic stress, independently at different AICRIP centres across India. The results received from different centres are presented below.

Anaerobic Germination:

Anaerobic germination potential (AGP) of the 35 rice entries was examined at 10 AICRP locations, including CBT, FZB, KRK, KJT, KAUL, PTB, MTU, PNR, TTB, and CRRI. The AGP of these lines was presented as the anaerobic germination index (AGI), which was calculated as the ratio of germination percentage under anaerobic conditions to the germination percentage under aerobic conditions. Across the locations, the mean AGI of the rice entries ranged from the lowest AGI of 22.14% in CBT to the highest AGI of 78.49% in FZB, where the overall mean was 44.55%, and CV was 20.04%. Based on the multilocation trial, Rahaspanjar, the tolerant check showed the highest AGI of about 59.87%. Among the tested entries, CR-4084-2-1-Sal-1 (58.88%), CRAC-3995-68 (57.30%), AC 41644 (56.80%), AC 42088 (55.49%), NICRA 20 (52.47%), AC 1303 (51.38%), RP 6469- 56 (51.22%), CBMAS22041 (50.13%), and AC 40331 (50.01) recorded the AGI of more than 50% across the locations and considered as tolerant to anaerobic condition. Whereas, the lowest AGI was noted in the susceptible checks FL478 (31.38%) and IR 29 (31.51%) (**Figure 6.5.1**).

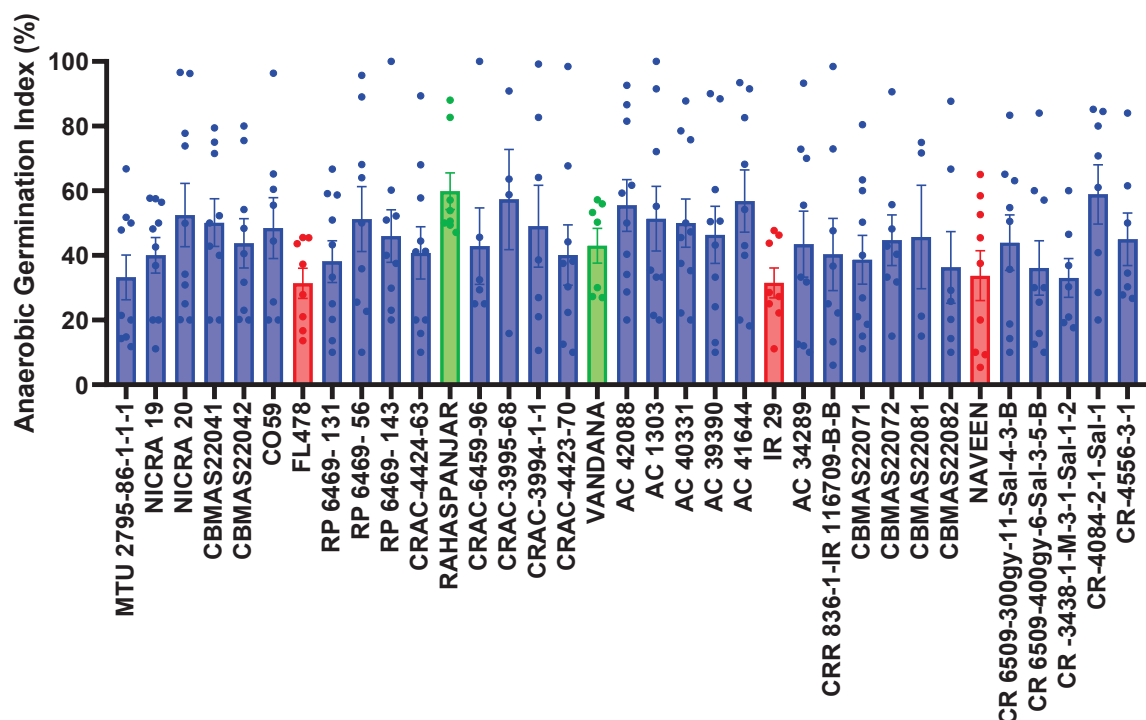


Fig. 6.5.1 Mean AGI (%) of rice genotypes recorded after 21 days of germination stage under anaerobic conditions tested at 10 different locations. Error bars representing SE (mean) of all locations, and scattered dots are representing mean of individual locations.

Alongside AGP, rice plants' ability to tolerate AG stress also depends on the elongation of the epicotyl of rice genotypes underwater. Epicotyl length of the germinated genotypes was noted 21 days after sowing under anaerobic conditions. The multilocation trial showed significant variation among the tested entries for epicotyl length under anaerobic conditions. Across the locations the epicotyl length ranged from 10.5 cm in FZB to 44.6cm in TTB with over mean of 23.1 cm and CV of 16.24% Highest epicotyl length was recorded for the tolerant check Rahaspanjar (30.9 cm) followed by the tested entries, AC 40331 (29.5 cm), RP 6469- 56 (29.2 cm), AC 41644 (29.2 cm), AC 1303 (29.1 cm), CR-4084-2-1-Sal-1 (27.4 cm), CRAC-4423-70 (26.6 cm), RP 6469- 143 (26.5 cm), CRAC-4424-63 (26.3 cm), and AC 42088 (26 cm). Whereas, the lowest epicotyl length was noted in CBMAS22072 (16.9 cm), followed by CBMAS22082 (17.5 cm), which was even lower than the susceptible check IR 29 (17.9 cm) and Naveen (20.1 cm) (**Figure 6.5.2**). Additionally, a highly significant ($R^2=0.386^{***}$) and positive association was found between AGI and epicotyl length at 21 days after anaerobic germination. This suggests that higher epicotyl length contributes to a higher germination potential of rice under anaerobic conditions (**Figure 6.5.3**).

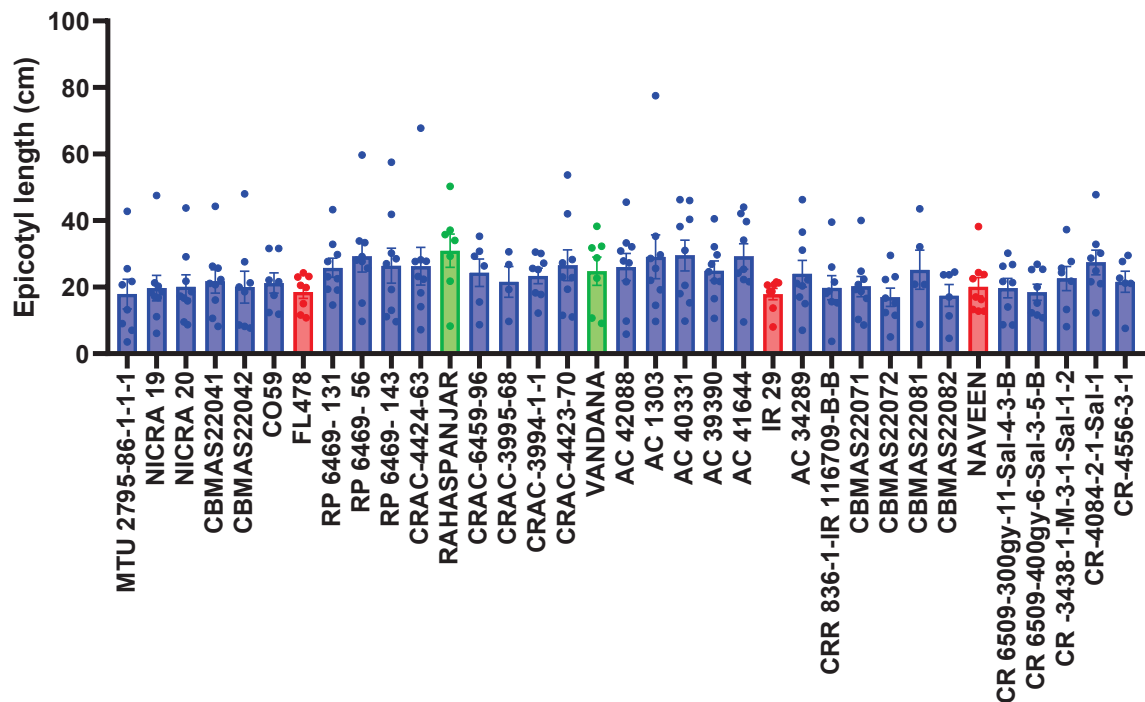


Fig. 6.5.2 Mean length of epicotyl (cm) of rice genotypes recorded after 21 days of germination stage under anaerobic conditions tested at ten different locations. Error bars representing SE (mean) of all locations, and scattered dots are representing mean of individual locations.

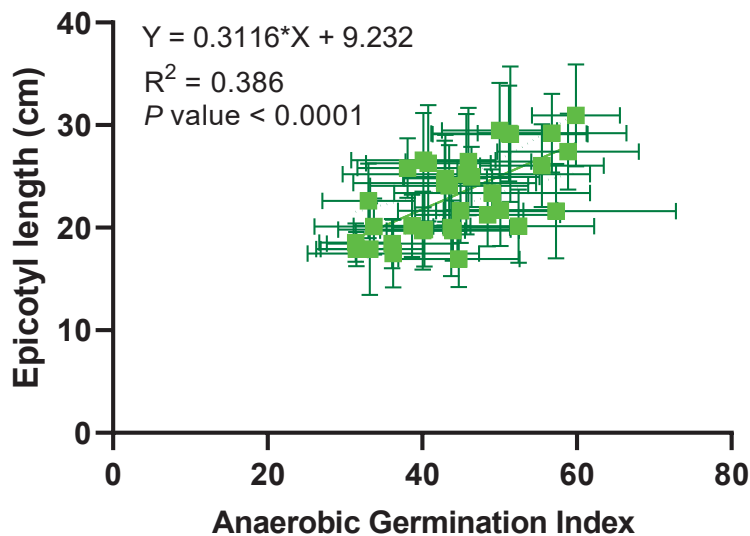


Fig. 6.5.3 An XY-scatter plot showing simple linear regression between anaerobic germination potential and epicotyl length of rice genotypes after 21 days of germination under anaerobic conditions, tested at 10 different locations. Error bars representing SE (mean) of all locations.

Salinity Stress:

Salinity stress tolerance ability of 35 rice genotypes was evaluated across 8 different locations, namely, CBT, CRRI, FZB, KJT, KRK, MTU, PNR, and PTB. Out of that, the results obtained from CBT were not considered for analysis as the performance of the tolerant check was significantly lower than the threshold value. To assess the ability of these genotypes to tolerate salinity stress, these genotypes were evaluated based on root length, shoot length, root dry weight, shoot dry weight, chlorophyll content, visual salt injury score, and shoot Na^+/K^+ ratio at the seedling stage under saline conditions. The genotypes varied significantly for root length under salinity stress. Under salinity stress condition root length declined from 10.76 cm in the control to 7.11 cm in stress, with 33.95% reduction over the control. Among the tested lines, the decline in root length in response to salinity stress was highest in CBMAS22041 (48.20%), followed by CBMAS22072 (42.94%). Susceptible check IR 29 and Naveen showed 47.01% and 41.13% decline in root length over the control. Whereas, the least reduction in root length was noted in the tested entries, AC 40331 (15.47%), CRAC-3995-68 (15.55%), and CRAC-4423-70 (15.74%), which was even lower than the tolerant check FL 478 (15.91%). RP 6469- 143 (16.21%), CRAC-4424-63 (17.64%), CR-4556-3-1 (17.80%), CR-4084-2-1-Sal-1 (19.59%), RP 6469- 56 (20.18%), and AC 1303 (21.40%) showed a lower decline in root length than Rahaspanjar (22.34%). Significant variation was noted among the genotypes for shoot length under salinity across the location. About 14.66% decline in shoot length was recorded due to salinity stress, which was 22.13cm in the control and 18.88 cm in salinity. Decline in shoot length in response to salinity was highest in susceptible checks Naveen (34.48%), IR 29 (33.99%), Vandana (30.97%), followed by the tested line CRAC-3994-1-1 (30.54%). Whereas, the lowest reduction in shoot length was observed in AC 42088 (11.41%) and AC 40331 (15.10%), which was even lower tolerant check FL478 (16.16%). AC 1303 (17.93%), CRAC-6459-96 (18.14%), AC 41644 (18.77%), RP 6469- 143 (19.18%), AC 39390 (21.15%), and CR-4556-3-1 (21.75%) showed a lower decline in shoot length than Rahaspanjar (21.98%) (**Figure 6.5.4**).

Root and shoot dry weight declined significantly under salinity stress compared to controls across the locations. About 36.59% reduction in root dry weight was noted in salinity (0.073 g) than in the control (0.115 g). Decline in root weight was most prominent in RP 6469-131 (38.99%), followed by CR-3438-1-M-3-1-Sal-1-2 (38.68) and the susceptible check IR 29 (37.58%). Whereas, the decline in root dry weight in response to salinity was lowest in AC42088 (20.38%), NICRA 20 (21.29%), AC39390 (21.46%), and AC40331 (23.23%), which was even lower than the tolerant check FL478 (24.32%). About 42.31% cut down in shoot dry weight was observed under salinity stress (0.099 g) compared to the control condition (0.172 g). The highest decline in shoot dry weight under salinity stress was recorded in CBMAS22042 (47.71%), followed by CO59 (45.10%) and RP 6469- 56 (44.98%). Whereas, 11 entries showed very low reduction in shoot dry weight under salinity stress AC42088 (13.86%), CR-3438-1-M-3-1-Sal-1-2 (19.52%), CR6509-400gy-6-Sal-3-5-B (19.57%), CR6509-300gy-11-Sal-4-3B (20.18%), CR-4084-2-1-Sal-1 (20.96%), NICRA 20 (21.47%), AC1303 (22.09%), CRAC-3994-1-1 (23.29%), CBMAS22082 (23.42%), CBMAS22081 (23.93%), CBMAS22071 (24.22%) which was even lower than tolerant check Rahaspanjar (24.54%) (**Figure 6.5.5**).

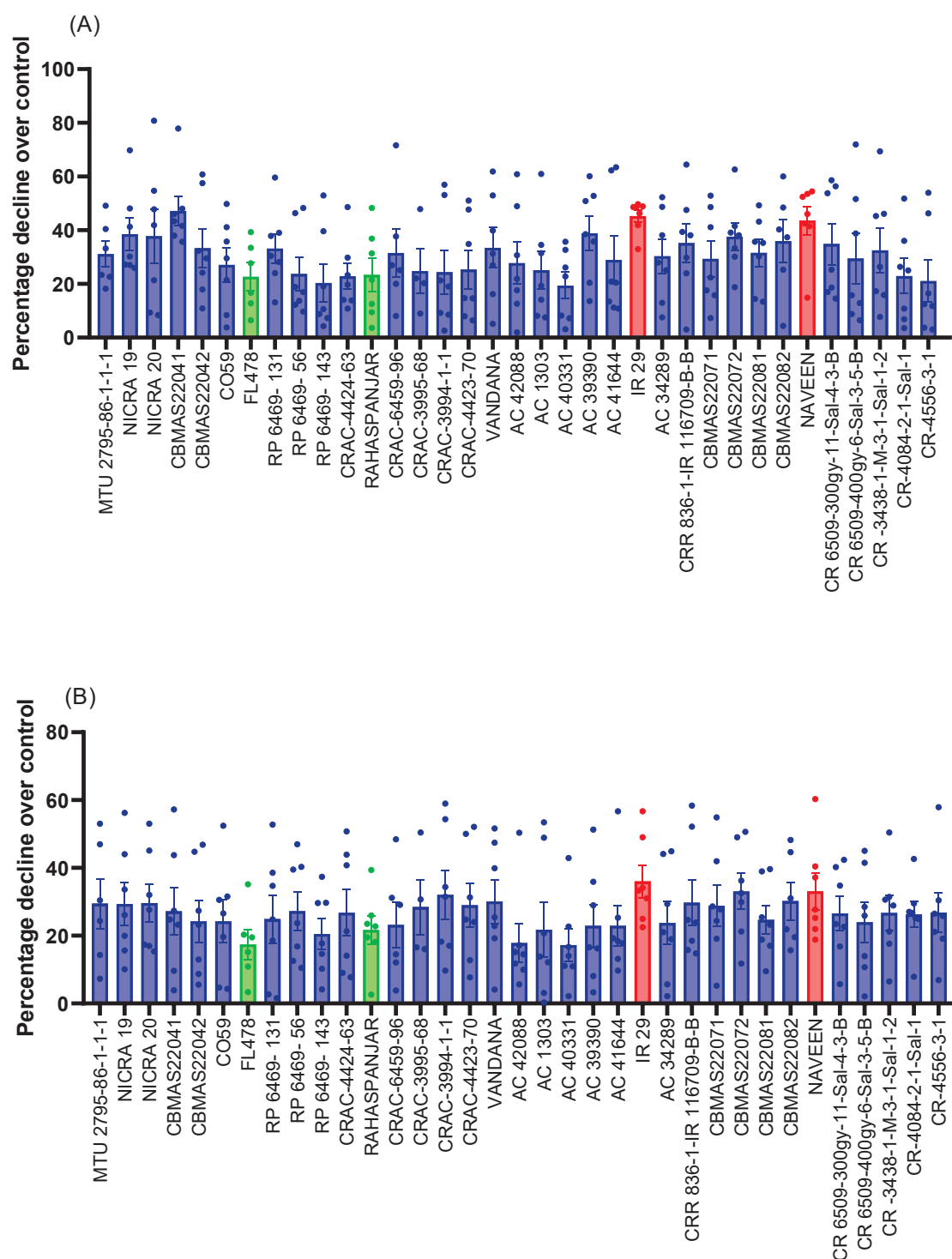


Fig. 6.5.4 Changes in root length (A) and shoot length (B) of 35 rice genotypes (mean of all locations) in response to 12 dS m^{-1} salinity stress imposed at seedling stage tested across distinct locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.

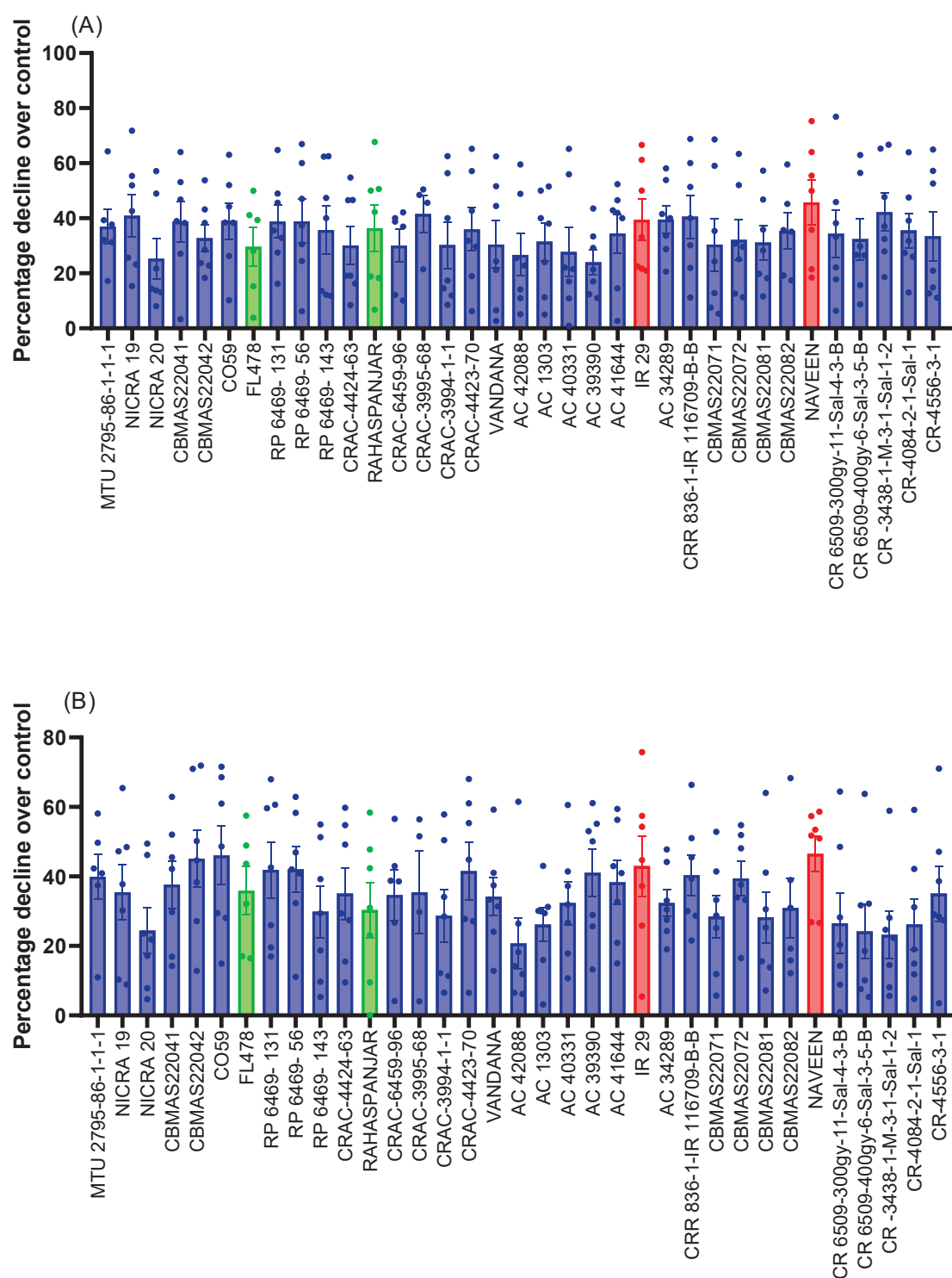


Fig. 6.5.5 Changes in root dry weight (A) and shoot dry weight (B) of 35 rice genotypes (mean of all locations) in response to 12 dS m⁻¹ salinity stress imposed at the seedling stage, tested across locations. Error bars representing SE (mean) of all locations, and scattered dots are representing mean of individual locations.

Chlorophyll content depleted significantly under salinity stress across the locations. About 44.41% decline in chlorophyll content under salinity stress (1.052 mg g⁻¹ FW) was noted as compared to the control (1.893 mg g⁻¹ FW). Among the tested lines, NICRA 19 (52.14%), CO59 (51.34%), and CBMAS22071 (50.20%) recorded the highest decline in total chlorophyll content, followed by the susceptible check IR 29 (48.05%). On the contrary, the lowest reduction in chlorophyll content under salinity stress was observed in CR -3438-1-M-3-1-Sal-1-2 (22.83%), AC40331 (24.71%), AC41644 (25.75%), and CRAC-3994-1-1 (26.50%). Besides these, many genotypes recorded lower depletion in chlorophyll content under salinity stress than the tolerant checks FL 478 (33.41%) and Rahaspanjar (37.30%) (**Figure 6.5.6**).

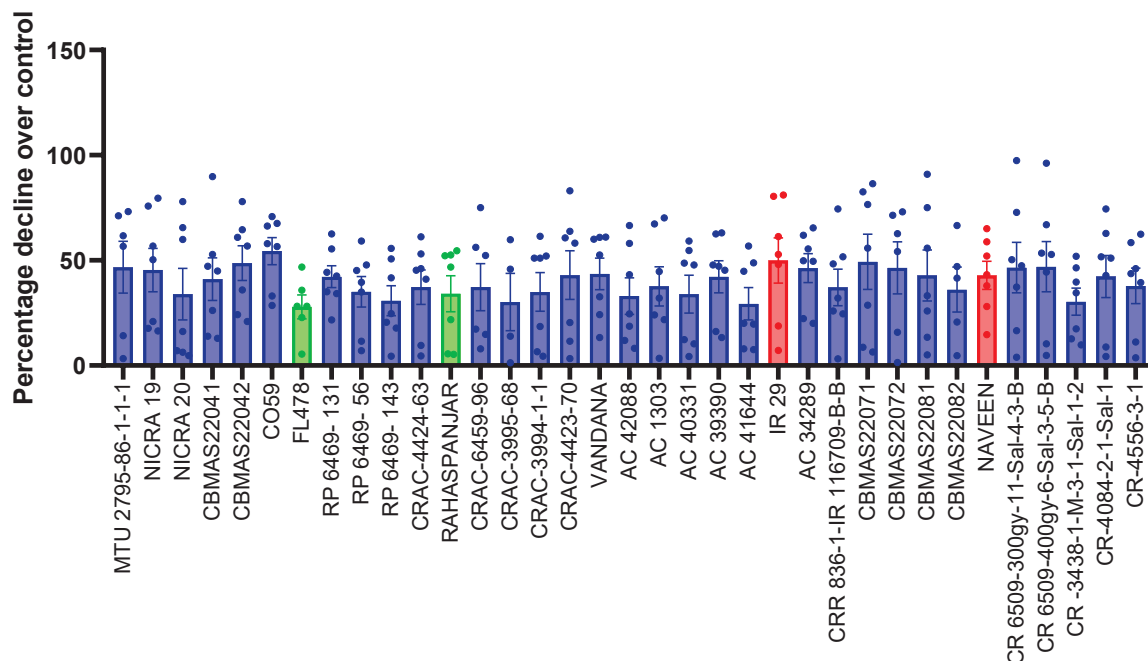


Fig. 6.5.6 Changes in total chlorophyll content of the leaf of 35 rice genotypes (mean of all locations) in response to 12 dS m⁻¹ salinity stress imposed at the seedling stage, tested at different locations. Error bars representing SE (mean) of all locations, and scattered dots are representing mean of individual locations.

A significant difference was found among the genotypes for the SES score recorded at different locations. IR29, a susceptible genotype, recorded the highest SES score of '9'. Apart from this, two entries, CBMAS22072 and CRAC-3995-68, recorded a SES score of '9', and Naveen recorded a SES score of '7'. Whereas, RP 6469- 143, Rahaspanjar, and FL478 recorded a SES score of '3' and can be considered as salt-tolerant genotypes. In addition, 10 genotypes recorded an SES score of '5', which may be considered as moderately tolerant to salinity stress (**Figure 6.5.7**).

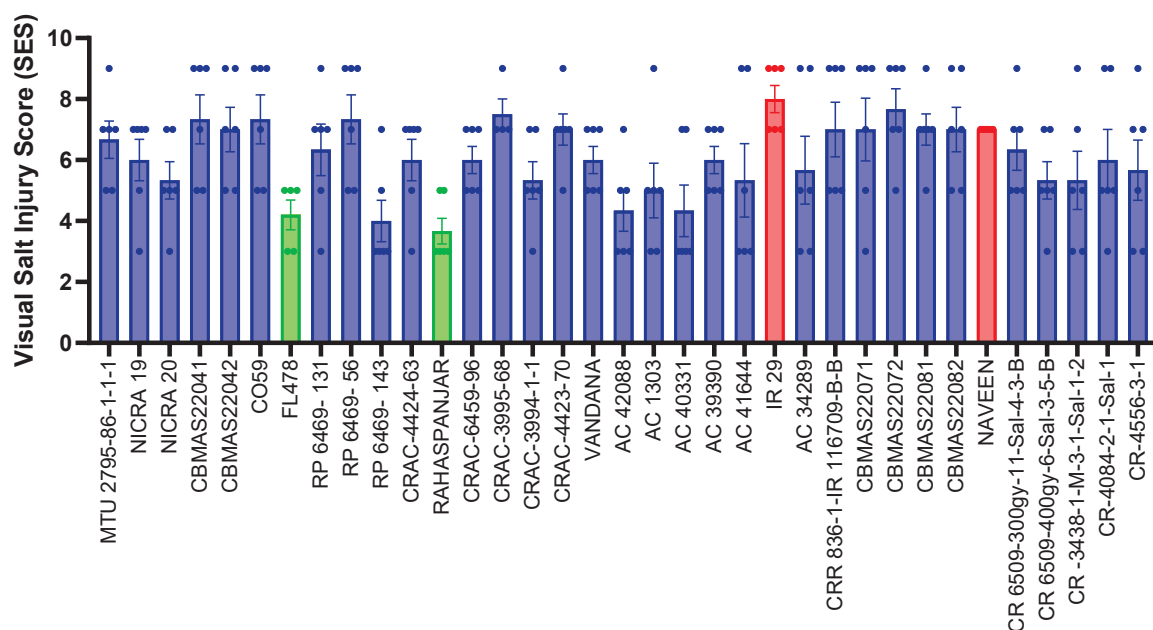


Fig. 6.5.7 Visual salt injury (VSI) score (mean of all locations) in response to 12 dS m⁻¹ salinity stress imposed at the seedling stage, tested at different locations. Error bars representing SE (mean) of all biological replicates. Error bars representing SE (mean) of all locations, and scattered dots are representing mean of individual locations.

The visual salt injury score (SES) and shoot Na⁺/K⁺ ratio under salinity stress conditions are two highly related traits that are mostly used to evaluate the salt tolerance ability of rice genotypes. The result obtained from linear regression analysis revealed a highly significant and positive association between the SES score and the shoot Na⁺/K⁺ ratio of different tested entries ($R^2 = 0.453^{**}$). The shoot Na⁺/K⁺ ratio in different tested entries across the locations ranged from 0.48 to 2.32. The tolerant checks FL 478 and Rahaspanjar recorded the shoot Na⁺/K⁺ ratio of 0.78 and 0.82, respectively. Among the tested entries, AC41644 (0.48), AC42088 (0.60), AC34289 (0.69), CR6509-300gy-11-Sal-4-3-B (0.69), and AC1303 (0.77) recorded even lower shoot Na⁺/K⁺ ratio under salinity stress conditions. These rice lines were considered to be tolerant to salinity stress conditions at the seedling stage. Whereas, the highest shoot Na⁺/K⁺ ratio was noted in IR 29 (2.32), followed by CR-4556-3-1 (2.00), CBMAS22041 (1.96). The evaluation of various adaptive traits showed that AC41644, AC42088, AC34289, CR6509-300gy-11-Sal-4-3-B, AC1303, and AC40331 were potent ion excluder due to which these genotypes were tolerant to seedling stage salt stress (**Figure 6.5.8**).

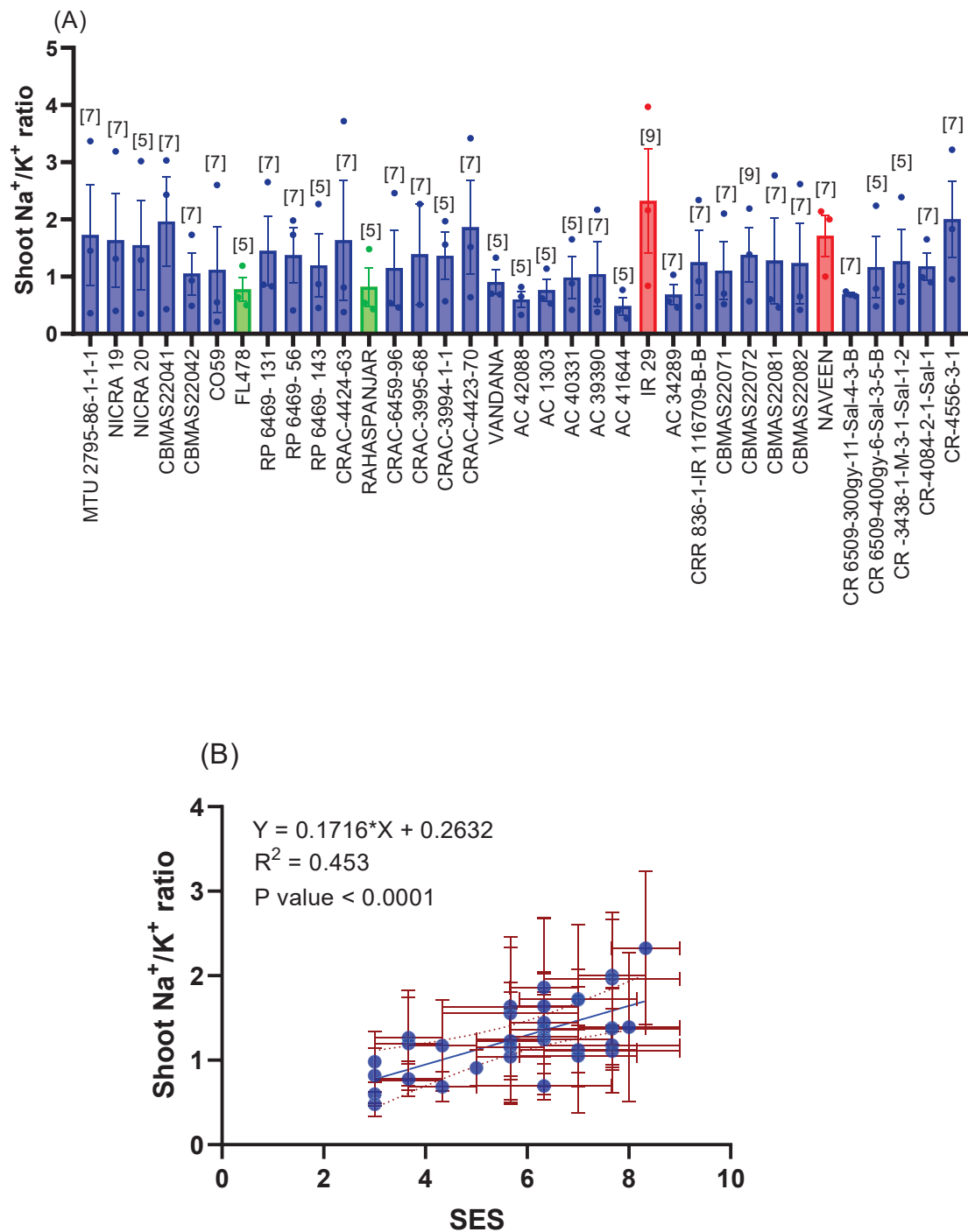


Fig. 6.5.8 Changes in shoot Na^+/K^+ ratio and visual salt injury (VSI) score (A) and XY-scatter plot showing simple linear regression between shoot Na^+/K^+ ratio and visual salt injury (VSI) score (B) of 35 rice entries (mean of all locations) in response to 12 dS m^{-1} salinity stress imposed at seedling stage. Error bars representing SE (mean) of all biological replicates.

Osmotic Stress

Drought or osmotic stress is one of the most prevalent and damaging abiotic stresses affecting plant growth, development, and productivity worldwide. It occurs when plants are exposed to conditions that reduce the availability of water in their surrounding environment, such as drought, soil salinity, or high concentrations of solutes, thereby disrupting the water potential gradient essential for normal cellular function. Under osmotic stress, plants experience a reduction in turgor pressure, impaired nutrient uptake, inhibition of cell expansion, and disruption of key physiological and biochemical processes, including photosynthesis, respiration, and protein synthesis. These adverse effects ultimately lead to stunted growth, reduced biomass accumulation, poor germination, and significant yield losses, particularly during critical developmental stages such as germination and early seedling establishment. Among the major cereal crops, rice (*Oryza sativa* L.) is considered highly sensitive to osmotic stress, making it especially vulnerable in drought-prone and water-limited agricultural ecosystems. The increasing frequency and severity of drought episodes attributed to climate change have further intensified the need to understand plant responses to osmotic stress and to identify genotypes with superior stress tolerance mechanisms. Screening germplasms under controlled osmotic stress conditions, commonly simulated using polyethylene glycol (PEG) or mannitol solutions, has proven to be an effective and reproducible approach for evaluating and categorizing genotypes based on their tolerance or susceptibility, thereby facilitating the development of stress-resilient crop varieties through targeted breeding programs.

The experiment was conducted as a multi-location screening trial involving a total of 35 rice genotypes, evaluated across nine research centres, namely the Central Rice Research Institute (CRRI), Ponnampet (PNR), Coimbatore (CBT), Mandya (MSD), Kakatiya (KAK), Kanjirappally (KJT), Titabar (TTB), Maruteru (MTU), and Patambi (PTB), ensuring a comprehensive and geographically diverse assessment of genotypic performance under stress conditions. The experimental design employed a hydroponic nutrient solution system, wherein osmotic stress was imposed by incorporating mannitol at two concentrations, viz., 1% and 2%, into the nutrient solution to simulate varying levels of water deficit stress at the seedling stage. The use of mannitol as an osmoticum provided a controlled and reproducible stress environment, allowing for reliable comparison of genotypic responses across locations. The 35 rice genotypes included a diverse set of germplasms such as AC40331, AC1303, AC39390, CRAC-3994-1-1, CRAC-3995-68, CR6509-300gy-11-Sal-4-3-B, CR 6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, CR-3438-1-M-3-1-Sal-1-2, CRR836-1-IR 116709-B-B, RP 6469-131, RP6469-143, VANDANA, RAHASPANJAR, NICRA 20, MTU 2795-86-1-1-1, CBMAS22041, CBMAS22042, CBMAS22071, and CBMAS22082, among others, representing a wide range of genetic backgrounds and stress response profiles. Each genotype was assessed for seven key morpho-physiological traits, such as root length, shoot length, root dry weight (RDW), shoot dry weight (SDW), total chlorophyll content, tolerance score, and germination percentage that comprehensively capture the range of seedling-stage responses to mannitol-induced osmotic stress across all participating locations.

Root Length

A screening experiment involving 35 rice genotypes was carried out by several research centres, including CRRI, PNR, CBT, MSD, KAK, KJT, TTB, MTU, and PTB, to assess their performance under water deficit conditions. Drought stress was imposed by incorporating 1% and 2% mannitol into the hydroponic nutrient solution. The results revealed notable variation in root length across genotypes and locations under both stress treatments. The average root length was 7.39 cm under 1% mannitol, which declined to 6.75 cm under 2% mannitol. This

reduction with increasing mannitol concentration suggests that elevated osmotic stress negatively impacts root growth and development. Among the tested genotypes, CRAC-3994-1-1 and AC40331 exhibited the greatest root lengths (8.08 cm and 7.79 cm, respectively), indicating their better adaptability to stress conditions. In contrast, genotypes such as CRAC-3995-68 and CR 6509-400gy-6-Sal-3-5-B showed relatively shorter roots, reflecting their susceptibility to drought stress (**Figure 6.5.9**).

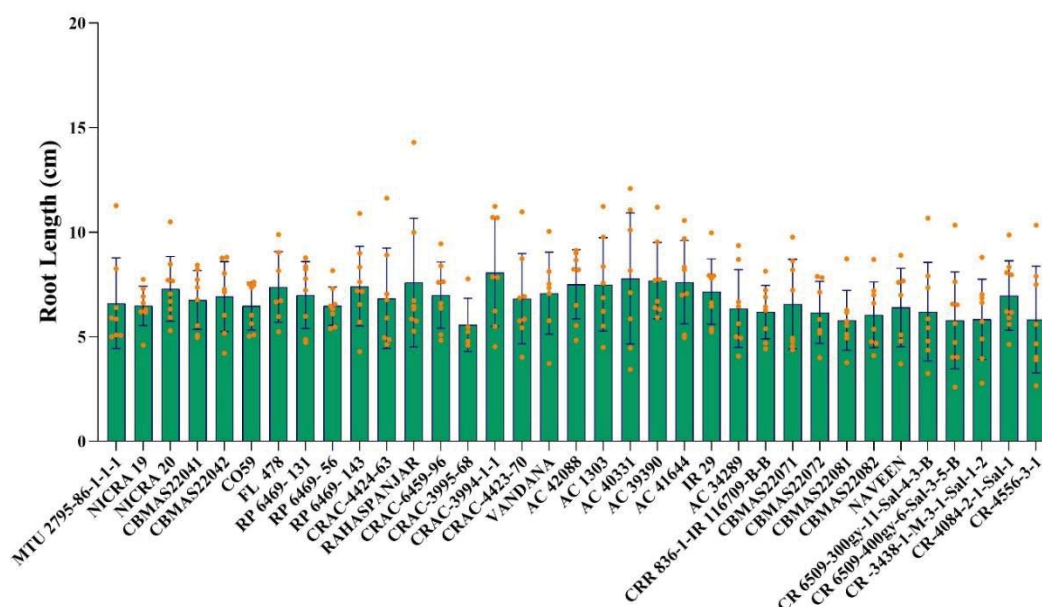


Fig. 6.5.9: Root length of the 35 rice genotypes under 2 % mannitol induced osmotic stress at the seedling stage at nine locations. The error bars represent the standard error mean (SEM) of all locations, and scattered dots represent the means of the individual locations.

Shoot Length:

Variation in shoot length among the different germplasms indicates differential responses to mannitol-induced stress. Under 2% mannitol conditions, shoot length showed considerable variability, ranging from 12.63 cm to 25.58 cm across the tested germplasms. Germplasms such as AC 40331 and AC 1303 recorded higher mean shoot lengths of 25.58 cm and 22.80 cm, respectively, suggesting a relatively better tolerance to osmotic stress. In contrast, germplasms like CBMAS22041 (12.63 cm) exhibited reduced shoot growth, indicating its susceptibility to 2% mannitol stress. Shoot length serves as an important indicator of a plant's genetic potential, adaptability to stress conditions, and overall, its physiological status. Germplasms including AC 40331, AC 1303, and AC 39390 consistently displayed greater shoot elongation, implying the presence of adaptive mechanisms that enable them to cope with mannitol-induced osmotic stress. These genotypes can therefore be considered relatively tolerant to such stress conditions (**Figure 6.5.10**).

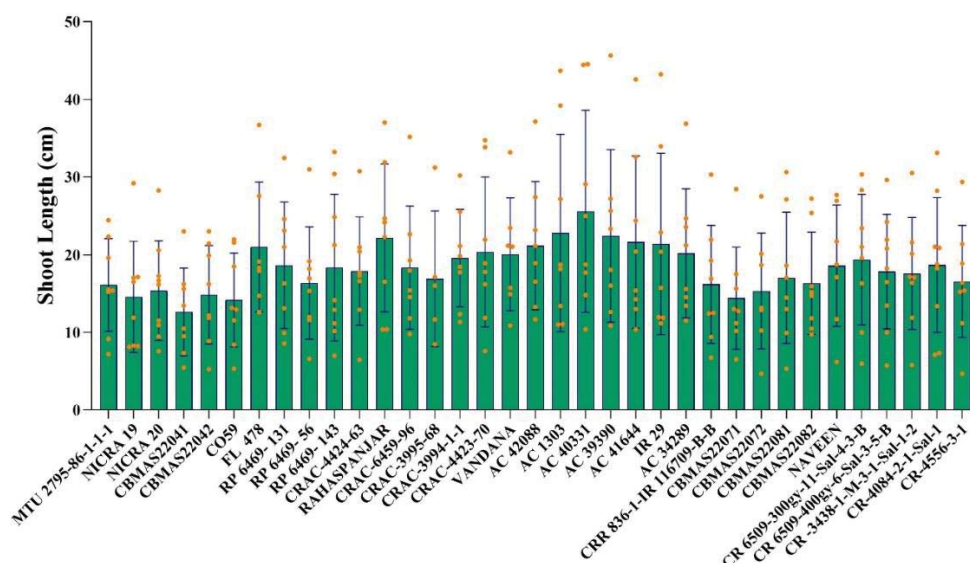


Fig. 6.5.10 Shoot length of the 35 rice genotypes under 2 % mannitol induced osmotic stress at the seedling stage at nine locations. The error bars represent the standard error mean (SEM) of all locations, and scattered dots represent the means of the individual locations.

Root Dry Weight

Root dry weight (RDW) under 2% mannitol stress exhibited considerable variation among the studied germplasms, ranging from 0.031 g to 0.055 g. The lowest RDW was recorded in CRAC-3995-68, whereas the highest was observed in CR 6509-300gy-11-Sal-4-3-B. Genotypes such as CR 6509-300gy-11-Sal-4-3-B (0.055 g), CR-4084-2-1-Sal-1 (0.053 g), AC 40331 (0.052 g), and AC 39390 (0.051 g) demonstrated comparatively higher root biomass, indicating their enhanced capacity for root development under osmotic stress conditions. The increased root dry weight in these genotypes suggests the presence of a more robust root system, which may contribute to improved water uptake and drought tolerance. Therefore, these germplasms can be considered promising candidates for breeding programs targeting enhanced tolerance to water deficit stress (**Figure 6.5.11**).

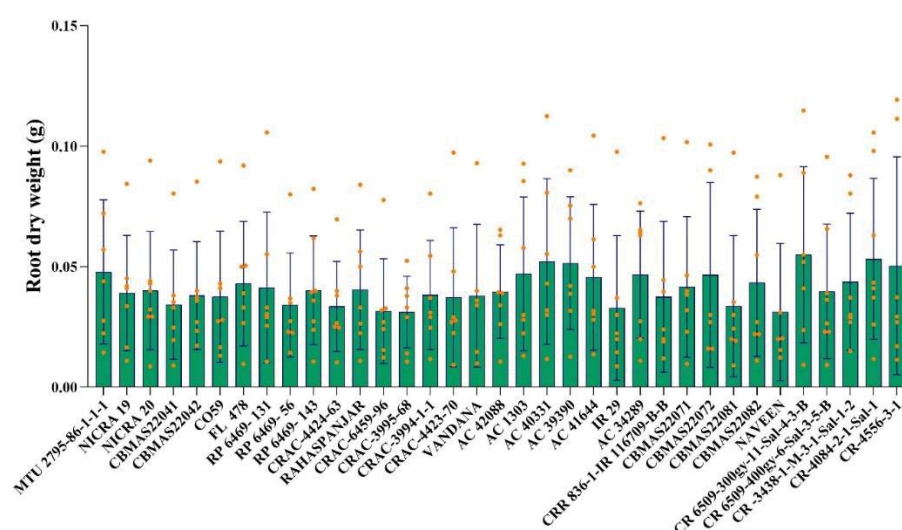


Fig. 6.5.11 Root dry weight (RDW) of the 35 rice genotypes under 2 % mannitol induced osmotic stress at the seedling stage at nine locations. The error bars represent the standard error mean (SEM) of all locations, and scattered dots represent the means of the individual locations.

Shoot Dry Weight

Shoot dry weight (SDW) varied from 0.022 g in CRR 836-1-IR 116709-B-B to 0.038 g in AC 40331, reflecting a wide range of shoot biomass accumulation among the evaluated genotypes. Among them, AC 40331, RAHASPANJAR (0.038 g), and CR 6509-400gy-6-Sal-3-5-B (0.037 g) recorded the highest SDW values, indicating their superior potential for the production of shoot biomass. These findings underscore the extent of genetic variability present within the germplasm collection in response to osmotic stress conditions (**Figure 6.5.12**).

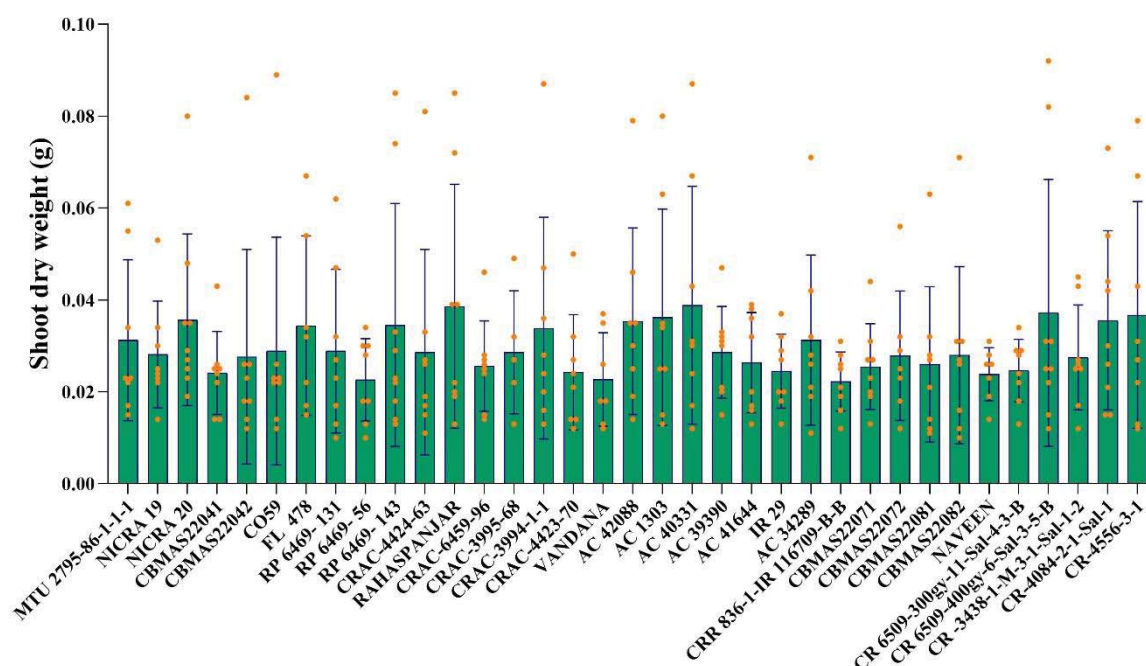


Fig. 6.5.12 Shoot dry weight (SDW) of the 35 rice genotypes under 2 % mannitol induced osmotic stress at the seedling stage at nine locations. The error bars represent the standard error mean (SEM) of all locations, and scattered dots represent the means of the individual locations.

Total Chlorophyll Content

The total chlorophyll content among the rice genotypes showed a wide range, from 0.705 mg/100 g FW in RP 6469- 143 to 1.002 mg/100 g FW in CR-3438-1-M-3-1-Sal-1-2. This variation suggests that different genotypes have different photosynthetic abilities and levels of adaptability to stress conditions. Genotypes like CR-3438-1-M-3-1-Sal-1-2 (1.002 mg/100 g FW) and CR 6509-300gy-11-Sal-4-3-B (1.0 mg/100 g FW) showed the highest chlorophyll content, indicating better photosynthetic performance. Other genotypes, such as CBMAS22041 (0.988 mg/100 g FW), CR 6509-400gy-6-Sal-3-5-B (0.969 mg/100 g FW), and RP 6469-131 (0.967 mg/100 g FW), also performed well. These genotypes can be considered potential candidates for future breeding and stress tolerance studies (**Figure 6.5.13**).

Tolerance Score

The tolerance scores of different germplasms varied, showing that they respond differently to mannitol-induced stress. The scores ranged from as low as 1 to as high as 8. Germplasms with higher scores showed better drought tolerance and could be useful for breeding programs focused on developing stress-resistant rice varieties.

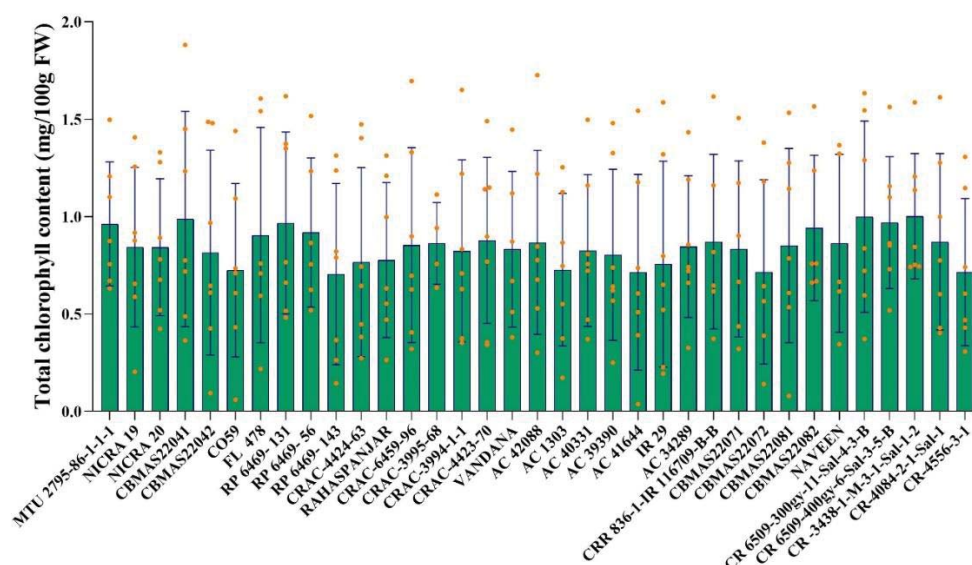


Fig. 6.5.13 Total chlorophyll content of the 35 rice genotypes under 2 % mannitol induced osmotic stress at the seedling stage at nine locations. The error bars represent the standard error mean (SEM) of all locations, and scattered dots represent the means of the individual locations.

Germplasms like NICRA 20 and MTU 2795-86-1-1-1 had lower tolerance scores, indicating that they are more sensitive to drought stress. In general, genotypes with lower scores are more vulnerable to stress, diseases, and pests, which can lead to poor growth and reduced yield, especially under water stress conditions. In contrast, germplasms such as RP 6469-143 and VANDANA showed higher tolerance scores of 6.75 and 6.44, respectively, indicating better stress tolerance (Figure 6.5.14).

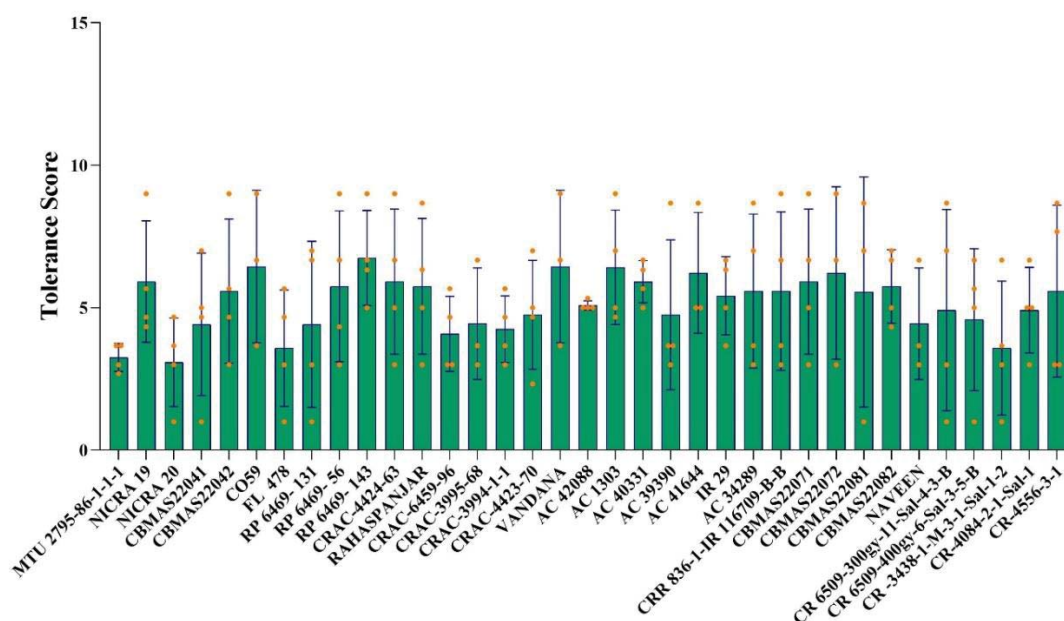


Fig. 6.5.14 Tolerance score of the 35 rice genotypes under 2 % mannitol induced osmotic stress at the seedling stage at nine locations. The error bars represent the standard error mean (SEM) of all locations, and scattered dots represent the means of the individual locations.

Germination Percentage

Most of the varieties showed fairly high germination rates, suggesting that their seeds can tolerate or adjust to low water availability and high osmotic stress. However, the germination percentage varied widely, from 63.59% in MTU 2795-86-1-1-1 to 92.36% in RP 6469-131. Germplasms like RP 6469-131, CBMAS22042, and CBMAS22071 recorded germination above 90%, indicating strong tolerance to the osmotic stress created by 2% mannitol (**Figure 6.5.15**). In contrast, varieties such as MTU 2795-86-1-1-1, CRAC-3995-68, and CBMAS22082 showed lower germination percentages, pointing to their sensitivity under water stress conditions. Varieties with higher germination rates are especially important for maintaining crop productivity in stress-prone environments like drought, and they play an important role in sustainable agriculture under changing climate conditions.

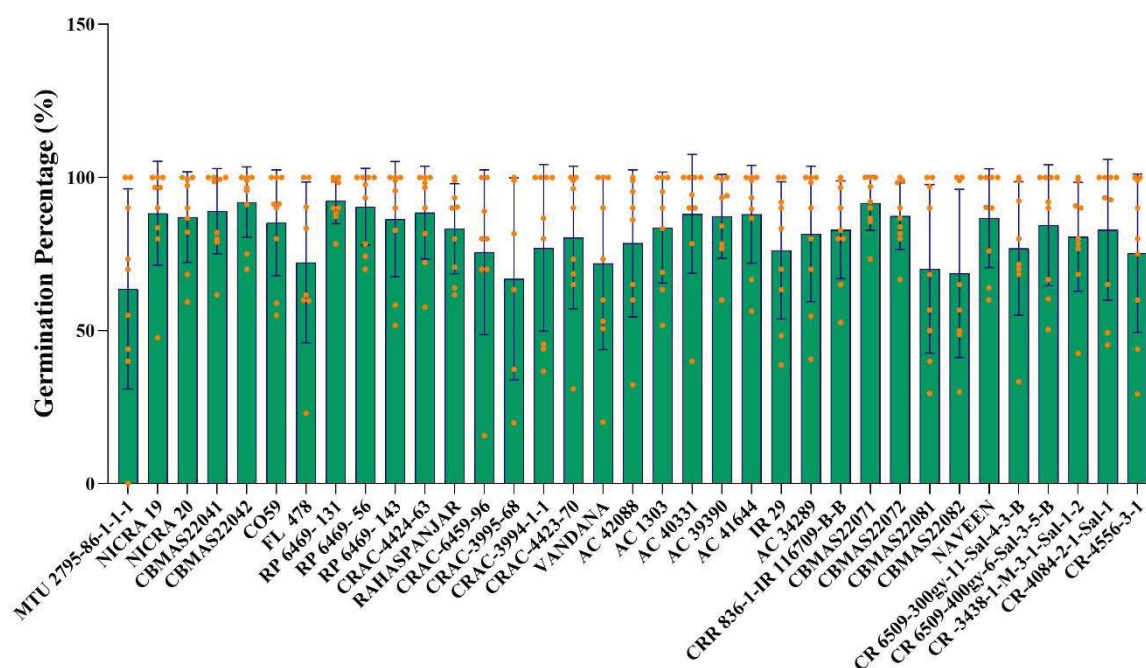


Fig. 6.5.15 Germination percentage of the 35 rice genotypes under 2 % mannitol induced osmotic stress at the seedling stage at nine locations. The error bars represent the standard error mean (SEM) of all locations, and scattered dots represent the means of the individual locations.

A screening of 35 rice genotypes under mannitol-induced water deficit stress revealed several cultivars with outstanding stress tolerance across multiple parameters. AC 40331 emerged as the most consistently superior genotype, recording the highest values for shoot length (25.58 cm), root dry weight (0.052 g), and shoot dry weight (0.038 g), alongside a strong root length of 7.79 cm, establishing it as the top all-round performer. CRAC-3994-1-1 recorded the longest root length (8.08 cm), reflecting exceptional root development capacity under osmotic stress. Among the germplasms evaluated for composite stress tolerance, RP 6469-143 and VANDANA stood out with the highest tolerance scores of 6.75 and 6.44, respectively. CR 6509-300gy-11-Sal-4-3-B demonstrated the greatest root dry weight (0.055 g) and near-highest chlorophyll content (1.0 mg/100 g FW), indicating a robust root architecture and sustained photosynthetic efficiency. CR-3438-1-M-3-1-Sal-1-2 recorded the highest total chlorophyll content (1.002 mg/100 g FW), while RP 6469-131 showed the strongest germination percentage (92.36%) under 2% mannitol stress. Collectively, these cultivars, particularly AC 40331, RP 6469-143, and VANDANA, represent promising genetic resources for developing

drought-resilient rice varieties suited to water-deficient environments. The overall results of the osmotic stress trial are summarized below.

- A multi-location evaluation experiment was conducted across nine research centres (CRRI, PNR, CBT, MSD, KAK, KJT, TTB, MTU, and PTB) to evaluate 35 rice genotypes for their tolerance to water deficit stress at the seedling stage.
- Drought stress was simulated by incorporating 1% and 2% mannitol into the hydroponic nutrient solution, and genotypes were assessed across seven key parameters: root length, shoot length, root dry weight (RDW), shoot dry weight (SDW), total chlorophyll content, tolerance score, and germination percentage.
- The results revealed substantial genotypic variation across all traits under 2% mannitol stress. Average root length declined from 7.39 cm (1% mannitol) to 6.75 cm (2% mannitol), reflecting the negative impact of increasing osmotic stress on root growth. AC 40331 consistently performed best across multiple traits, recording the highest shoot length (25.58 cm), among the highest root dry weight (0.052 g) and shoot dry weight (0.038 g). CRAC-3994-1-1 recorded the longest root length (8.08 cm), while CR 6509-300gy-11-Sal-4-3-B showed the highest root dry weight (0.055 g) and near-highest chlorophyll content (1.0 mg/100 g FW). CR-3438-1-M-3-1-Sal-1-2 attained the highest total chlorophyll content (1.002 mg/100 g FW), indicating superior photosynthetic capacity under stress.
- In terms of composite tolerance score, RP 6469-143 (6.75) and VANDANA (6.44) ranked highest, while RP 6469-131 recorded the best germination percentage (92.36%) under osmotic stress. On the other hand, genotypes such as MTU 2795-86-1-1-1, CRAC-3995-68, and NICRA 20 consistently showed poor performance, indicating their susceptibility to water deficit stress.

Summary and Conclusion:

A panel of 35 rice entries was evaluated for multiple abiotic stresses, including anaerobic germination, salinity stress (12 dS m⁻¹), and osmotic stress (1 and 2% mannitol) across 10 different AICRIP centres. The lines were exposed to stress conditions at germination and early seedling stage, resulting in a reduction in key plant traits such as germination percentage, epicotyl length, root and shoot length, root and shoot dry weight, and leaf chlorophyll content. The result obtained from across the locations revealed nine (09) genotypes, viz., AC 40331, CBMAS22041, RP6469-56, AC1303, NICRA 20, AC42088, AC41644, CRAC-3995-68, CR-4084-2-1-Sal-1, which are tolerant to AG stress. These genotypes can be used as potential donors to improve the anaerobic germination potential in rice genotypes. Among the tested lines, RP 6469-143 was highly tolerant to salt stress with the lowest SES score and moderate shoot Na⁺/K⁺ ratio. The genotypes, AC40331, AC42088, AC34289, AC1303, AC41644, and CR6509-300gy-11-Sal-4-3-B were found to be moderately tolerant to salinity stress with a lower shoot Na⁺/K⁺ ratio. Among the tested lines, AC39390, AC40331, CR6509-300gy-11-Sal-4-3-B, CR 6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, and RP6469-143 were found to be tolerant to osmotic stress. Out of 35 entries, AC40331, AC1303, NICRA 20, AC42088, and CR-4084-2-1-Sal-1 were found to be tolerant to both anaerobic germination and salinity stress. The genotypes, AC40331 and CR-4084-2-1-Sal-1, were tolerant to both anaerobic germination and osmotic stress. The genotypes, AC40331, CR6509-300gy-11-Sal-4-3-B, CR 6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, RP6469-143 were tolerant to both salinity and osmotic stress. Interestingly, we identified two promising entries, AC40331 and CR-4084-2-1-Sal-1, which showed tolerance to all three stress conditions.

Table 6.5.1 List of genotypes identified as tolerant to individual and combination of multiple abiotic stresses based on the data obtained from multi-locational screening.

Sl. No.	Nature of Stress	Tolerant genotypes identified
1	Anaerobic germination (AG)	AC40331, CBMAS22041, RP 6469-56, AC1303, NICRA 20, AC42088, AC41644, CRAC-3995-68, CR-4084-2-1-Sal-1
2	Salinity stress (SS)	AC1303, AC34289, AC40331, AC41644, AC42088, CR6509-300gy-11-Sal-4-3-B, CR6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, CR-4556-3-1, CRAC-3994-1-1, CRAC-6459-96, FL478, NICRA 20, RP 6469-143
3	Osmotic stress (OS)	AC 39390, AC 40331, CR 6509-300gy-11-Sal-4-3-B, CR 6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, RP 6469-143
4	AG + SS	AC40331, AC1303, NICRA 20, AC42088, CR-4084-2-1-Sal-1
5	AG + OS	AC40331, CR-4084-2-1-Sal-1
6	SS + OS	AC40331, CR6509-300gy-11-Sal-4-3-B, CR6509-400gy-6-Sal-3-5-B, CR-4084-2-1-Sal-1, RP 6469-143
7	AG + SS+ OS	AC 40331, CR-4084-2-1-Sal-1

Table 6.5.2 Effect of 21 days of anaerobic germination stress on anaerobic germination index (%) of rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	CBT	FZB	KRK	KJT	KAUL	PTB	MTU	PNR	TTB	CRRI	Mean
1	MTU 2795-86-1-1-1	14.81	66.82		51.82	21.43	14.29	20.00	50.00	47.88	11.76	33.20
2	NICRA 19	20.00	57.50	48.19	56.48	50.00	11.11	20.00	57.69	42.66	36.84	40.05
3	NICRA 20	77.78	96.59	96.26	49.93	25.00	20.00	20.13	73.91	30.90	34.21	52.47
4	CBMAS22041	20.00	79.46	50.00	52.30	42.86	20.00		75.00	71.54	40.00	50.13
5	CBMAS22042		80.00	48.39	40.56	23.08	20.00	20.20	54.17	75.56	31.71	43.74
6	CO59	20.00	96.36	44.44	25.62		55.56	20.00	65.22		60.47	48.46
7	FL 478		37.30	45.50	43.62	13.64	16.67		21.05	45.45	27.84	31.38
8	RP 6469- 131	33.33	58.72	66.67	43.32	13.64	10.00	20.20	59.09	50.94	25.00	38.09
9	RP 6469- 56	10.00	95.71	89.04	35.84	22.73	50.00		64.00	68.09	25.58	51.22
10	RP 6469- 143	20.00	100.00	60.24	29.90	23.08	40.00		52.17	50.97	37.50	45.98
11	CRAC-4424-63	10.00	89.39	41.10	41.29	20.00	44.44	20.00	68.00	57.80	15.91	40.79
12	RAHASPANJAR		82.70	49.41	47.16	57.14	50.00	50.63	53.85		88.07	59.87
13	CRAC-6459-96	25.00	100.00		45.62	25.00			29.41		32.43	42.91
14	CRAC-3995-68	15.87	58.78			90.91					63.64	57.30
15	CRAC-3994-1-1		99.23	10.64	64.09	26.92			21.05	82.73	38.64	49.04
16	CRAC-4423-70	10.00	98.46	22.39	38.20	12.50		30.30	37.50	67.74	44.19	40.14
17	VANDANA	30.00	53.33	50.33	57.24	26.92				55.97	27.27	43.01
18	AC 42088	20.00	81.54	28.74	61.68	59.26	50.00	40.40	92.59	86.60	34.09	55.49
19	AC 1303	33.33	91.58	21.43	55.17	33.33	20.00		100.00	35.48	72.09	51.38
20	AC 40331	20.00	45.56	37.50	47.28	35.29	22.22	50.00	78.57	75.83	87.80	50.01
21	AC 39390	10.00	90.00	24.10	50.43	13.04	33.33	60.40	88.46	50.64	43.18	46.36
22	AC 41644	20.00	91.50	43.01	54.20	18.18	40.00		82.61	93.49	68.18	56.80
23	IR 29	22.22	47.73	25.00	46.30	27.27	28.57		43.81		11.14	31.51
24	AC 34289	10.00	72.86	12.50	55.53	12.00	33.33		70.00	93.29	31.82	43.48
25	CRR 836-1-IR 116709-B-B	22.22	98.46	6.02	47.59		25.00		13.33	36.71	72.97	40.29
26	CBMAS22071	40.00	80.45	26.88	50.31	15.00	11.11	60.00	21.05	18.68	63.41	38.69
27	CBMAS22072	33.33	90.61	48.19	55.73	15.00		40.40	42.86		31.82	44.74
28	CBMAS22081		71.71		21.24	15.00					74.95	45.72
29	CBMAS22082	10.00	87.69		29.20	14.29	66.67	20.20			25.81	36.26
30	NAVEEN	10.00	65.00	5.38	58.44	37.50	20.00		45.45	52.63	9.30	33.74

SN	GENOTYPES	CBT	FZB	KRK	KJT	KAUL	PTB	MTU	PNR	TTB	CRRI	Mean
31	CR 6509-300gy-11-Sal-4-3-B	10.00	83.41	35.71	54.80	18.75	14.29	50.51	63.16		65.12	43.97
32	CR 6509-400gy-6-Sal-3-5-B	30.00	84.00	60.00	15.87	12.50	10.00	30.00	57.14		25.58	36.12
33	CR -3438-1-M-3-1-Sal-1-2		60.00	46.51	19.19	17.65		30.30	36.84		20.93	33.06
34	CR-4084-2-1-Sal-1		70.77	80.00	61.08	28.57	20.00		85.19	84.56	40.91	58.88
35	CR-4556-3-1		84.00	50.00	34.55	26.67		30.30	27.78		61.54	44.98
	Mean	22.14	78.49	42.45	45.34	27.10	28.71	33.37	55.84	59.83	42.33	44.55
	LSD (Genotype)										4.54	
	LSD (Location × Genotype)										14.36	
	CV (Residual) %										20.04	

Table 6.5.3 Effect of 21 days of anaerobic germination stress on epicotyl growth (cm) of rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	CBT	FZB	KRK	KJT	KAUL	PTB	PNR	TTB	CRRI	Mean
1	MTU 2795-86-1-1-1	3.5	9.0		25.5	20.7	7.0	21.7	42.8	13.2	17.9
2	NICRA 19	6.1	11.1	18.6	18.4	21.3	17.2	20.3	47.5	16.9	19.7
3	NICRA 20	9.5	8.7	16.7	21.8	17.3	15.9	18.6	43.8	29.1	20.2
4	CBMAS22041	10.6	8.2	25.7	22.3	16.1	26.3	20.7	44.3	21.1	21.7
5	CBMAS22042		8.6	27.6	8.2	20.0	18.6	21.3	48.0	7.7	20.0
6	CO59	12.4	11.9	17.5	21.6		31.6	31.6		22.1	21.2
7	FL 478		10.8	19.9	23.2	15.0	23.0	20.5	24.3	11.6	18.5
8	RP 6469- 131	14.6	19.1	19.4	22.5	29.8	23.1	27.7	43.3	32.9	25.8
9	RP 6469- 56	15.2	9.7	28.1	25.7	27.7	33.9	29.2	59.7	33.4	29.2
10	RP 6469- 143	11.1	9.6	13.0	19.3	28.5	41.9	27.0	57.5	30.2	26.5
11	CRAC-4424-63	14.1	7.2	28.2	22.4	18.3	27.8	23.2	67.8	27.7	26.3
12	RAHASPANJAR		8.3	29.3	21.8	37.1	50.3	34.0		35.8	30.9
13	CRAC-6459-96	15.5	8.7		29.3	30.8		26.4		35.3	24.3
14	CRAC-3995-68	9.7	19.3			30.6				26.8	21.6
15	CRAC-3994-1-1		12.2	30.1	17.8	27.2	18.3	25.3	30.5	25.6	23.4
16	CRAC-4423-70	11.5	11.0	22.9	19.4	27.3	42.0	28.3	53.7	23.0	26.6
17	VANDANA	9.1	10.7	22.7	31.8	32.3			38.3	28.8	24.8
18	AC 42088	5.9	9.8	27.3	27.9	30.9	33.3	32.1	45.5	21.6	26.0
19	AC 1303	14.5	9.7	22.0	19.2	25.6	77.5	28.6	35.3	29.7	29.1
20	AC 40331	15.3	9.8	18.0	20.5	31.0	46.3	38.2	46.0	40.4	29.5
21	AC 39390	16.5	10.6	21.7	21.9	29.7	32.1	24.6	40.5	26.9	24.9
22	AC 41644	21.6	9.5	22.3	25.4	24.2	39.7	34.1	44.0	42.1	29.2
23	IR 29	13.7	8.0	18.7	21.5	21.3	20.6	20.8		18.7	17.9
24	AC 34289	15.0	7.0	22.2	20.4	17.0	36.5	31.1	46.3	21.1	24.1
25	CRR 836-1-IR 116709-B-B	3.7	15.6	18.1	18.8		26.0	15.3	39.5	21.5	19.8
26	CBMAS22071	8.6	10.3	19.3	20.8	18.7	24.8	22.4	40.0	16.6	20.2
27	CBMAS22072	5.0	12.4	15.2	23.1	16.7	29.5	22.3		11.5	16.9
28	CBMAS22081		8.8		20.9	20.8	43.5			32.1	25.2
29	CBMAS22082	4.6	11.4		23.7	17.0	24.5			23.7	17.5
30	NAVEEN	12.8	12.8	17.0	22.5	13.3	24.4	23.8	38.2	16.3	20.1
31	CR 6509-300gy-11-Sal-4-3-B	8.6	8.7	14.0	21.7	26.3	30.2	26.8		21.4	19.7
32	CR 6509-400gy-6-Sal-3-5-B	11.6	10.8	12.3	25.3	20.0	15.2	25.4		26.9	18.4
33	CR -3438-1-M-3-1-Sal-1-2		8.1	13.3	21.8	24.4	37.3	27.7		25.7	22.6
34	CR-4084-2-1-Sal-1		12.3	21.6	30.2	21.0	32.9	24.9	47.8	28.7	27.4
35	CR-4556-3-1		7.6	22.7	21.1	27.7		21.2		29.5	21.6
	Mean	11.1	10.5	20.8	22.3	23.8	30.7	25.6	44.6	25.0	23.1
	LSD (Genotype)										9.98
	LSD (Location × Genotype)										5.998
	CV (Residual) %										16.237

Table 6.5.4 Effect of salinity stress on root length (cm) of rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
1	MTU 2795-86-1-1-1	9.92	4.60	9.97	9.30	4.57	4.47	11.83	7.81
2	NICRA 19	9.76	4.77	8.25	6.65	4.20	3.50	13.73	7.26
3	NICRA 20	8.41	4.67	2.11	9.89	5.20	5.93	10.90	6.73
4	CBMAS22041	10.91	4.33	7.50	6.61	3.97	2.67	7.83	6.26
5	CBMAS22042	7.33	5.33	4.43	8.14	4.53	8.03	8.23	6.58
6	CO59	10.83	6.70	8.10	7.89	4.07	5.07	13.57	8.03
7	FL 478	9.79	6.37	8.22	10.84		6.43	10.47	8.69
8	RP 6469- 131	7.86	6.77	6.39	11.52	3.80	5.30	8.20	7.12
9	RP 6469- 56	9.68	7.17	9.17	9.45	5.27	5.17	9.83	7.96
10	RP 6469- 143	8.31	6.60	7.71	9.09	5.07	5.73	11.83	7.76
11	CRAC-4424-63	8.40	5.83	8.63	9.54	4.67	5.50	14.10	8.10
12	RAHASPANJAR	10.38	8.90	5.17	11.76	4.87	6.57	12.17	8.54
13	CRAC-6459-96	6.07	4.77	8.21	7.54	4.97	7.50	13.03	7.44
14	CRAC-3995-68	9.14	4.20			5.07		11.73	7.54
15	CRAC-3994-1-1	9.78	6.17	9.16	9.44	4.93	6.17	15.77	8.77
16	CRAC-4423-70	9.50	4.23	9.21	9.66	5.30	7.17	13.30	8.34
17	VANDANA	7.93	5.13	7.33	8.19	3.47	4.13	9.50	6.53
18	AC 42088	6.84	5.60	8.59	7.46	5.30	6.37	17.00	8.16
19	AC 1303	6.60	6.40	6.85	8.81	4.07	6.70	14.17	7.66
20	AC 40331	9.80	6.57	8.75	10.45	4.83	7.40	12.07	8.55
21	AC 39390	7.65	5.70	5.99	7.37	4.10	5.10	6.93	6.12
22	AC 41644	7.21	5.37	8.73	8.19	5.03	3.67	11.90	7.16
23	IR 29	10.39	3.03	5.08	4.77	3.17	5.60	6.00	5.43
24	AC 34289	9.56	4.87	6.59	11.09	4.30	7.83	10.67	7.84
25	CRR 836-1-IR 116709-B-B	11.24	4.23	6.49	5.58	3.33	3.80	5.33	5.72
26	CBMAS22071	9.52	3.93	4.69	3.97	5.07	6.17	10.10	6.21
27	CBMAS22072	12.19	4.47	4.57	3.58	4.00	6.33	7.27	6.06
28	CBMAS22081	11.51	3.90	5.31	5.03	4.37	4.80	7.33	6.04
29	CBMAS22082	7.70	4.30	5.03	2.81	4.03	5.43	5.30	4.94
30	NAVEEN	9.09	5.10	5.15	6.58	4.97	4.63	6.87	6.06
31	CR 6509-300gy-11-Sal-4-3-B	6.38	4.40	3.91	3.32	5.10	5.13	10.40	5.52
32	CR 6509-400gy-6-Sal-3-5-B	10.42	4.97	4.75	7.75	4.87	3.00	11.17	6.70
33	CR -3438-1-M-3-1-Sal-1-2	9.36	4.23	3.42	7.50	4.63	5.83	9.50	6.35
34	CR-4084-2-1-Sal-1	8.78	4.40	8.21	9.81	5.83	7.03	9.50	7.65
35	CR-4556-3-1	9.97	4.70	8.42	8.27	5.30	4.23	9.50	7.20
	Mean	9.09	5.22	6.77	7.88	4.60	5.54	10.49	7.08
	LSD (Genotype)							0.84	
	LSD (Location × Genotype)							2.23	
	CV (Residual) %							19.57	

Table 6.5.5 Effect of salinity stress on shoot length (cm) of rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
1	MTU 2795-86-1-1-1	14.31	34.43	9.14	11.01	8.90	12.83	41.23	18.84
2	NICRA 19	13.88	29.00	8.86	9.61	7.83	13.07	37.27	17.07
3	NICRA 20	15.13	28.67	5.02	8.43	11.00	14.50	32.87	16.52
4	CBMAS22041	13.11	29.30	5.56	6.00	8.70	8.00	32.83	14.79
5	CBMAS22042	18.65	27.87	6.82	7.82	10.23	9.13	27.67	15.46
6	CO59	14.39	33.17	6.33	9.73	7.87	15.27	31.33	16.87
7	FL 478	15.72	36.23	9.03	13.49		19.93	49.77	24.03
8	RP 6469- 131	13.12	39.47	6.05	13.02	9.17	17.40	39.70	19.70

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
9	RP 6469- 56	15.71	32.17	9.87	8.18	10.57	11.17	29.77	16.77
10	RP 6469- 143	18.73	36.33	7.27	15.93	10.87	21.00	47.87	22.57
11	CRAC-4424-63	18.35	33.17	8.36	12.24	12.47	11.57	37.87	19.15
12	RAHASPANJAR	15.34	47.33	8.89	20.06	9.50	25.50	51.13	25.39
13	CRAC-6459-96	15.59	31.10	9.89	11.98	11.20	17.17	46.80	20.53
14	CRAC-3995-68	15.01	30.83			11.40		39.40	24.16
15	CRAC-3994-1-1	13.11	34.40	7.83	12.84	11.07	10.67	42.97	18.98
16	CRAC-4423-70	13.76	38.83	10.53	8.45	12.30	13.07	37.67	19.23
17	VANDANA	15.38	43.83	8.61	14.28	10.23	16.27	33.77	20.34
18	AC 42088	14.34	39.80	12.02	10.61	12.03	26.17	45.73	22.96
19	AC 1303	16.35	40.20	9.98	13.92	10.73	12.97	44.87	21.29
20	AC 40331	15.86	47.00	18.15	15.34	11.50	28.50	52.33	26.95
21	AC 39390	14.75	40.17	7.75	14.12	11.53	21.67	45.43	22.20
22	AC 41644	14.03	39.47	15.04	11.73	10.03	24.50	55.40	24.31
23	IR 29	12.01	29.70	8.23	10.93	10.20	14.50	21.13	15.24
24	AC 34289	16.64	40.60	6.63	14.00	10.53	25.67	46.27	22.90
25	CRR 836-1-IR 116709-B-B	13.82	29.90	7.41	5.36	10.80	8.40	22.30	14.00
26	CBMAS22071	17.63	30.17	6.03	7.09	12.07	8.50	21.60	14.73
27	CBMAS22072	15.90	27.80	4.70	7.61	10.73	8.83	21.57	13.88
28	CBMAS22081	18.93	31.23	7.00	7.69	11.13	11.17	27.03	16.31
29	CBMAS22082	15.06	28.17	5.68	6.58	10.27	12.30	15.73	13.40
30	NAVEEN	17.75	32.20	6.56	10.92	10.17	10.50	28.03	16.59
31	CR 6509-300gy-11-Sal-4-3-B	16.82	30.33	6.36	14.90	9.87	18.63	29.03	17.99
32	CR 6509-400gy-6-Sal-3-5-B	17.82	29.87	6.38	12.00	13.77	17.90	29.23	18.14
33	CR -3438-1-M-3-1-Sal-1-2	16.02	29.50	8.18	10.44	11.23	16.33	27.27	17.00
34	CR-4084-2-1-Sal-1	17.67	30.07	6.93	10.78	13.17	18.17	23.20	17.14
35	CR-4556-3-1	12.62	30.77	7.36	10.28	13.10	15.97	18.50	15.51
	Mean	15.52	34.09	8.19	11.10	10.77	15.80	35.27	18.68
	LSD (Genotype)							1.69	
	LSD (Location × Genotype)							4.48	
	CV (Residual) %							14.85	

Table 6.5.6 Effect of salinity stress on root dry weight (g) of rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
1	MTU 2795-86-1-1-1	0.073	0.014	0.030	0.021	0.373	0.06	0.028	0.085
2	NICRA 19	0.053	0.010	0.023	0.030	0.403	0.04	0.023	0.083
3	NICRA 20	0.074	0.012	0.025	0.031	0.417	0.04	0.023	0.089
4	CBMAS22041	0.080	0.010	0.024	0.031	0.273	0.02	0.021	0.066
5	CBMAS22042	0.074	0.012	0.025	0.034	0.353	0.03	0.016	0.078
6	CO59	0.077	0.008	0.026	0.021	0.347	0.04	0.016	0.076
7	FL 478	0.064	0.012	0.025	0.024		0.03	0.027	0.030
8	RP 6469- 131	0.075	0.010	0.023	0.022	0.227	0.02	0.024	0.057
9	RP 6469- 56	0.059	0.011	0.023	0.034	0.303	0.02	0.011	0.066
10	RP 6469- 143	0.077	0.010	0.022	0.025	0.383	0.03	0.021	0.081
11	CRAC-4424-63	0.068	0.013	0.032	0.037	0.360	0.03	0.025	0.080
12	RAHASPANJAR	0.068	0.012	0.022	0.045	0.258	0.04	0.030	0.068
13	CRAC-6459-96	0.067	0.012	0.027	0.018	0.387	0.03	0.042	0.083
14	CRAC-3995-68	0.085	0.008			0.353	0.00	0.023	0.094
15	CRAC-3994-1-1	0.073	0.038	0.023	0.046	0.353	0.02	0.041	0.085
16	CRAC-4423-70	0.070	0.048	0.026	0.020	0.323	0.03	0.030	0.078
17	VANDANA	0.066	0.043	0.024	0.018	0.267	0.02	0.037	0.068
18	AC 42088	0.076	0.011	0.024	0.045	0.407	0.08	0.040	0.097
19	AC 1303	0.086	0.014	0.021	0.048	0.213	0.03	0.031	0.063

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
20	AC 40331	0.065	0.013	0.023	0.054	0.330	0.03	0.031	0.078
21	AC 39390	0.093	0.011	0.024	0.033	0.363	0.07	0.040	0.091
22	AC 41644	0.077	0.014	0.024	0.020	0.240	0.06	0.032	0.067
23	IR 29	0.065	0.012	0.028	0.031	0.320	0.04	0.022	0.074
24	AC 34289	0.082	0.013	0.023	0.046	0.160	0.05	0.027	0.057
25	CRR 836-1-IR 116709-B-B	0.057	0.010	0.024	0.018	0.177	0.02	0.024	0.047
26	CBMAS22071	0.062	0.011	0.024	0.011	0.367	0.03	0.017	0.075
27	CBMAS22072	0.058	0.009	0.023	0.031	0.160	0.04	0.015	0.048
28	CBMAS22081	0.083	0.008	0.030	0.029	0.300	0.03	0.026	0.072
29	CBMAS22082	0.087	0.011	0.024	0.012	0.190	0.03	0.013	0.052
30	NAVEEN	0.066	0.020	0.028	0.043	0.330	0.03	0.026	0.078
31	CR 6509-300gy-11-Sal-4-3-B	0.051	0.042	0.024	0.019	0.387	0.04	0.027	0.085
32	CR 6509-400gy-6-Sal-3-5-B	0.077	0.011	0.026	0.028	0.313	0.03	0.016	0.072
33	CR -3438-1-M-3-1-Sal-1-2	0.061	0.011	0.027	0.027	0.250	0.02	0.018	0.060
34	CR-4084-2-1-Sal-1	0.064	0.009	0.025	0.040	0.397	0.07	0.021	0.090
35	CR-4556-3-1	0.066	0.011	0.024	0.022	0.367	0.02	0.014	0.075
	Mean	0.071	0.015	0.025	0.030	0.313	0.035	0.025	0.073
	LSD (Genotype)								0.01
	LSD (Location × Genotype)								0.03
	CV (Residual) %								23.32

Table 6.5.7 Effect of salinity stress on shoot dry weight (g) of rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
1	MTU 2795-86-1-1-1	0.186	0.037	0.172	0.016	0.146	0.173	0.133	0.123
2	NICRA 19	0.199	0.154	0.066	0.025	0.136	0.196	0.130	0.129
3	NICRA 20	0.237	0.037	0.029	0.031	0.149	0.173	0.109	0.109
4	CBMAS22041	0.229	0.034	0.022	0.011	0.128	0.123	0.080	0.090
5	CBMAS22042	0.212	0.034	0.020	0.028	0.132	0.103	0.067	0.085
6	CO59	0.175	0.036	0.011	0.008	0.128	0.120	0.092	0.081
7	FL 478	0.245	0.031	0.012	0.053	0.000	0.103	0.204	0.093
8	RP 6469- 131	0.167	0.038	0.013	0.044	0.119	0.103	0.093	0.083
9	RP 6469- 56	0.238	0.040	0.037	0.050	0.126	0.097	0.071	0.094
10	RP 6469- 143	0.200	0.038	0.022	0.032	0.142	0.110	0.088	0.090
11	CRAC-4424-63	0.188	0.038	0.020	0.018	0.143	0.086	0.155	0.092
12	RAHASPANJAR	0.200	0.042	0.034	0.062	0.125	0.157	0.316	0.134
13	CRAC-6459-96	0.195	0.041	0.032	0.018	0.139	0.117	0.202	0.106
14	CRAC-3995-68	0.225	0.033	0.000	0.000	0.136		0.126	0.087
15	CRAC-3994-1-1	0.223	0.040	0.026	0.035	0.137	0.184	0.132	0.111
16	CRAC-4423-70	0.215	0.039	0.022	0.026	0.139	0.107	0.109	0.094
17	VANDANA	0.237	0.043	0.026	0.033	0.115	0.127	0.084	0.095
18	AC 42088	0.208	0.038	0.031	0.055	0.147	0.260	0.158	0.128
19	AC 1303	0.223	0.042	0.030	0.068	0.121	0.133	0.118	0.105
20	AC 40331	0.205	0.039	0.020	0.073	0.134	0.140	0.119	0.104
21	AC 39390	0.178	0.039	0.063	0.035	0.136	0.197	0.074	0.103
22	AC 41644	0.229	0.036	0.027	0.046	0.118	0.153	0.179	0.113
23	IR 29	0.241	0.039	0.022	0.025	0.134	0.178	0.082	0.103
24	AC 34289	0.218	0.041	0.016	0.049	0.109	0.260	0.087	0.111
25	CRR 836-1-IR 116709-B-B	0.180	0.031	0.052	0.016	0.103	0.123	0.052	0.080
26	CBMAS22071	0.259	0.034	0.037	0.012	0.132	0.166	0.040	0.097
27	CBMAS22072	0.232	0.032	0.013	0.020	0.121	0.167	0.040	0.089
28	CBMAS22081	0.196	0.035	0.014	0.017	0.130	0.137	0.064	0.085
29	CBMAS22082	0.173	0.034	0.022	0.008	0.114	0.153	0.125	0.090
30	NAVEEN	0.251	0.037	0.033	0.045	0.138	0.192	0.063	0.108

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
31	CR 6509-300gy-11-Sal-4-3-B	0.168	0.035	0.022	0.023	0.130	0.198	0.081	0.094
32	CR 6509-400gy-6-Sal-3-5-B	0.215	0.033	0.022	0.085	0.131	0.173	0.036	0.099
33	CR -3438-1-M-3-1-Sal-1-2	0.192	0.039	0.023	0.026	0.121	0.160	0.052	0.088
34	CR-4084-2-1-Sal-1	0.195	0.038	0.032	0.034	0.146	0.147	0.061	0.093
35	CR-4556-3-1	0.246	0.035	0.018	0.023	0.138	0.126	0.031	0.088
	Mean	0.211	0.040	0.030	0.033	0.127	0.151	0.104	0.099
	LSD (Genotype)								0.02
	LSD (Location × Genotype)								0.05
	CV (Residual) %								28.70

Table 6.5.8 Effect of salinity stress on leaf total chlorophyll content (mg g⁻¹ dry weight) of rice genotypes during *Kharif* 2025 at different locations.

SN	GENOTYPES	FZB	KRK	KJT	PTB	MTU	PNR	CTC	Mean
1	MTU 2795-86-1-1-1	1.224	0.838	1.153	0.210	1.467	0.391	1.852	1.019
2	NICRA 19	1.493	1.088	0.933	0.204	1.237	0.419	2.030	1.058
3	NICRA 20	1.020	1.098	1.280	0.682	1.310	0.534	1.696	1.088
4	CBMAS22041	1.472	0.450	1.053	0.441	1.115	0.242	2.016	0.970
5	CBMAS22042	1.147	0.239	1.150	0.948	1.247	0.381	1.026	0.877
6	CO59	1.238	0.368	1.190	0.076	1.027	0.567	1.396	0.837
7	FL 478	1.179	1.292	0.970	0.478		0.933	2.852	1.284
8	RP 6469- 131	1.155	0.565	1.193	0.690	1.327	0.744	1.534	1.030
9	RP 6469- 56	1.443	0.460	1.177	0.479	1.307	0.672	1.960	1.071
10	RP 6469- 143	1.267	0.688	1.163	1.053	1.453	0.820	1.832	1.182
11	CRAC-4424-63	1.489	0.559	1.067	0.140	1.387	0.570	2.121	1.047
12	RAHASPANJAR	1.542	1.228	1.237	0.373	1.183	0.927	1.771	1.180
13	CRAC-6459-96	1.425	0.336	1.173	0.328	1.470	0.726	0.989	0.921
14	CRAC-3995-68	1.049	1.213			1.343		2.858	1.616
15	CRAC-3994-1-1	1.411	0.411	1.437	0.713	1.427	0.778	2.095	1.182
16	CRAC-4423-70	1.324	0.786	1.287	0.106	1.297	0.751	1.345	0.985
17	VANDANA	1.363	0.387	1.167	0.204	1.097	0.724	1.910	0.979
18	AC 42088	1.276	0.714	1.263	0.267	1.413	0.539	2.420	1.128
19	AC 1303	1.408	0.716	1.313	0.238	1.103	0.315	0.937	0.862
20	AC 40331	1.267	0.372	1.313	0.513	1.383	0.476	1.761	1.012
21	AC 39390	1.242	0.698	1.133	0.245	1.187	0.623	2.043	1.024
22	AC 41644	1.184	0.818	1.110	0.168	1.157	0.986	3.880	1.329
23	IR 29	1.076	0.559	1.423	0.095	1.280	0.558	0.745	0.820
24	AC 34289	1.366	0.433	1.267	0.370	1.123	0.867	1.707	1.019
25	CRR 836-1-IR 116709-B-B	1.311	0.866	1.227	0.353	1.107	1.582	1.179	1.089
26	CBMAS22071	1.307	0.851	1.400	0.058	1.307	0.512	0.847	0.897
27	CBMAS22072	1.345	0.475	1.347		1.190	0.691	1.420	1.078
28	CBMAS22081	1.355	0.548	1.267	0.045	1.247	0.735	1.123	0.903
29	CBMAS22082	1.428	0.511	1.367		1.190	0.674	2.287	1.243
30	NAVEEN	1.275	0.585	1.607	0.255	1.297	1.119	1.119	1.037
31	CR 6509-300gy-11-Sal-4-3-B	1.408	0.317	1.153	0.024	1.240	0.496	2.039	0.954
32	CR 6509-400gy-6-Sal-3-5-B	1.246	0.551	1.167	0.085	1.390	0.817	1.432	0.955
33	CR -3438-1-M-3-1-Sal-1-2	1.627	0.554	1.253	0.543	1.120	1.007	1.997	1.157
34	CR-4084-2-1-Sal-1	1.665	0.502	1.127	0.331	1.313	0.933	0.749	0.946
35	CR-4556-3-1	1.421	0.558	1.263	0.458	1.377	0.595	1.638	1.044
	Mean	1.327	0.647	1.224	0.349	1.268	0.697	1.732	1.052
	LSD (Genotype)								0.08
	LSD (Location × Genotype)								0.20
	CV (Residual) %								12.05

6.6. Screening of rice varieties for tolerance to low light stress

Locations: CRRRI, RPUR, PTB, KJT, PNR, MTU, CHN and TTB

In rice (*Oryza sativa* L.), adequate light availability is essential for driving photosynthesis, regulating carbon assimilation, and supporting the energy demands of vegetative and reproductive development. However, in the major rice-growing regions of eastern and northeastern India, as well as in several other parts of South and Southeast Asia, the kharif crop season is frequently characterized by prolonged cloud cover, heavy monsoon rains, and atmospheric haze, leading to a significant reduction in solar radiation reaching the crop canopy. This condition, commonly referred to as low light stress or shade stress, severely limits the photosynthetically active radiation (PAR) available to the plant, thereby impairing chlorophyll synthesis, reducing the rate of photosynthesis, and disrupting the source-sink relationships critical for grain filling. Under low light stress, rice plants typically exhibit characteristic responses such as increased stem elongation through shade-avoidance mechanisms, reduced tillering, lower leaf area index, and decreased accumulation of photoassimilates, all of which collectively suppress biomass production and yield potential. The reproductive stage is particularly vulnerable, with reduced spikelet number, poor grain setting, and lower grain weight reported under sub-optimal irradiance conditions. With the increasing unpredictability of weather patterns due to climate change, the incidence and intensity of low-light stress events are expected to rise, making it increasingly important to identify and develop shade-tolerant rice genotypes capable of maintaining stable productivity under reduced irradiance environments.

The experiment on screening of rice varieties for tolerance to low light stress was conducted across eight diverse agro-climatic locations, namely Cuttack (CRRRI), Raipur (RPUR), Pattambi (PTB), Karjat (KJT), Pantnagar (PNR), Maruteru (MTU), Chinsurah (CHN), and Titabar (TTB), during the Kharif 2025 season. A total of 18 rice genotypes, viz., IET33125, IET33159, IET33264, IET33127, IET33150, IET33129, IET33262, IET32175, IET32150, IET32134, IET31237, IET31246, IET31220, IET33139, CR6549, IR8, Swarnaprava, and Pratikhya, were evaluated under two light regimes, namely control (normal light) and low light stress. The trial was laid out in a split-plot design under Randomized Complete Block Design (RCBD) with three replications, with light regimes as the main plot factor and genotypes as the subplot factor. Low light stress was imposed immediately after transplantation by covering the plants with shade nets permitting only 50% light transmittance, supported by metal rods or bamboo poles to ensure uniform and stable coverage throughout the crop growth period. Of the 18 genotypes, 17 exhibited uniform germination and stable establishment across all locations under both conditions.

6.6.1. Influence of low light stress on days to flowering and maturity

The analysis of days to flowering showed clear variation among genotypes under both control and low light stress conditions (Table 6.6.1). The earliest flowering genotype was Swarnaprava, with mean values of 88.46 days under control and 90.25 days under low light stress, followed by IR8 (97.46 and 99.21 days). In contrast, the latest flowering genotype was IET33264, recording 114.38 days under control and 116.46 days under stress, closely followed by IET32175 (114.75 and 113.25 days). Analysis of variance indicated that location, treatment, and genotype had highly significant effects ($p < 0.001$), and all interactions, including location $\times$ treatment, location $\times$ genotype, treatment $\times$ genotype, and location $\times$ treatment $\times$ genotype, were also highly significant, showing differential genotype responses across environments and treatments.

Across environments, mean days to maturity ranged widely among genotypes (Table 6.6.2), with Swarnaprava showing the lowest mean (~118-120 days) and thus the earliest maturity, while IET33264 (~144–145 days) and CR6549 (~142–145 days) were the latest. Most genotypes, such as IET33125, IET33127, and IET32175, also showed relatively late maturity (>140 days). Mean performance under low light stress was slightly higher overall than the control, indicating a small delay in maturity. ANOVA revealed highly significant effects of location, treatment, genotype, and their interactions ($L \times T$, $L \times G$, and $L \times T \times G$ all $p < 0.001$), while $T \times G$ interaction was significant but smaller ($p \approx 0.026$). This indicates that genotype response to maturity is strongly influenced by environment and stress conditions

6.6.2. Influence of low light stress on chlorophyll content at the panicle initiation stage

The chlorophyll content during the panicle initiation stage varied significantly among genotypes, locations, and treatments (Table 6.6.3). Under control (normal light) conditions, the highest mean chlorophyll content was recorded in CR6549 (3.80 mg/g FW), followed by IET33127 (3.56 mg/g FW) and IET33159 (3.71 mg/g FW), indicating superior photosynthetic potential during panicle initiation. In contrast, IET31246 (2.79 mg/g FW) and IET32150 (2.84 mg/g FW) exhibited the lowest chlorophyll levels, suggesting limited pigment accumulation and potentially lower light-harvesting efficiency under non-stress conditions (Fig. 6.6.1).

Exposure to low light stress resulted in a general increase in chlorophyll content across most genotypes, reflecting an adaptive response to reduced light availability. The highest chlorophyll content under low light was observed in IET33125 (5.01 mg/g FW), followed by IET32134 (4.88 mg/g FW), and IET33127 (4.79 mg/g FW). These genotypes displayed strong light-compensation mechanisms, likely through enhanced chlorophyll biosynthesis or reduced degradation. Conversely, IET33150 (3.61 mg/g FW) and IET32150 (3.75 mg/g FW) maintained the lowest chlorophyll levels, indicating poor adaptability to shading stress.

The three-way ANOVA indicated highly significant effects of location, treatment, and genotype, as well as significant interactions among location $\times$ treatment, location $\times$ genotype, treatment $\times$ genotype, and location $\times$ treatment $\times$ genotype ($P < 0.001$ for all), highlighting that chlorophyll accumulation during panicle initiation is strongly influenced by environmental condition, genetic background, and light availability. Genotype-specific comparisons revealed that IET33125, IET33264, IET32134, IET33127, and CR6549 consistently maintained high chlorophyll content across locations and treatments, reflecting robust photosynthetic performance and adaptability under varying light environments. In contrast, IET32150 exhibited the lowest chlorophyll content in both control and low light stress, and IET33150 showed poor chlorophyll content under low light condition, identifying it as highly light-sensitive.

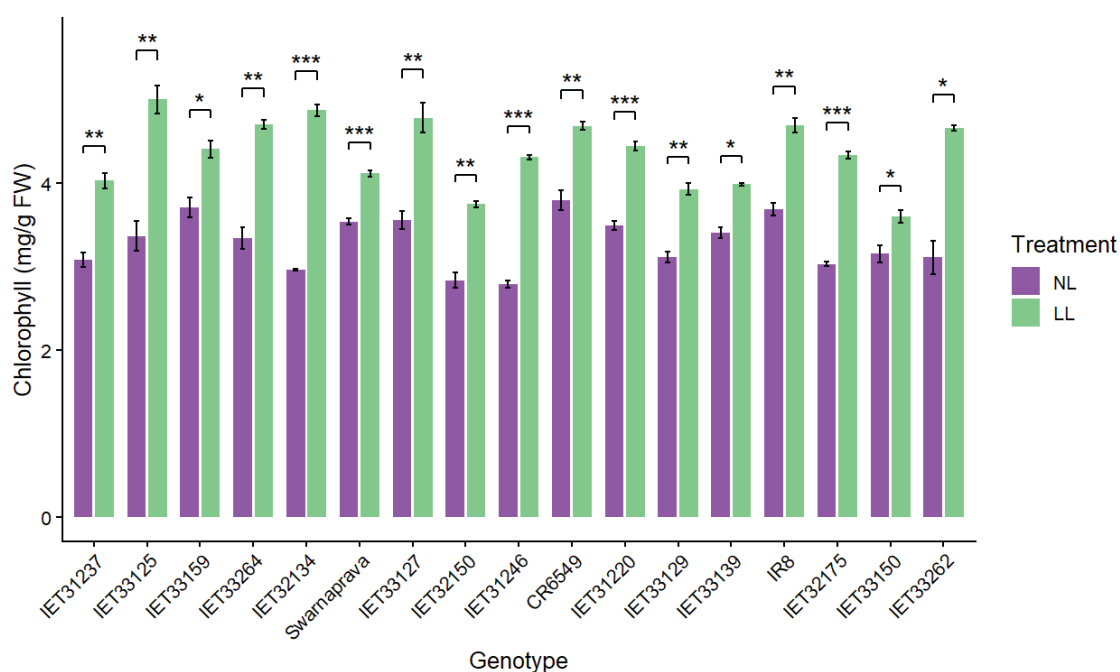


Fig. 6.6.1: Influence of low light stress on chlorophyll content at panicle initiation stage

6.6.3. Influence of low light stress on chlorophyll content at the flowering stage

The chlorophyll content at the flowering stage showed substantial variation among genotypes, locations, and treatments (Table 6.6.4). Under control (normal light) conditions, the highest mean chlorophyll content was observed in IET33159 (3.12 mg/g FW), followed by CR6549 (3.00 mg/g FW) and CR6549 (2.96 mg/g FW). These genotypes exhibited superior photosynthetic potential, indicating efficient light capture and chlorophyll accumulation at flowering. In contrast, IET31246 (2.26 mg/g FW) and IET32175 (2.28 mg/g FW) recorded the lowest mean chlorophyll levels, suggesting limited pigment accumulation and potential vulnerability to light-limiting conditions even under normal light conditions (Fig. 6.6.2).

Exposure to low light stress resulted in an overall increase in chlorophyll content across most genotypes, reflecting an adaptive response to reduced light intensity. The highest chlorophyll content under low light was found in IET33125 (4.08 mg/g FW), followed by IET33264 (3.88 mg/g FW), CR6549 (3.81 mg/g FW), and IR8 (3.81 mg/g FW). These genotypes demonstrated strong light-compensation mechanisms, likely involving enhanced chlorophyll biosynthesis or reduced degradation. Conversely, IET33150 (3.12 mg/g FW) and IET31246 (3.28 mg/g FW) showed the lowest chlorophyll levels under low light stress, indicating poor adaptability to shading conditions.

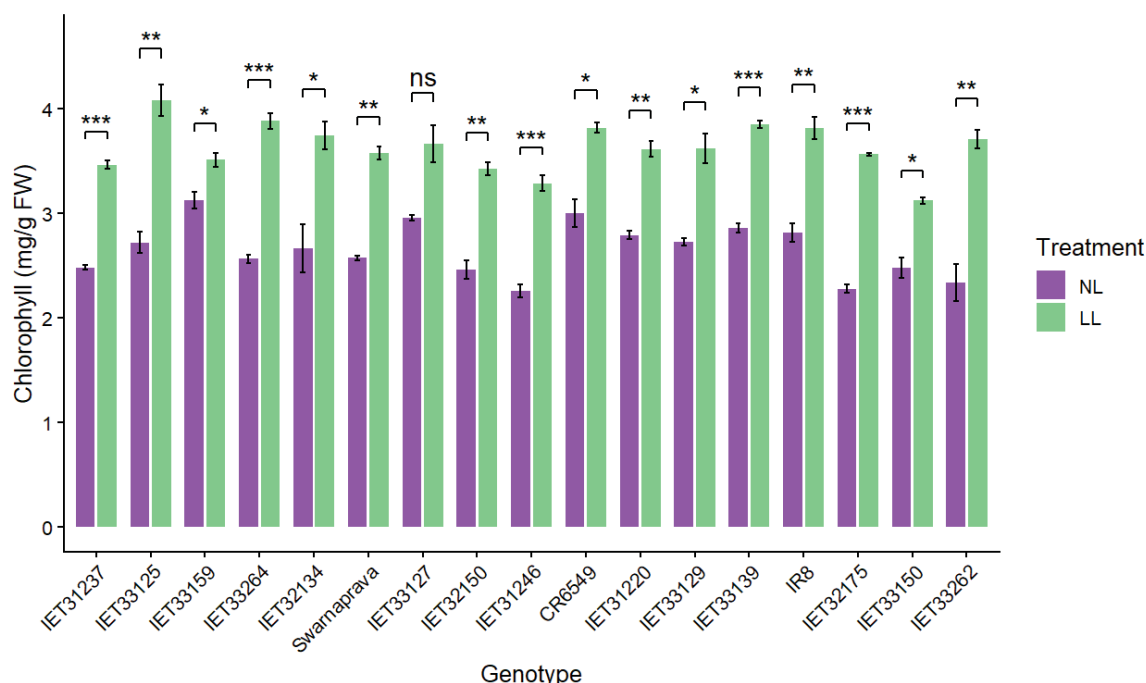


Fig. 6.6.2: Influence of low light stress on chlorophyll content at the flowering stage

The three-way ANOVA confirmed highly significant effects of location, treatment, genotype, and significant interactions among location $\times$ treatment, location $\times$ genotype, treatment $\times$ genotype, and location $\times$ treatment $\times$ genotype ($P < 0.001$ for all). This highlights that chlorophyll accumulation at flowering is strongly influenced by environmental conditions, genotype, and their interactions under variable light conditions. Genotype-specific analysis revealed that IET33125, IET33264, CR6549, IR8, and IET33159 consistently maintained high chlorophyll content across locations and treatments, indicating robust photosynthetic performance and shade adaptability. In contrast, IET31246 consistently exhibited the lowest chlorophyll levels under both control and low light stress, and IET33150 exhibited the lowest chlorophyll under low light conditions, marking it as highly light-sensitive.

6.6.4. Influence of low light stress on plant height (cm)

Plant height varied significantly among genotypes, locations, and light treatments, indicating strong genotypic differences and environmental influence (Table 6.6.5). Under control (normal light) conditions, genotype IET33150 recorded the highest mean plant height (128.16 cm), followed by Swarnaprava (126.41 cm) and IET32150 (126.04 cm), demonstrating superior plant height and stable growth across environments. In contrast, IR8 exhibited the lowest plant height (119.18 cm). Among the remaining genotypes, CR6549 (108.52 cm) also showed comparatively reduced plant stature under normal light conditions (Fig. 6.6.3).

Low light stress significantly influenced plant height, indicating a general elongation response under reduced irradiance. The tallest plants under low light stress were observed in genotype Swarnaprava, which recorded the highest mean plant height (139.34 cm), followed by IET33150 (134.21 cm) and IET32150 (132.54 cm). These genotypes exhibited strong elongation ability, suggesting effective shade adaptation mechanisms that promote stem growth under limited light availability. Conversely, IR8 again recorded the lowest plant height (113.14 cm), confirming its poor adaptability to low-light environments. Genotype CR6549 (115.99 cm) also showed relatively lower elongation responses compared with high-performing genotypes.

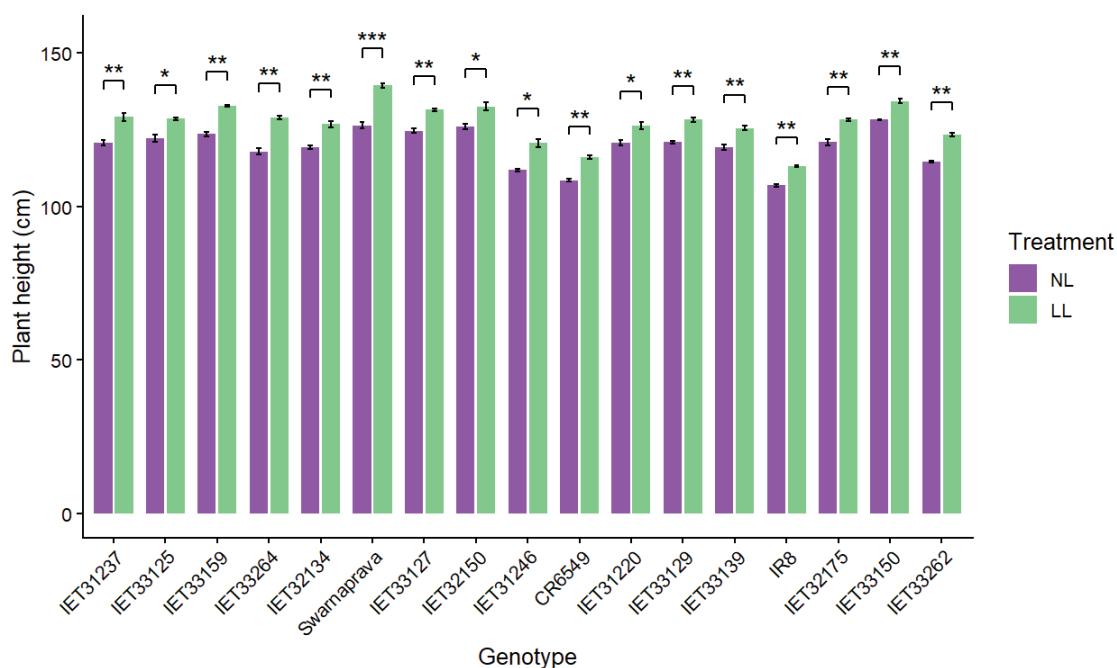


Fig. 6.6.3: Influence of low light stress on plant height (cm)

The three-factor analysis of variance revealed highly significant effects of location, treatment, and genotype on plant height. Significant interaction effects were also observed for location $\times$ treatment, location $\times$ genotype, treatment $\times$ genotype, and location $\times$ treatment $\times$ genotype ($P < 0.001$), indicating that plant height responses differed depending on genotype and environmental conditions. These strong interaction effects highlight the importance of genotype-specific plasticity in determining plant growth under varying light environments. Overall, low light conditions promoted increased plant height across most genotypes, reflecting a typical shade-avoidance response characterized by enhanced stem elongation. Genotypes Swarnaprava, IET33150, and IET32150 consistently maintained superior plant height under both normal and low light conditions, suggesting stable growth performance and adaptive plasticity. In contrast, IR8 and CR6549 showed consistently poor growth across treatments, identifying them as highly sensitive to environmental variation.

6.6.5. Influence of low light stress on shoot weight (g/m^2)

Significant variation in shoot weight was observed among genotypes under control (normal light) conditions across different locations (Table 6.6.6). Under control (normal light) conditions, the overall mean values indicated that genotype IET33264 recorded the highest shoot weight (1074.50 g/m^2), followed by IET33150 (1069.55 g/m^2) and IET32175 (1066.69 g/m^2), demonstrating superior biomass accumulation under favourable light conditions. The higher shoot weight in these genotypes suggests efficient photosynthetic activity and better

resource utilization when light was not limiting. In contrast, IET33262 exhibited the lowest mean shoot weight (842.82 g/m²), indicating poor growth performance and adaptability. Analysis of variance revealed highly significant effects of location, treatment, and genotype, confirming that both environmental and genetic factors played a major role in determining shoot weight (Fig. 6.6.4).

Under low light stress, shoot weight decreased considerably across genotypes, indicating the suppressive effect of reduced irradiance on plant growth and biomass accumulation. Among the genotypes, IET33125 recorded the highest mean shoot weight (828.20 g/m²), followed by Swarnaprava (777.83 g/m²) and IET33264 (774.20 g/m²), suggesting relatively better tolerance to low light stress through maintenance of shoot biomass. Conversely, IET33139 recorded the lowest shoot weight (430.94 g/m²), confirming high susceptibility to light limitation.

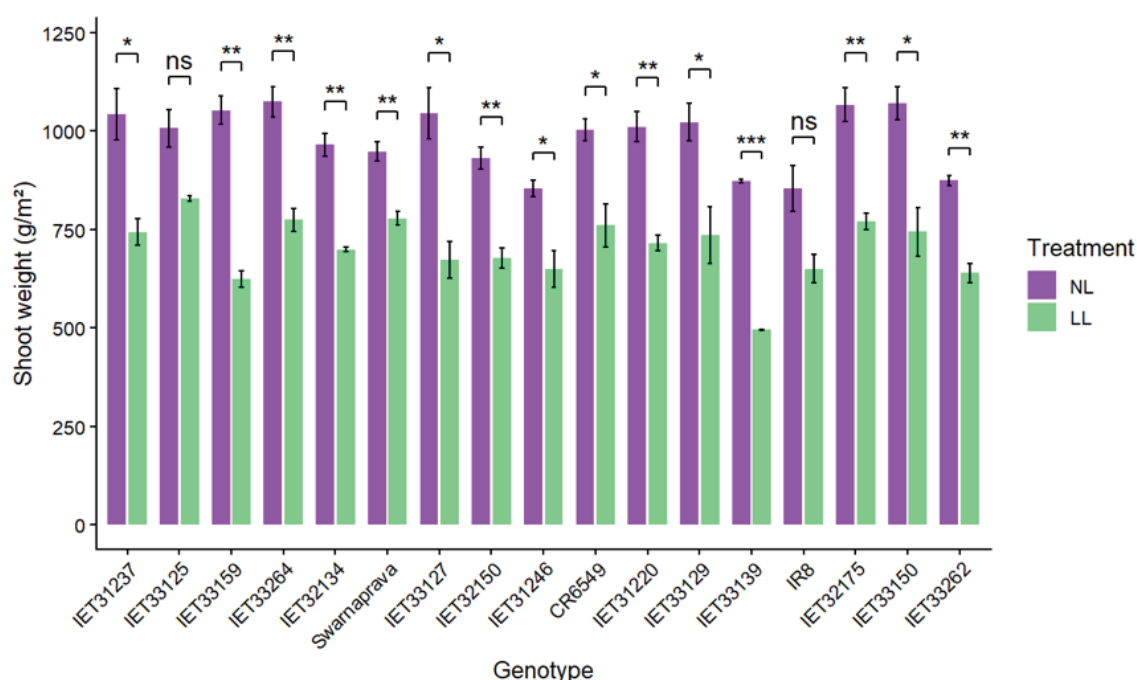


Fig. 6.6.4: Influence of low light stress on shoot weight (g/m²)

The three-way ANOVA for shoot weight revealed highly significant effects of location, treatment, and genotype, indicating that biomass accumulation was strongly influenced by environmental conditions, light regime, and genetic variability. The significant interactions indicate that the reduction in shoot weight under low light varied across locations and genotypes, reflecting strong interaction among environmental and genetic factors. Genotype-wise analysis showed that IET33264, IET32175, IET33150, IET33125, and IET33127 maintained comparatively higher shoot weight across locations under both normal and low light conditions, suggesting better biomass retention and adaptability to reduced irradiance. In contrast, IET33262 and IET33139 recorded the lowest shoot weight under normal light and low light conditions, respectively, indicating high sensitivity to low light stress.

6.6.6. Influence of low light stress on panicle weight (g/m²)

Panicle weight (g/m²) varied significantly among genotypes, locations, and light treatments, indicating strong environmental and genetic control over reproductive biomass production (Table 6.6.7). Under control (normal light) conditions, genotype IET33159

recorded the highest mean panicle weight (908.51 g/m²), followed by IET33150 (842.49 g/m²) and IET31237 (832.82 g/m²), demonstrating superior sink development and efficient assimilate partitioning under favourable light environments. In contrast, IET32134 exhibited the lowest mean panicle weight (602.93 g/m²), largely due to poor performance across several locations (Fig. 6.6.5).

Under low light stress, overall panicle weight declined markedly. The highest mean under stress was observed in IET31237 (571.92 g/m²), closely followed by IET33159 (571.47 g/m²) and IET33150 (539.11 g/m²), indicating relatively better tolerance through maintenance of reproductive biomass. The lowest mean again occurred in IET32150 (381.53 g/m²), confirming its strong sensitivity to reduced light conditions.

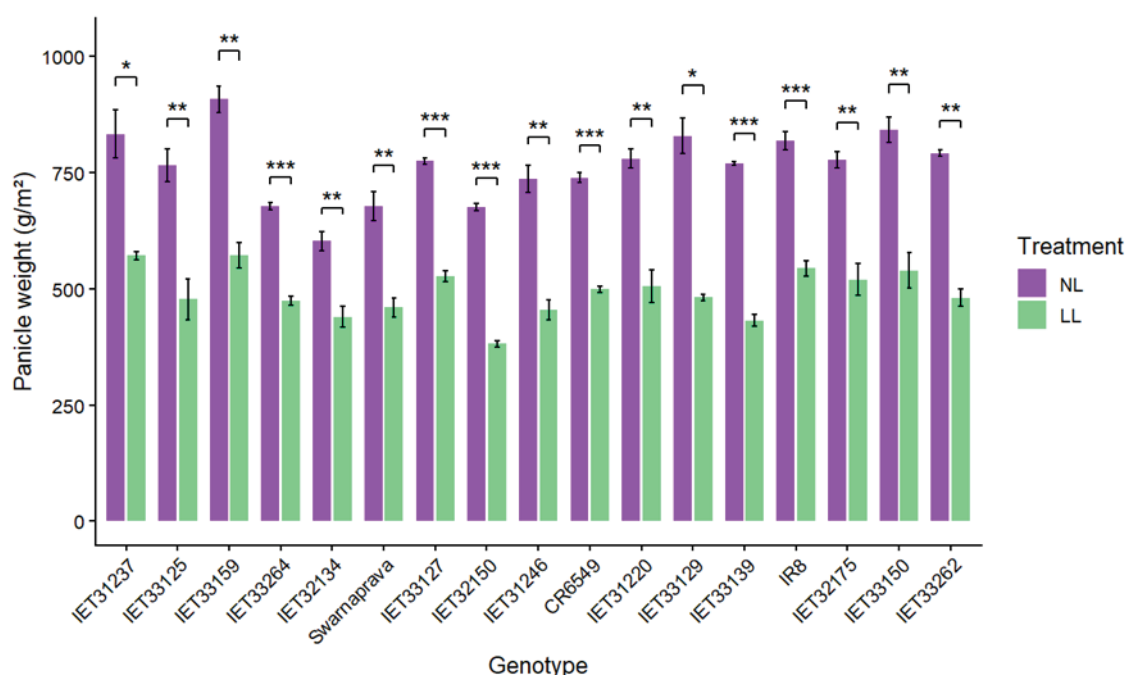


Fig. 6.6.5: Influence of low light stress on panicle weight (g/m²)

Three-way ANOVA revealed highly significant effects of location, treatment, and genotype. Significant interactions indicated that genotype responses to low light differed across environments and that panicle weight expression depended on combined environmental and genetic effects. Overall, IET33159 emerged as the best-performing genotype due to consistently high panicle weight under both light conditions. Whereas, IET32134 and IET32150 were the least-performing genotypes under normal and low light conditions, respectively. These results suggest that stable reproductive biomass under variable light conditions is genotype-dependent, emphasizing the importance of multi-location screening for identifying shade-tolerant, high-yielding rice genotypes suitable for diverse production environments.

6.6.7. Influence of low light stress on spikelet number per panicle

Spikelet number per panicle showed substantial variation among genotypes, locations, and light treatments, indicating strong environmental and genetic regulation of reproductive development (Table 6.6.8). Under control (normal light) conditions, the highest mean spikelet number was recorded in IET33159 (235.85), followed by IET33129 (231.67) and IR8 (212.81), reflecting superior panicle development and reproductive efficiency under favourable light

environments. In contrast, IET32134 exhibited the lowest mean value (161.16), primarily due to extremely poor performance across several locations (Fig. 6.6.6).

Under low light stress, spikelet number declined across genotypes, confirming the sensitivity of reproductive traits to reduced irradiance. The highest mean under stress was jointly observed in IET33159 and IET33129 (175.72), followed by IET33262 (167.17), indicating relatively better maintenance of spikelet formation under light limitation. The lowest mean again occurred in Swarnaprava (132.73), demonstrating high susceptibility to low light stress.

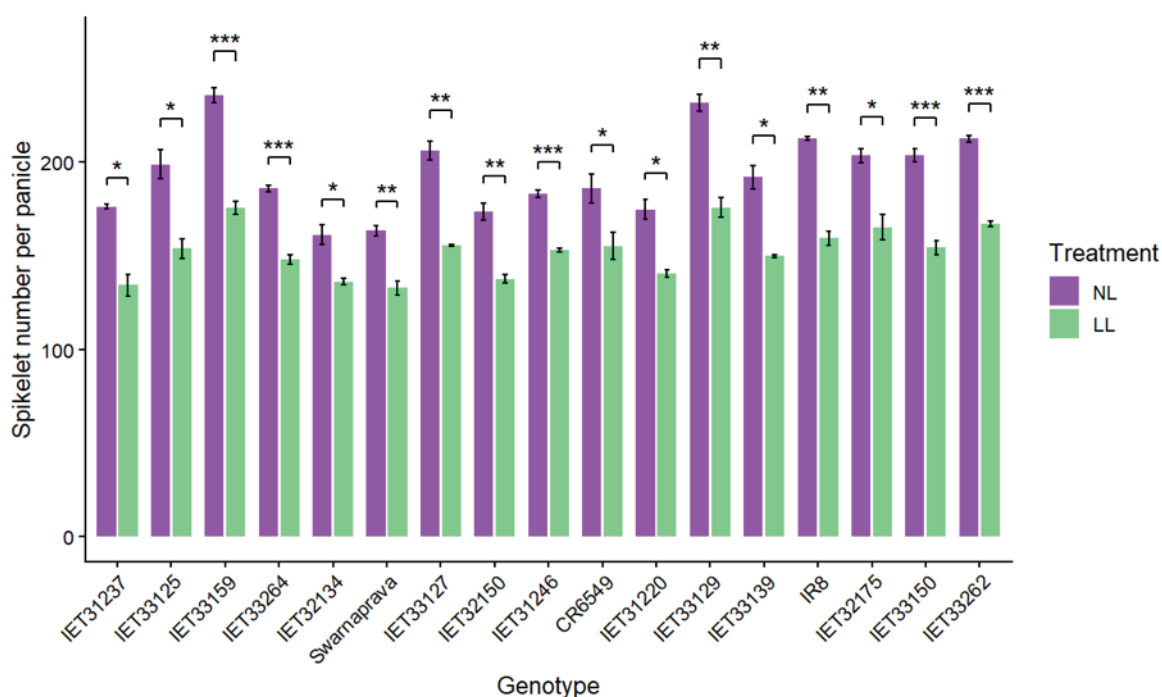


Fig. 6.6.6: Influence of low light stress on spikelet number per panicle

Three-way ANOVA revealed highly significant main effects of location, treatment, and genotype. Significant interaction indicating that genotype responses to low light varied across environments and that spikelet formation depended on combined genetic and environmental influences. Overall, IET33159 emerged as the best-performing genotype due to consistently high spikelet numbers under both light regimes, whereas IET32134 and Swarnaprava were the least-performing genotypes under normal and low light conditions, respectively.

6.6.8. Influence of low light stress on grain number per panicle

Grain number per panicle varied significantly among genotypes and environments, clearly demonstrating the combined influence of genetic potential and light availability on reproductive success (Table 6.6.9). Under control (normal light) conditions, the highest mean grain number per panicle was recorded in IET33159 (190.90), followed by IET33129 (177.56) and IET33262 (176.40), indicating superior grain-setting ability under optimal radiation, whereas IET33264 registered the lowest mean value (130.27), followed by IET32134 (130.88) (Fig. 6.6.7).

Exposure to low light stress caused an overall reduction in grain number across genotypes, confirming the sensitivity of grain formation to reduced photosynthetic radiation.

Under stress, IET33159 again maintained the highest mean (152.27), closely followed by IET33129 (151.33) and IET33262 (132.00), suggesting better tolerance and stability of reproductive processes. The lowest mean under low light was observed in IET33264 (104.96), indicating high susceptibility to shading stress.

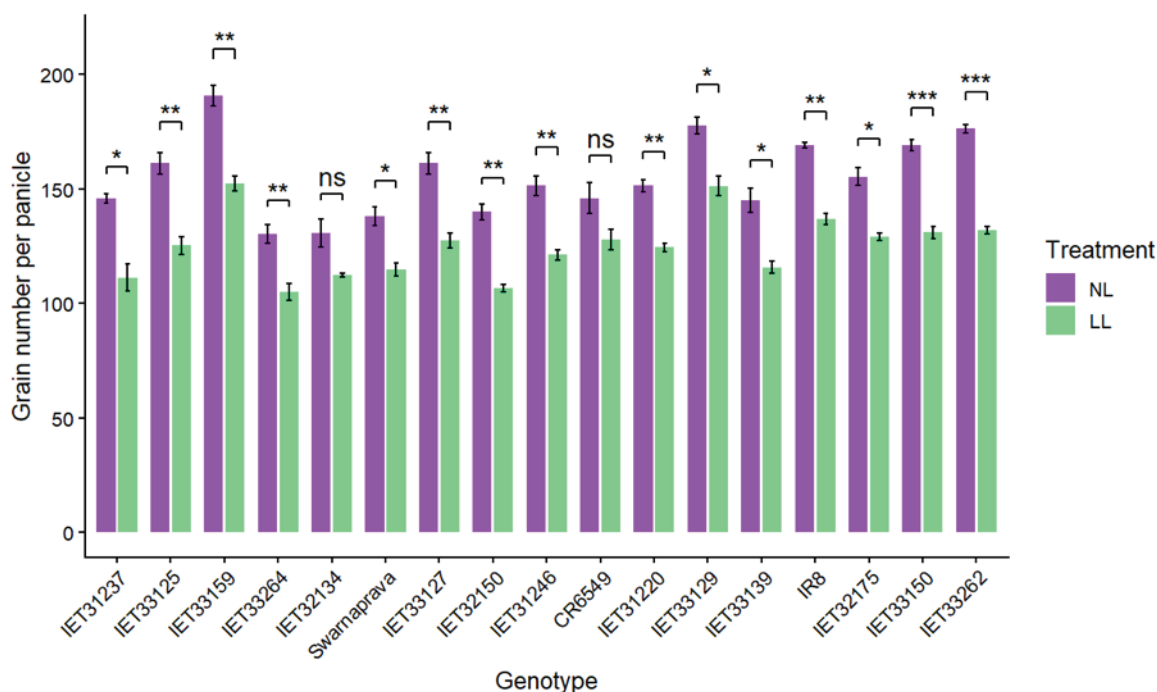


Fig. 6.6.7: Influence of low light stress on grain number per panicle

Analysis of variance revealed highly significant effects of location, treatment, and genotype, confirming strong environmental and genetic control over grain number per panicle. Interaction effects were also significant, indicating differential genotype responses across environments. Treatment $\times$ genotype interaction suggests that genotype performance under low light varied depending on location-specific conditions. Overall, IET33159 emerged as the best-performing genotype due to consistently high grain numbers under both light regimes, whereas IET33264 was the least-performing genotype.

6.6. Influence of low light stress on grain yield (g/m^2)

Grain yield (g/m^2) exhibited substantial variation among genotypes, locations, and light environments, indicating strong environmental modulation of yield expression (Table 6.6.10). Under control (normal light) conditions, the highest mean grain yield was recorded in IET33159 (741.39 g/m^2), followed by IET33150 (722.67 g/m^2) and IET31220 (679.13 g/m^2), demonstrating superior productivity under optimal radiation. In contrast, Swarnaprava registered the lowest mean yield (510.07 g/m^2). Overall, the control environment produced markedly higher yields compared with stress conditions, confirming the dependence of biomass accumulation and grain filling on adequate light availability (Fig. 6.6.8).

Under low light stress, a pronounced reduction in grain yield was observed across genotypes. The highest mean yield under stress was again maintained by IET33159 (469.58 g/m^2), followed by IET31237 (416.49 g/m^2) and CR6549 (414.79 g/m^2), indicating better adaptability and yield stability under reduced irradiance. The lowest yield under low light occurred in IET33129 (324.21 g/m^2), highlighting extreme sensitivity to shading conditions.

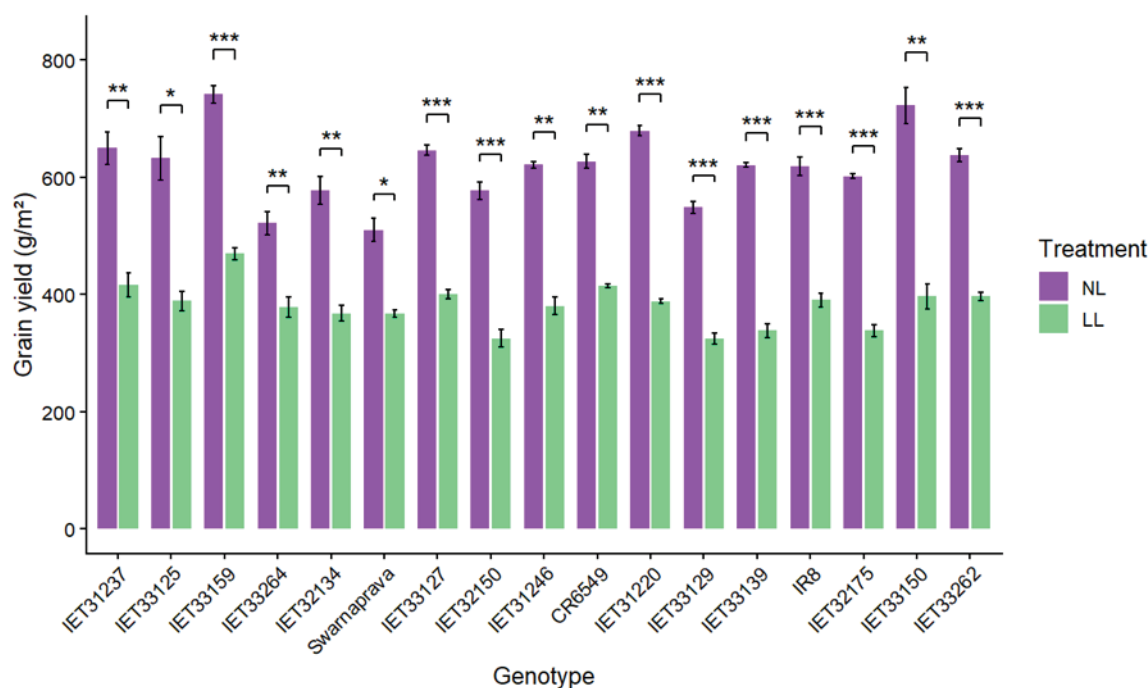


Fig. 6.6.8: Influence of low light stress on grain yield (g/m²)

Analysis of variance revealed highly significant effects of location, treatment, and genotype, confirming that both environmental and genetic factors strongly influenced yield performance. Interaction effects were also highly significant, indicating differential genotype responses across environments and light regimes. The significant three-way interaction (location $\times$ treatment $\times$ genotype; LSD = 118.54) further demonstrates that genotype performance under low light was environment-specific. Overall, IET33159 emerged as the best-performing genotype, combining the highest productivity and stability across both light regimes, whereas Swarnaprava and IET33129 were the least performing genotypes under normal and low light conditions. resilience under light-limited or dense canopy production systems.

6.6.10. Influence of low light stress on total dry matter (g/m²)

The total dry matter production (g/m²) varied widely among genotypes across both normal and low light environments, indicating substantial genetic variability and differential response to light stress (Table 6.6.11). Under control (normal light) conditions, the highest mean total dry matter was recorded in IET33150 (1829.20 g/m²), followed by IET33159 (1802.73 g/m²), reflecting their superior biomass accumulation under optimal growing conditions. In contrast, the lowest mean was observed in IET32134 (1386.97 g/m²), indicating comparatively lower productivity.

Under low light stress, a marked reduction in dry matter was observed across all genotypes. However, IET32175 (1304.49 g/m²) and IET33150 (1287.55 g/m²) maintained relatively higher means, suggesting better tolerance to reduced light intensity. The lowest mean under stress was recorded in IET33139 (932.82 g/m²), indicating higher sensitivity (Fig. 6.6.9).

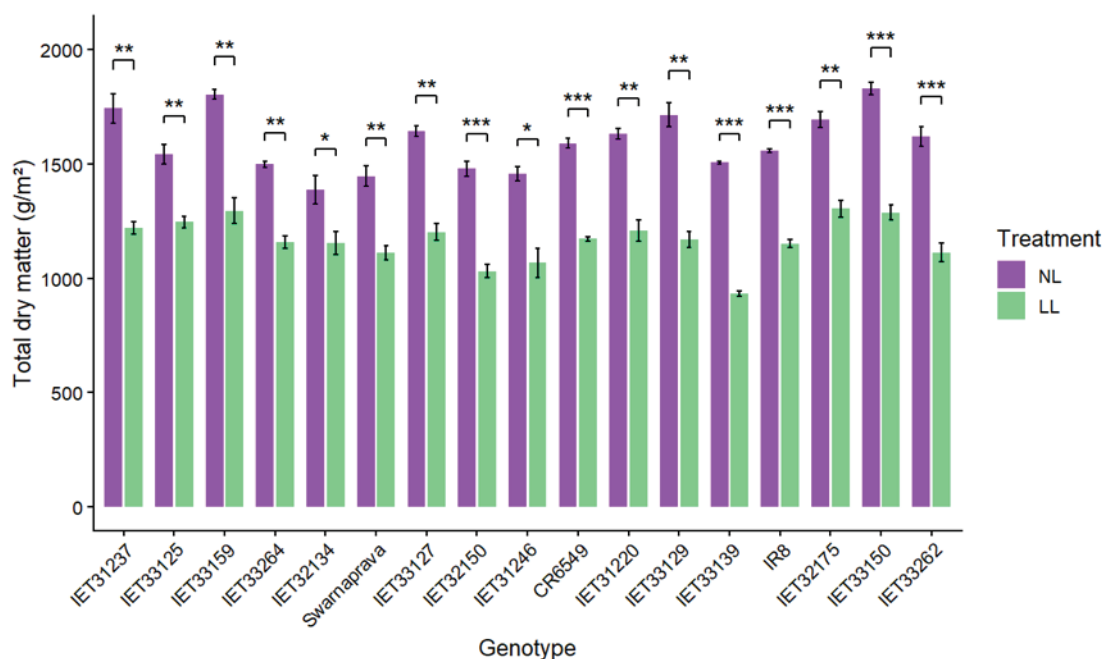


Fig. 6.6.9: Influence of low light stress on total dry matter (g/m²)

The analysis of variance revealed highly significant effects ($p < 0.001$) for all sources of variation, confirming the strong impact of light availability and environmental conditions on biomass production. All interaction effects were also significant, indicating that genotype performance varied across environments and light conditions. Overall, IET33150 emerged as the best-performing genotype due to its consistently high dry matter under both conditions, while IET32134 and IET33139 showed the least performance under stress conditions.

6.6.11. Influence of low light stress on 1000-grain weight (g)

The 1000-grain weight (g) exhibited notable variation among genotypes under both normal and low light conditions, reflecting differential sensitivity to light stress (Table 6.6.12). Under control (normal light), the highest mean 1000-grain weight was recorded in IET31237 (28.75 g), followed by IET31220 (23.50 g) and Swarnaprava (23.06 g), indicating superior grain filling under optimal conditions. In contrast, the lowest mean was observed in IR8 (18.75 g), closely followed by IET33139 (18.75 g), suggesting relatively poor performance (Fig. 6.6.10).

Under low light stress, a general decline in grain weight was evident across all genotypes. However, IET31237 (26.40 g) maintained the highest mean, demonstrating strong tolerance, while Swarnaprava (21.33 g) and IET32134 (20.52 g) also performed relatively well. The lowest mean under stress was recorded in IR8 (16.51 g), followed by IET33262 (17.10 g), indicating susceptibility to reduced light. In some genotypes, the 1000-grain weight was higher under normal light conditions compared to low light stress; however, the differences between treatments were non-significant.

Analysis of variance revealed highly significant ($p < 0.001$), confirming that both environmental and genetic factors strongly influenced grain weight. All interaction effects were also significant, indicating that genotype performance varied across environments and light conditions. Overall, IET31237 emerged as the best-performing genotype, maintaining the highest grain weight under both conditions, while IR8 was the least-performing genotype (Fig. 10).

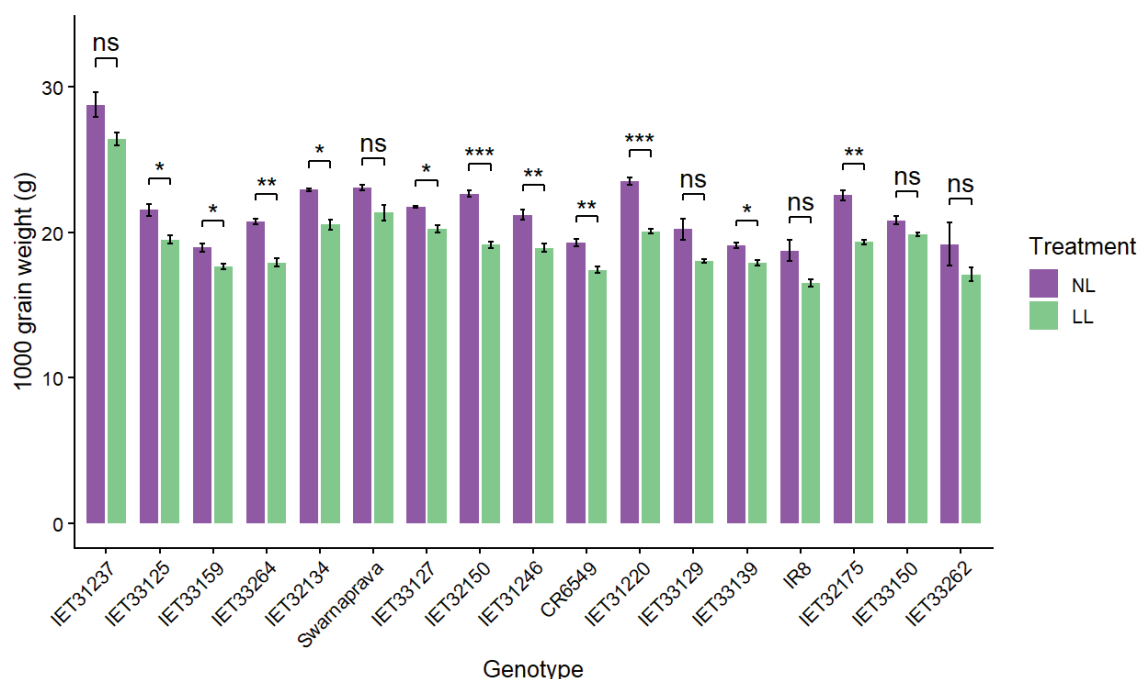


Fig. 6.6.10: Influence of low light stress on 1000 grain weight (g)

6.6.12. Influence of low light stress on harvest index (%)

The harvest index (%) showed considerable variation among genotypes under both normal and low light conditions, reflecting differences in biomass partitioning efficiency (Table 6.6.13). Under control (normal light), the highest mean harvest index was recorded in IET31237 (42.54%), followed closely by IET33262 (41.95%) and IET32134 (41.43%), indicating superior allocation of assimilates towards grain yield under optimal conditions. In contrast, the lowest mean was observed in IET32175 (35.02%), suggesting relatively poor partitioning efficiency.

Under low light stress, a general decline in harvest index was observed across genotypes. However, IET31237 (37.77%) maintained the highest mean, followed by IET31246 (36.53%) and IET33159 (36.35%), indicating better tolerance to stress conditions. The lowest mean under stress was recorded in IET32175 (29.99%), indicating sensitivity to reduced light.

The analysis of variance revealed highly significant effects ($p < 0.001$) for all sources of variation. All interaction effects were also significant, indicating that genotype performance varied across environments and light conditions. (Fig. 6.6.11).

Overall, IET31237 emerged as the best-performing genotype, maintaining the highest harvest index under both conditions, indicating strong stability and efficient assimilate

partitioning. In contrast, IET32175 was identified as the least-performing genotype under stress conditions.

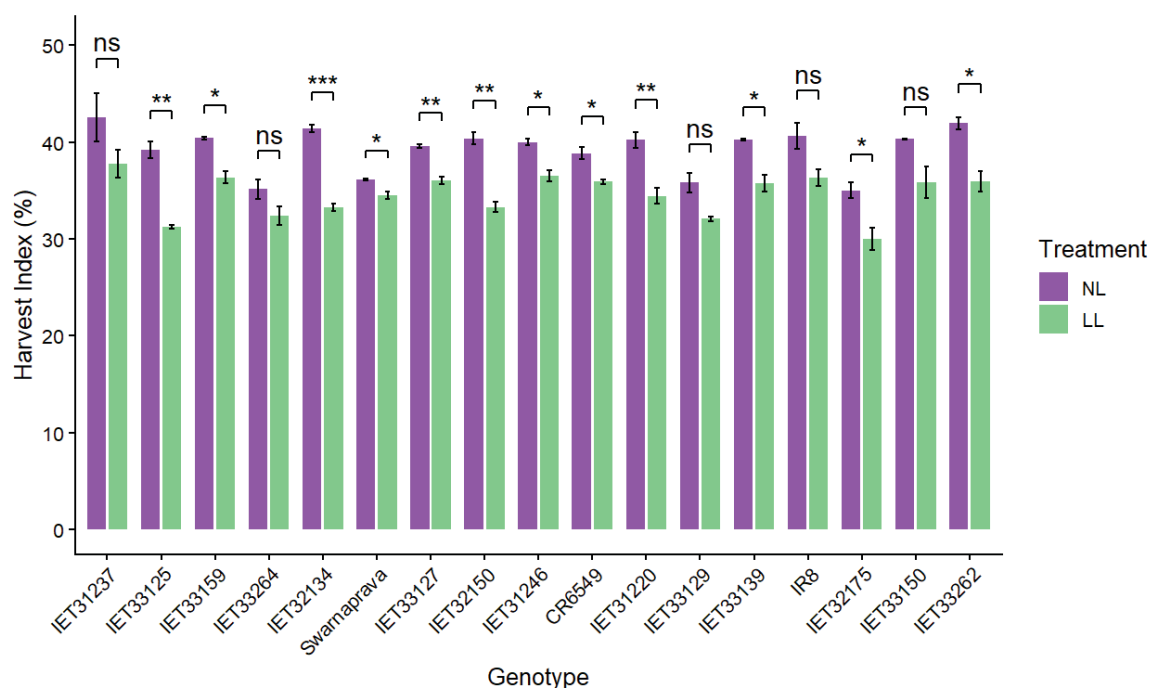


Fig. 6.6.11: Influence of low light stress on harvest index (%)

6.6.13. Summary

- The AICRP trial evaluated 18 rice genotypes across eight locations (CRRI, RPUR, PTB, KJT, PNR, MTU, CHN, and TTB) during the Kharif 2025 season under a split-plot design with low light stress imposed through 50% shade net immediately after transplantation.
- Of the 18 genotypes, 17 exhibited uniform germination under both control and stress conditions; genotype Pratikhya failed to germinate at any location, indicating inherent poor seed viability rather than a stress-specific response.
- Low light stress significantly influenced all growth, physiological, and yield-related traits across genotypes. Flowering and maturity were slightly delayed under stress, with Swarnaprava recording the earliest mean flowering (88.46 days) and IET32175 the latest (114.75 days). Chlorophyll content exhibited a compensatory increase under low light at both panicle initiation and flowering stages across most genotypes, reflecting an adaptive mechanism to enhance light-harvesting capacity under reduced irradiance. Plant height increased under stress due to shade-avoidance elongation responses, while biomass accumulation and reproductive traits viz., including shoot weight, panicle weight, spikelet number, and grain number per panicle that declined markedly, confirming the sensitivity of yield components to reduced light availability.
- Trait-wise analysis revealed genotype-specific differences in stress tolerance. IET33159 consistently recorded the highest grain yield under stress (469.58 g/m²), along with superior panicle weight, spikelet number (175.72), and grain number per panicle (152.27), emerging as the best-performing genotype across most yield parameters. IET33125 maintained the highest chlorophyll content under low light (4.08 mg/g FW at flowering) and the highest

shoot weight under stress (828.20 g/m²), reflecting strong photosynthetic adaptability. IET33150 recorded the highest total dry matter under stress (1,287.55 g/m²), while IET31237 maintained the highest 1000-grain weight (26.40 g) and harvest index (37.77%) under stress, indicating superior assimilate partitioning efficiency. IET33264 and IET33127 also exhibited consistently superior performance across traits and locations.

- In contrast, genotypes Swarnaprava, IET32134, IET32150, and IET33262 demonstrated higher sensitivity to low light stress, registering poor performance across yield and biomass parameters. IET32175 showed the lowest harvest index under stress (29.99%), indicating the weakest assimilate partitioning efficiency, while IR8 was the least-performing genotype for grain weight. Strong genotype × environment × treatment interactions were observed for all traits ($p < 0.001$), underscoring the necessity of multi-location evaluation for reliable identification of shade-tolerant genotypes.

6.6.14. Conclusion

The present multi-location evaluation clearly demonstrates that low light stress during the kharif season significantly impairs rice productivity by suppressing biomass accumulation, reducing reproductive efficiency, and lowering grain yield. However, considerable genotypic variation was observed, and several genotypes exhibited commendable adaptive responses to low irradiance. Among all genotypes evaluated, IET33159 emerged as the most promising shade-tolerant cultivar, consistently outperforming others in grain yield, panicle weight, spikelet number, and grain number per panicle under stress across locations. IET33125, IET33264, IET33127, CR6549, IET33150, and IET31237 also demonstrated notable tolerance, contributing superior chlorophyll maintenance, biomass production, and grain quality under reduced irradiance. These genotypes are recommended as promising candidates for direct cultivation in cloudy and low-radiation rice-growing regions of eastern and northeastern India, as well as for use as donor parents in breeding programs aimed at developing shade-tolerant, high-yielding rice varieties. Multi-location, multi-season evaluation of these promising lines is recommended to confirm their stability and adaptability before large-scale deployment.

Table 6.6.1: Influence of low light stress on days to flowering at different locations during Kharif 2025

Genotype	CRR	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	108.00	102.33	97.00	92.67	106.00	95.00	109.67	114.33	103.13
IET33125	118.00	111.67	95.67	100.00	117.00	97.33	124.00	106.33	108.75
IET33159	112.00	106.67	90.67	99.33	118.00	91.33	118.00	101.00	104.63
IET33264	112.00	119.00	92.33	102.00	143.00	109.33	132.00	105.33	114.38
IET32134	106.67	98.67	89.33	78.00	141.00	101.33	107.00	105.00	103.38
Swarnaprava	82.00	86.00	80.00	82.33	84.00	95.33	93.00	105.00	88.46
IET33127	121.00	112.00	89.33	96.00	120.00	106.67	122.00	123.33	111.29
IET32150	112.00	99.33	80.67	75.00	97.00	108.33	105.00	109.00	98.29
IET31246	109.00	106.00	82.33	96.33	119.00	101.33	118.00	115.67	105.96
CR6549	109.00	112.00	92.67	103.67	137.00	98.67	131.00	110.67	111.83
IET31220	112.00	109.00	92.00	100.67	119.00	92.67	119.67	109.00	106.75
IET33129	112.00	104.00	100.33	101.00	100.00	101.67	115.00	108.00	105.25
IET33139	94.00	95.67	-	-	-	-	109.00	108.00	101.67
IR8	94.00	96.00	93.67	90.00	96.00	100.00	105.00	105.00	97.46
IET32175	121.00	123.00	106.00	86.33	124.00	101.67	134.00	122.00	114.75
IET33150	112.00	106.00	90.00	100.33	105.00	97.33	112.00	124.00	105.83
IET33262	108.00	102.67	88.33	93.00	107.00	100.67	111.00	124.00	104.33
Mean	108.39	105.29	85.90	88.04	107.82	94.04	115.61	111.51	
Low light stress									
IET31237	108.00	102.33	96.00	93.33	108.00	98.33	114.67	115.33	104.50
IET33125	118.00	119.00	95.33	98.33	120.00	100.33	132.00	104.33	110.92
IET33159	112.00	112.33	90.00	97.67	119.00	94.33	120.33	103.33	106.13
IET33264	112.00	126.67	93.00	102.00	144.00	111.67	133.33	109.00	116.46
IET32134	104.00	101.00	90.67	78.00	143.00	104.67	110.67	105.33	104.67
Swarnaprava	82.00	92.00	83.00	80.67	86.00	98.33	95.00	105.00	90.25
IET33127	123.00	109.33	93.33	95.33	122.00	108.67	125.33	118.00	111.88
IET32150	104.00	99.00	81.67	75.00	98.00	111.33	109.00	109.00	98.38
IET31246	114.00	104.67	83.00	96.67	120.00	104.33	122.00	112.00	107.08
CR6549	112.00	115.67	90.67	102.67	138.00	105.33	132.00	119.00	114.42
IET31220	112.00	116.67	92.67	101.67	120.00	93.00	120.00	108.67	108.08
IET33129	114.00	106.67	106.33	99.33	103.00	102.67	116.67	109.67	107.29
IET33139	99.00	93.33	-	-	-	-	109.67	112.33	103.58
IR8	108.00	97.33	84.33	90.00	98.00	102.67	105.00	108.33	99.21
IET32175	108.00	127.00	112.00	82.67	127.00	104.00	137.00	108.33	113.25
IET33150	108.00	108.33	88.67	101.00	107.00	102.67	115.67	106.00	104.67
IET33262	112.00	110.33	90.33	91.33	111.00	102.67	112.33	107.33	104.67
Mean	108.82	108.33	86.53	87.39	109.65	96.76	118.27	109.47	
LSD (Treatment)							0.31		
LSD (Location × Treatment)							0.89		
LSD (Genotype)							0.94		
LSD (Location × Genotype)							2.66		
LSD (Treatment × Genotype)							1.33		
LSD (Location × Treatment × Genotype)							3.76		
CV (Residual) %							2.42		

Table 6.6.2: Influence of low light stress on days to maturity at different locations during Kharif 2025

Genotype	CRR1	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	137.00	141.67	129.33	122.33	136.00	126.33	142.00	144.33	134.88
IET33125	148.00	149.33	127.67	123.67	146.00	129.00	157.00	136.33	139.63
IET33159	144.00	141.67	122.67	125.67	147.00	122.67	149.00	131.00	135.46
IET33264	144.00	152.67	125.00	127.67	165.00	137.00	166.00	135.33	144.08
IET32134	134.00	139.00	121.33	108.00	164.00	130.67	136.00	135.00	133.50
Swarnaprava	112.00	125.00	112.00	106.33	116.00	125.33	118.00	135.00	118.71
IET33127	153.00	147.33	121.67	123.00	148.00	138.00	152.00	153.33	142.04
IET32150	142.00	138.00	112.67	102.00	129.00	139.33	134.00	139.00	129.50
IET31246	142.00	141.67	114.67	126.67	147.00	131.67	151.00	145.67	137.54
CR6549	142.00	148.67	124.67	127.00	164.00	127.33	162.00	140.67	142.04
IET31220	144.00	145.33	123.00	122.67	147.00	122.33	154.00	139.00	137.17
IET33129	144.00	141.00	133.00	126.00	135.00	132.00	144.00	138.00	136.63
IET33139	125.00	136.33	-	-	-	-	143.00	138.00	135.58
IR8	125.00	136.00	124.67	120.00	129.00	129.67	138.00	135.00	129.67
IET32175	153.00	147.33	137.67	109.00	147.00	132.00	167.00	152.00	143.13
IET33150	142.00	139.00	120.67	128.33	136.00	126.33	147.00	154.00	136.67
IET33262	137.00	140.33	121.00	118.67	142.00	129.67	144.00	154.00	135.83
Mean	139.29	141.78	115.98	112.76	135.18	122.31	147.29	141.51	
Low light stress									
IET31237	137.00	141.67	126.67	123.33	139.00	133.00	147.33	145.33	136.67
IET33125	146.00	149.33	127.00	124.33	151.00	133.67	166.00	134.33	141.46
IET33159	141.00	141.67	121.33	126.00	149.00	126.33	152.67	133.33	136.42
IET33264	141.00	152.67	124.33	129.00	166.00	142.00	168.33	139.00	145.29
IET32134	137.00	139.00	122.33	108.00	166.00	135.67	139.67	135.33	135.38
Swarnaprava	112.00	125.00	115.67	106.67	120.00	130.67	121.00	135.00	120.75
IET33127	155.00	147.33	124.00	124.00	150.00	143.67	157.67	148.00	143.71
IET32150	137.00	138.00	114.00	102.00	132.00	145.33	137.00	139.00	130.54
IET31246	143.00	141.67	115.00	126.67	152.00	137.67	155.33	142.00	139.17
CR6549	143.00	148.67	122.33	127.67	166.00	138.00	164.00	149.00	144.83
IET31220	143.00	145.33	124.33	123.33	149.00	123.00	154.67	138.67	137.67
IET33129	143.00	141.00	139.00	120.33	139.00	132.33	146.00	139.67	137.54
IET33139	132.00	136.33	-	-	-	-	144.33	142.33	138.75
IR8	141.00	136.00	116.33	120.00	134.00	133.00	140.00	138.33	132.33
IET32175	141.00	147.33	143.00	109.00	150.00	136.33	168.00	138.33	141.63
IET33150	141.00	139.00	121.00	129.00	138.00	134.33	150.67	136.00	136.13
IET33262	145.00	140.33	121.67	118.33	144.00	134.67	146.33	137.33	135.96
Mean	139.88	141.78	116.35	112.80	137.94	127.04	150.53	139.47	
LSD (Treatment)									
LSD (Location × Treatment)									
LSD (Genotype)									
LSD (Location × Genotype)									
LSD (Treatment × Genotype)									
LSD (Location × Treatment × Genotype)									
CV (Residual) %									

Table 6.6.3: Influence of low light stress on chlorophyll (mg/g FW) at panicle initiation at different locations during Kharif 2025

Genotype	CRRI	RPUR	PTB	KJT	PNR	Mean
Control						
IET31237	4.42	1.75	3.47	2.38	3.39	3.08
IET33125	4.71	2.53	3.48	2.62	3.50	3.37
IET33159	6.31	2.83	3.47	2.73	3.21	3.71
IET33264	5.51	2.62	3.54	2.55	2.51	3.35
IET32134	3.29	2.12	3.52	2.86	3.04	2.97
Swarnaprava	4.56	2.36	3.45	2.79	4.56	3.54
IET33127	6.25	2.01	3.54	2.93	3.08	3.56
IET32150	3.44	2.00	3.47	2.91	2.38	2.84
IET31246	3.54	1.64	3.49	2.37	2.93	2.79
CR6549	6.40	2.07	3.52	3.39	3.59	3.80
IET31220	5.58	2.44	3.55	2.60	3.32	3.50
IET33129	4.62	2.31	3.52	2.82	2.33	3.12
IET33139	4.41	2.40	-	-	-	3.41
IR8	5.56	2.87	3.50	2.71	3.77	3.69
IET32175	2.60	1.89	3.56	2.88	4.24	3.03
IET33150	4.90	1.72	3.58	3.20	2.38	3.16
IET33262	3.92	1.80	3.44	2.66	3.74	3.11
Mean	4.71	2.20	3.30	2.61	3.06	
Low light stress						
IET31237	4.54	2.17	3.48	4.59	5.38	4.03
IET33125	7.62	3.05	3.51	4.58	6.28	5.01
IET33159	6.95	3.04	3.51	3.99	4.58	4.41
IET33264	9.24	2.73	3.49	3.28	4.78	4.71
IET32134	8.63	2.60	3.45	4.73	4.97	4.88
Swarnaprava	4.51	2.71	3.47	3.60	6.31	4.12
IET33127	9.16	2.55	3.54	4.18	4.51	4.79
IET32150	3.97	2.48	3.46	3.20	5.66	3.75
IET31246	5.66	2.04	3.48	4.01	6.38	4.31
CR6549	6.54	2.56	3.50	4.20	6.63	4.69
IET31220	6.52	2.85	3.55	3.81	5.51	4.45
IET33129	5.80	2.83	3.52	3.47	4.02	3.93
IET33139	5.41	2.58	-	-	-	3.99
IR8	7.73	3.36	3.51	3.49	5.38	4.69
IET32175	6.71	2.26	3.60	3.70	5.42	4.34
IET33150	4.68	2.14	3.52	3.27	4.43	3.61
IET33262	7.21	2.24	3.61	4.01	6.26	4.66
Mean	6.52	2.60	3.31	3.65	5.09	
LSD (Treatment)				0.03		
LSD (Location × Treatment)				0.10		
LSD (Genotype)				0.10		
LSD (Location × Genotype)				0.29		
LSD (Treatment × Genotype)				0.15		
LSD (Location × Treatment × Genotype)				0.41		
CV (Residual) %				11.81		

Table 6.6.4: Influence of low light stress on chlorophyll (mg/g FW) at flowering at different locations during Kharif 2025

Genotype	CRR	RPUR	PTB	KJT	PNR	MTU	Mean
Control							
IET31237	3.02	1.99	1.94	1.95	2.65	3.33	2.48
IET33125	3.30	2.87	2.05	1.92	2.50	3.66	2.72
IET33159	5.16	3.21	1.98	2.40	2.47	3.53	3.12
IET33264	3.62	2.98	2.07	2.12	1.54	3.06	2.56
IET32134	3.86	2.41	2.11	2.23	2.21	3.17	2.66
Swarnaprava	3.03	2.68	2.14	2.26	2.36	2.96	2.57
IET33127	5.05	2.28	2.15	2.20	2.91	3.16	2.96
IET32150	2.41	2.27	2.12	2.61	2.11	3.25	2.46
IET31246	2.25	1.86	2.12	2.01	2.18	3.12	2.26
CR6549	4.75	2.35	2.15	2.73	2.71	3.31	3.00
IET31220	3.69	2.77	2.06	2.00	2.39	3.83	2.79
IET33129	3.46	2.63	2.02	2.42	2.03	3.79	2.73
IET33139	2.98	2.73	-	-	-	-	2.86
IR8	3.84	3.26	2.08	2.11	2.33	3.26	2.81
IET32175	1.88	2.15	2.20	2.44	1.66	3.33	2.28
IET33150	3.33	1.96	2.17	2.66	1.63	3.10	2.48
IET33262	3.04	2.05	2.21	2.03	1.58	3.12	2.34
Mean	3.45	2.50	1.98	2.12	2.07	3.12	
Low light stress							
IET31237	3.80	2.47	2.03	4.09	4.51	3.87	3.46
IET33125	6.37	3.61	2.09	4.08	4.43	3.90	4.08
IET33159	4.87	3.52	2.02	3.36	3.40	3.88	3.51
IET33264	7.65	3.10	2.17	2.78	3.61	3.96	3.88
IET32134	5.88	2.96	2.17	4.09	3.46	3.90	3.74
Swarnaprava	3.74	3.08	2.22	3.30	5.62	3.48	3.57
IET33127	6.38	2.90	2.24	3.61	3.21	3.62	3.66
IET32150	2.99	2.81	2.24	2.73	5.79	3.97	3.42
IET31246	4.86	2.32	2.07	3.57	3.66	3.23	3.28
CR6549	5.87	2.91	2.13	3.57	4.73	3.67	3.81
IET31220	5.95	3.24	2.16	3.21	3.16	3.95	3.61
IET33129	5.62	3.21	2.19	3.07	3.65	3.97	3.62
IET33139	4.77	2.93	-	-	-	-	3.85
IR8	6.60	3.82	2.16	3.02	4.30	2.95	3.81
IET32175	5.44	2.57	2.24	3.10	4.24	3.77	3.56
IET33150	4.01	2.43	2.29	2.63	3.83	3.54	3.12
IET33262	6.16	2.54	2.29	3.51	4.43	3.31	3.71
Mean	5.35	2.97	2.04	3.16	3.88	3.47	
LSD (Treatment)					0.04		
LSD (Location × Treatment)					0.12		
LSD (Genotype)					0.12		
LSD (Location × Genotype)					0.35		
LSD (Treatment × Genotype)					0.17		
LSD (Location × Treatment × Genotype)					0.49		
CV (Residual) %					14.39		

Table 6.6.5: Influence of low light stress on plant height (cm) at different locations during Kharif 2025

Genotype	CRRI	RPUR	PTB	KJT	PNR	MTU	CHNH	TTB	Mean
Control									
IET31237	105.79	133.57	100.33	121.07	121.33	142.33	122.33	118.17	120.62
IET33125	109.39	131.73	89.67	135.87	131.33	138.00	132.67	108.83	122.19
IET33159	112.64	132.30	95.89	129.53	131.00	137.33	128.33	121.17	123.52
IET33264	95.54	121.63	91.56	113.80	123.67	145.00	121.00	130.83	117.88
IET32134	106.00	137.43	101.33	135.20	125.00	135.00	110.33	103.00	119.16
Swarnaprava	109.04	148.10	131.67	131.93	143.67	134.33	97.00	115.50	126.41
IET33127	107.53	139.33	103.78	133.20	140.67	137.00	125.00	110.50	124.63
IET32150	106.60	144.87	105.00	135.53	126.67	148.00	115.00	126.67	126.04
IET31246	94.93	126.27	94.00	115.33	110.67	128.00	112.33	113.17	111.84
CR6549	95.45	126.27	86.33	113.27	110.33	139.33	97.67	99.50	108.52
IET31220	108.09	140.23	84.33	125.80	121.67	133.33	117.00	134.83	120.66
IET33129	98.14	140.17	89.89	130.33	125.00	125.00	125.00	133.50	120.88
IET33139	94.70	129.70	-	-	-	-	129.67	122.67	119.18
IR8	84.97	116.80	87.56	115.67	104.33	121.67	103.67	120.00	106.83
IET32175	104.23	128.27	85.44	125.07	132.00	128.67	144.33	118.83	120.85
IET33150	112.20	142.77	105.78	133.07	145.33	141.67	142.00	102.50	128.16
IET33262	88.44	148.27	95.56	123.33	120.00	131.67	117.33	112.67	117.16
Mean	101.98	134.57	91.07	118.71	118.39	127.43	120.04	117.20	
Low light stress									
IET31237	113.03	151.47	103.56	131.47	129.00	155.33	131.00	117.33	129.02
IET33125	109.37	136.47	92.33	136.67	138.00	143.00	141.33	130.83	128.50
IET33159	113.17	150.57	106.22	136.20	137.67	145.67	135.33	136.83	132.71
IET33264	104.63	144.57	94.33	123.20	140.33	154.33	129.33	141.17	128.99
IET32134	107.90	150.63	103.11	137.27	145.00	144.33	118.33	107.33	126.74
Swarnaprava	112.95	172.43	144.56	133.13	165.00	151.33	114.00	121.33	139.34
IET33127	107.53	154.40	104.44	135.93	155.33	145.67	132.33	116.00	131.46
IET32150	120.79	151.23	107.67	136.80	131.00	157.67	121.33	133.83	132.54
IET31246	104.87	141.43	95.44	127.07	126.67	135.00	116.33	118.50	120.66
CR6549	93.20	131.63	91.22	115.67	129.33	150.33	105.67	110.83	115.99
IET31220	110.63	149.33	87.33	126.07	132.33	136.67	124.33	142.50	126.15
IET33129	100.37	146.83	105.17	132.60	138.00	132.00	129.67	140.67	128.16
IET33139	98.76	138.47	-	-	-	-	133.33	131.50	125.52
IR8	86.90	119.27	91.67	117.27	127.33	130.33	107.67	124.67	113.14
IET32175	107.40	139.37	94.67	126.73	146.33	140.00	149.33	121.50	128.17
IET33150	116.52	148.33	113.00	138.00	149.67	152.67	146.33	109.17	134.21
IET33262	90.47	127.73	106.56	124.07	126.67	142.67	121.67	126.67	120.81
Mean	105.79	144.36	96.55	122.24	130.45	136.29	126.90	125.33	
LSD (Treatment)									
0.47									
LSD (Location × Treatment)									
1.32									
LSD (Genotype)									
1.40									
LSD (Location × Genotype)									
3.95									
LSD (Treatment × Genotype)									
1.97									
LSD (Location × Treatment × Genotype)									
5.59									
CV (Residual) %									
3.08									

Table 6.6.6: Influence of low light stress on shoot weight (g/m²) at different locations during Kharif 2025

Genotype	CRR1	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	624.93	761.93	2163.54	1415.00	1154.17	705.00	567.47	943.93	1042.00
IET33125	754.80	799.51	1589.87	1475.33	961.17	657.33	794.77	1021.50	1006.78
IET33159	774.78	973.84	1397.10	1631.67	1500.67	726.00	502.37	910.37	1052.10
IET33264	560.55	849.35	1332.99	1905.00	1342.67	817.33	786.73	1001.40	1074.50
IET32134	519.48	904.38	1403.39	1665.00	985.83	796.33	745.70	697.97	964.76
Swarnaprava	440.67	990.11	1516.53	1715.67	476.17	768.33	837.60	832.07	947.14
IET33127	757.02	1170.84	1854.70	1713.00	963.17	701.00	468.50	727.17	1044.42
IET32150	778.11	820.89	1278.51	1706.00	909.17	793.00	454.83	701.00	930.19
IET31246	561.66	679.09	1265.52	1531.67	810.83	786.67	402.87	786.10	853.05
CR6549	528.36	1299.04	1307.85	1531.00	1236.50	829.33	558.03	729.30	1002.43
IET31220	741.48	1053.67	1459.54	1723.33	973.00	815.00	555.17	765.30	1010.81
IET33129	760.35	1017.99	1498.93	1748.33	952.33	799.00	712.33	690.33	1022.45
IET33139	749.25	936.40	-	-	-	-	-	-	842.82
IR8	418.47	637.13	1272.23	1531.67	1029.17	808.67	405.43	728.50	853.91
IET32175	718.17	1096.00	1622.55	1408.33	1289.50	778.00	689.27	931.67	1066.69
IET33150	724.83	906.42	1338.02	1573.67	1629.83	752.33	898.20	733.13	1069.55
IET33262	389.61	764.09	1211.89	1509.33	1134.67	798.00	435.33	748.27	873.90
Mean	635.44	921.21	1383.13	1516.71	1020.52	725.37	577.33	761.65	
Low light stress									
IET31237	199.80	681.06	1522.40	1282.67	378.67	652.00	521.20	701.80	742.45
IET33125	365.61	667.79	1405.49	1399.33	954.00	639.33	434.10	759.93	828.20
IET33159	257.52	723.48	657.07	1340.00	246.83	673.67	316.47	780.47	624.44
IET33264	231.99	788.80	853.60	1573.33	780.00	648.33	507.27	810.30	774.20
IET32134	261.96	700.57	800.80	1392.67	710.50	715.00	393.83	616.30	698.95
Swarnaprava	215.34	811.94	1357.71	1571.00	317.83	652.33	697.03	599.43	777.83
IET33127	256.41	881.53	891.73	1459.00	454.33	600.67	223.53	613.87	672.63
IET32150	157.62	745.09	1097.07	1421.00	383.67	680.00	316.20	618.43	677.38
IET31246	209.79	539.36	1102.93	1291.67	439.33	659.33	327.43	625.13	649.37
CR6549	172.16	981.81	1105.87	1300.67	739.83	665.33	424.67	690.77	760.14
IET31220	313.02	1049.16	1047.20	1199.33	360.83	745.33	304.53	705.30	715.59
IET33129	149.85	891.70	1079.47	1349.33	467.17	747.00	535.03	658.73	734.78
IET33139	181.75	680.13	-	-	-	-	-	-	430.94
IR8	178.71	477.89	991.47	1366.00	445.33	750.67	224.83	768.97	650.48
IET32175	367.30	1076.14	1102.93	1138.33	672.67	664.33	306.13	840.40	771.03
IET33150	472.86	880.22	932.80	1382.33	531.83	724.67	354.17	670.37	743.66
IET33262	288.60	479.12	853.60	1325.00	542.33	657.33	323.20	645.07	639.28
Mean	251.78	767.99	988.36	1281.86	495.60	639.73	365.27	653.25	
LSD (Treatment)					22.35				
LSD (Location × Treatment)					63.21				
LSD (Genotype)					67.05				
LSD (Location × Genotype)					189.63				
LSD (Treatment × Genotype)					94.82				
LSD (Location × Treatment × Genotype)					268.18				
CV (Residual) %					21.50				

Table 6.6.7: Influence of low light stress on panicle weight (g/m²) at different locations during Kharif 2025

Genotype	CRR1	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	637.46	825.59	1734.33	516.00	995.17	519.33	723.53	711.13	832.82
IET33125	689.48	907.47	1257.67	624.00	958.00	527.33	536.17	626.40	765.81
IET33159	860.39	955.64	1397.00	556.97	1224.50	543.67	896.97	832.93	908.51
IET33264	479.46	569.94	1158.67	711.00	389.83	640.12	776.67	691.07	677.09
IET32134	461.49	908.09	946.00	609.00	342.58	577.00	431.87	547.43	602.93
Swarnaprava	269.65	671.54	1415.33	582.00	954.17	584.33	311.10	631.07	677.40
IET33127	467.38	861.68	1514.33	453.00	858.00	549.00	933.37	565.27	775.25
IET32150	690.83	971.91	825.00	714.00	537.00	616.67	531.87	520.17	675.93
IET31246	613.73	957.15	924.00	735.00	739.00	580.00	727.83	615.17	736.48
CR6549	625.42	880.87	916.67	627.00	540.67	616.33	1036.67	667.23	738.86
IET31220	692.53	1235.56	1276.00	582.00	577.33	617.38	738.67	525.33	780.60
IET33129	679.62	1205.52	1430.00	534.00	1254.33	584.00	446.33	499.50	829.16
IET33139	852.52	1311.93	-	-	-	-	383.60	529.40	769.36
IR8	574.98	1274.92	1063.33	588.00	1190.00	601.19	713.77	543.03	818.65
IET32175	641.59	720.80	1457.50	555.00	679.83	559.00	935.67	674.67	778.01
IET33150	702.64	1235.30	1569.33	429.87	1227.50	557.96	404.67	612.63	842.49
IET33262	356.24	1076.76	1162.33	469.40	1339.50	608.33	803.03	522.97	792.32
Mean	605.61	974.74	1179.26	546.25	812.20	545.98	666.57	606.79	
Low light stress									
IET31237	159.25	714.11	1547.33	452.20	307.00	367.00	515.67	512.80	571.92
IET33125	198.08	500.10	1180.67	549.20	72.83	456.00	310.87	555.57	477.91
IET33159	310.40	792.53	1195.33	375.00	222.17	455.33	533.70	687.27	571.47
IET33264	111.58	554.59	1122.00	397.43	77.17	409.00	525.70	600.33	474.72
IET32134	176.63	611.89	902.00	446.00	192.67	417.67	317.13	454.67	439.83
Swarnaprava	171.75	558.43	1191.67	326.90	310.83	408.00	228.33	482.67	459.82
IET33127	198.83	579.95	1312.67	413.30	211.50	391.67	615.53	488.50	526.49
IET32150	119.78	541.32	810.33	380.87	43.00	410.67	409.10	337.13	381.53
IET31246	213.31	589.72	850.67	509.67	196.00	408.00	525.60	344.07	454.63
CR6549	171.62	617.37	850.67	359.00	264.67	420.00	664.70	643.40	498.93
IET31220	279.29	742.49	1173.33	287.53	98.00	552.67	513.53	403.10	506.24
IET33129	106.53	788.28	1138.50	448.97	178.17	530.67	270.13	388.07	481.16
IET33139	196.76	754.70	-	-	-	-	273.43	503.13	432.01
IR8	182.96	889.43	1056.00	416.63	323.33	527.61	485.07	470.97	544.00
IET32175	199.54	714.53	1173.33	369.20	77.50	470.33	642.10	511.47	519.75
IET33150	584.73	684.67	1378.67	321.00	349.25	403.00	224.43	367.17	539.11
IET33262	86.00	933.74	982.67	357.00	147.00	399.33	535.07	407.93	481.09
Mean	203.94	680.46	1050.93	377.05	180.65	413.35	446.48	479.90	
LSD (Treatment)					14.92				
LSD (Location × Treatment)					42.19				
LSD (Genotype)					44.75				
LSD (Location × Genotype)					126.58				
LSD (Treatment × Genotype)					63.29				
LSD (Location × Treatment × Genotype)					179.00				
CV (Residual) %					19.35				

Table 6.6.8: Influence of low light stress on number of spikelets per panicle at different locations during Kharif 2025

Genotype	CRRI	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	135.00	191.67	160.17	287.83	108.00	134.67	218.00	174.67	176.25
IET33125	163.67	212.67	204.33	254.90	175.33	154.67	167.00	257.67	198.78
IET33159	224.33	333.67	187.50	264.33	260.33	158.00	257.00	201.67	235.85
IET33264	137.00	208.00	160.67	232.30	181.00	139.00	232.67	196.00	185.83
IET32134	119.67	162.00	144.00	231.93	180.00	142.33	139.67	169.67	161.16
Swarnaprava	126.33	146.00	204.17	206.63	230.00	137.00	110.33	146.33	163.35
IET33127	139.33	174.33	221.17	221.03	233.67	161.33	286.33	211.00	206.03
IET32150	147.33	163.33	159.83	225.83	151.00	143.67	185.33	213.67	173.75
IET31246	160.33	238.33	153.17	196.63	175.00	170.67	217.33	154.00	183.18
CR6549	126.67	258.00	163.17	225.60	145.33	128.67	242.67	197.33	185.93
IET31220	142.67	172.00	173.17	187.97	194.33	190.00	209.00	128.00	174.64
IET33129	180.67	252.00	293.50	228.17	380.33	181.67	192.00	145.00	231.67
IET33139	169.00	255.67	-	-	-	-	183.67	159.33	191.92
IR8	232.33	261.33	171.83	238.97	211.00	188.33	213.33	185.33	212.81
IET32175	175.33	209.67	226.83	241.67	211.67	168.67	263.67	130.33	203.48
IET33150	176.33	231.33	213.50	232.63	203.33	172.33	218.33	180.00	203.48
IET33262	176.67	227.67	181.33	237.73	285.67	170.67	286.00	133.67	212.43
Mean	160.75	217.51	177.55	218.48	195.65	149.51	213.08	175.51	
Low light stress									
IET31237	62.00	125.00	161.17	172.77	102.00	126.00	192.33	133.67	134.37
IET33125	166.00	130.33	199.50	178.67	85.67	147.67	143.67	179.33	153.85
IET33159	151.33	208.33	177.33	179.10	221.33	151.67	200.00	116.67	175.72
IET33264	90.00	162.33	148.50	179.33	107.67	136.00	239.00	122.00	148.10
IET32134	79.33	136.00	139.33	164.63	154.00	137.33	137.00	142.00	136.20
Swarnaprava	93.33	128.33	190.17	155.63	139.33	133.33	98.67	123.00	132.73
IET33127	120.33	164.67	192.17	166.90	65.67	155.33	244.00	135.33	155.55
IET32150	82.67	138.00	155.17	155.77	116.33	141.33	175.67	136.33	137.66
IET31246	88.00	172.67	149.00	161.67	161.67	168.00	207.00	116.33	153.04
CR6549	86.33	150.00	149.33	166.37	110.67	122.67	210.67	137.67	141.71
IET31220	89.33	136.67	150.67	160.73	156.33	187.67	172.67	70.33	140.55
IET33129	102.67	201.67	258.83	165.23	248.00	177.67	162.33	89.33	175.72
IET33139	105.00	200.00	-	-	-	-	155.00	139.33	149.83
IR8	116.67	158.00	148.83	153.60	207.00	187.00	180.33	123.33	159.35
IET32175	93.00	197.67	180.50	161.40	157.67	167.33	226.00	137.00	165.07
IET33150	79.67	172.00	234.50	153.67	127.00	165.67	177.00	124.67	154.27
IET33262	80.33	219.67	184.00	172.37	155.67	165.00	242.67	117.67	167.17
Mean	99.18	164.78	165.82	155.75	136.24	145.27	186.12	126.12	
LSD (Treatment)					2.96				
LSD (Location × Treatment)					8.38				
LSD (Genotype)					8.89				
LSD (Location × Genotype)					25.14				
LSD (Treatment × Genotype)					12.57				
LSD (Location × Treatment × Genotype)					35.56				
CV (Residual) %					13.98				

Table 6.6.9: Influence of low light stress on number of grains per panicle at different locations during Kharif 2025

Genotype	CRRI	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	114.67	164.67	145.33	195.00	100.33	123.67	198.33	125.33	145.92
IET33125	153.33	189.00	182.50	181.33	157.67	141.67	136.00	148.67	161.27
IET33159	203.33	248.67	172.17	223.00	202.33	148.00	217.33	112.33	190.90
IET33264	116.00	160.67	132.17	160.33	68.33	130.33	153.33	121.00	130.27
IET32134	106.33	144.00	123.00	157.67	113.33	132.00	126.67	144.00	130.88
Swarnaprava	98.67	136.67	166.83	177.00	178.33	125.67	86.00	135.67	138.10
IET33127	118.00	147.33	171.17	160.67	155.33	149.67	243.67	144.33	161.27
IET32150	113.33	152.33	140.17	146.33	142.67	132.33	163.67	128.67	139.94
IET31246	112.67	208.67	137.83	162.33	132.33	159.33	183.00	115.33	151.44
CR6549	109.67	178.33	142.67	159.67	119.67	118.67	204.00	134.33	145.88
IET31220	125.00	159.00	130.83	141.67	190.33	184.67	168.00	112.00	151.44
IET33129	136.00	216.00	226.83	191.33	243.00	167.67	142.33	97.33	177.56
IET33139	154.67	199.00	-	-	-	-	120.33	106.00	145.00
IR8	162.67	201.33	130.00	193.67	116.00	177.33	192.00	180.00	169.13
IET32175	102.67	153.67	166.17	140.67	183.33	163.67	228.67	104.33	155.40
IET33150	142.67	207.33	201.67	192.00	116.33	166.67	183.67	143.67	169.25
IET33262	158.33	213.33	149.50	159.67	224.67	161.33	236.67	107.67	176.40
Mean	131.06	181.18	148.17	161.31	143.76	140.16	175.51	127.10	
Low light stress									
IET31237	52.33	108.00	147.83	133.00	68.67	93.33	165.33	121.00	111.19
IET33125	131.00	116.33	191.50	154.00	34.00	118.67	109.33	147.33	125.27
IET33159	133.00	194.00	170.83	167.00	162.67	127.33	162.67	100.67	152.27
IET33264	70.67	141.00	144.67	142.33	14.67	100.67	113.00	112.67	104.96
IET32134	66.00	114.67	133.00	158.67	90.00	96.67	108.00	132.33	112.42
Swarnaprava	55.67	114.67	179.50	141.00	129.33	92.33	76.33	129.00	114.73
IET33127	97.00	106.67	203.50	134.33	36.00	112.33	196.67	133.67	127.52
IET32150	72.67	82.67	146.17	112.00	76.67	93.67	142.33	127.33	106.69
IET31246	72.33	146.67	141.50	139.33	84.33	122.67	154.67	108.33	121.23
CR6549	74.67	141.00	146.17	148.00	97.67	86.67	166.67	162.00	127.85
IET31220	68.33	90.00	142.83	139.00	144.00	166.33	133.00	113.33	124.60
IET33129	80.33	163.67	231.00	146.33	231.00	147.33	117.00	94.00	151.33
IET33139	83.00	179.67	-	-	-	-	97.33	109.33	117.33
IR8	96.33	134.00	138.83	138.67	80.33	153.67	156.33	152.00	131.27
IET32175	76.67	136.00	166.00	145.00	90.00	135.33	183.67	102.33	129.38
IET33150	83.00	140.67	219.50	123.00	88.33	129.67	132.33	131.67	131.02
IET33262	49.33	188.33	157.67	137.33	113.33	123.33	185.67	101.00	132.00
Mean	80.14	135.18	156.50	132.88	90.65	111.76	141.20	122.24	
LSD (Treatment)					2.71				
LSD (Location × Treatment)					7.65				
LSD (Genotype)					8.12				
LSD (Location × Genotype)					22.95				
LSD (Treatment × Genotype)					11.48				
LSD (Location × Treatment × Genotype)					32.46				
CV (Residual) %					15.74				

Table 6.6.10: Influence of low light stress on grain yield (g/m²) at different locations during Kharif 2025

Genotype	CRRI	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	594.78	580.67	1085.33	449.00	662.18	490.00	685.94	651.37	649.91
IET33125	544.72	610.00	1184.33	537.67	592.40	505.33	488.72	596.43	632.45
IET33159	753.27	627.67	1287.00	640.67	531.78	520.67	809.33	760.73	741.39
IET33264	398.18	385.33	825.00	445.67	219.72	553.00	689.11	659.03	521.88
IET32134	413.01	601.67	977.17	484.67	661.11	556.00	366.00	559.07	577.34
Swarnaprava	238.88	354.33	1299.83	336.00	447.69	566.67	234.00	603.13	510.07
IET33127	392.43	525.33	971.67	647.33	676.69	534.00	878.39	539.93	645.72
IET32150	626.16	617.67	726.00	393.00	666.50	604.33	487.44	494.60	576.96
IET31246	472.85	660.67	957.00	591.67	487.82	565.00	634.06	599.93	621.12
CR6549	540.51	579.33	902.00	525.00	296.58	604.33	911.00	657.50	627.03
IET31220	612.60	899.00	1012.00	592.33	557.74	601.67	649.33	508.40	679.13
IET33129	454.58	722.00	599.50	510.33	694.78	567.67	358.06	479.93	548.36
IET33139	701.99	1020.00	-	-	-	-	245.33	516.33	620.91
IR8	406.17	822.00	704.00	525.67	747.07	588.00	636.78	521.03	618.84
IET32175	511.21	467.00	575.67	745.00	466.85	546.33	851.50	650.97	601.82
IET33150	601.76	983.33	1173.33	653.00	893.59	544.00	338.00	594.30	722.67
IET33262	297.56	870.00	700.33	687.33	738.10	594.33	727.17	484.93	637.47
Mean	503.57	666.24	881.19	515.55	549.45	525.96	587.66	581.04	
Low light stress									
IET31237	213.72	547.33	942.33	172.33	163.76	346.67	447.33	498.47	416.49
IET33125	134.22	348.33	990.00	262.67	157.35	426.33	248.33	541.50	388.59
IET33159	244.54	526.00	1103.67	200.33	74.17	435.00	497.00	675.93	469.58
IET33264	85.28	405.33	781.00	226.67	80.68	387.00	464.00	595.10	378.13
IET32134	141.89	391.33	843.33	254.00	138.33	399.33	264.33	506.73	367.41
Swarnaprava	124.62	327.00	1045.00	231.67	209.82	388.67	139.33	473.77	367.48
IET33127	169.00	382.00	806.67	257.33	220.30	366.33	557.00	446.43	400.63
IET32150	94.81	283.33	674.67	344.00	116.03	395.67	315.67	378.53	325.34
IET31246	180.65	422.00	931.33	246.00	122.73	392.00	438.67	312.00	380.67
CR6549	140.04	429.33	869.00	193.33	139.14	398.00	545.00	604.47	414.79
IET31220	226.10	148.33	1008.33	264.00	112.70	533.00	431.00	384.13	388.45
IET33129	95.52	457.00	583.00	182.67	194.55	507.00	196.00	377.97	324.21
IET33139	142.64	580.00	-	-	-	-	154.67	475.10	338.10
IR8	127.12	665.00	667.33	148.33	172.22	516.00	396.67	431.20	390.48
IET32175	194.32	338.67	476.67	182.67	85.25	449.00	537.33	444.03	338.49
IET33150	407.59	437.33	927.67	169.67	258.44	384.33	167.67	423.90	397.07
IET33262	67.44	854.33	682.00	194.67	150.00	380.00	491.33	356.80	397.07
Mean	164.09	443.69	784.24	207.67	140.91	394.37	370.08	466.24	
LSD (Treatment)						9.88			
LSD (Location × Treatment)						27.94			
LSD (Genotype)						29.64			
LSD (Location × Genotype)						83.82			
LSD (Treatment × Genotype)						41.91			
LSD (Location × Treatment × Genotype)						118.54			
CV (Residual) %						16.09			

Table 6.6.11: Influence of low light stress on total dry matter (g/m²) at different locations during Kharif 2025

Genotype	CRR	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	1262.39	1506.65	3215.67	2177.00	2149.33	705.00	1269.67	1655.07	1742.60
IET33125	1444.28	1575.25	2552.00	1787.67	1919.17	657.33	1014.33	1386.33	1542.04
IET33159	1635.17	1679.12	2702.33	2024.67	2725.17	726.00	1316.00	1613.40	1802.73
IET33264	1040.01	1419.29	2273.33	1821.33	1732.50	817.33	1195.67	1692.47	1498.99
IET32134	980.97	1608.66	2104.67	2081.33	1328.42	796.33	950.00	1245.40	1386.97
Swarnaprava	710.32	1661.65	2882.00	1890.67	1430.33	768.33	759.67	1463.13	1445.76
IET33127	1224.40	2032.51	2790.33	2044.33	1821.17	701.00	1357.67	1179.13	1643.82
IET32150	1468.94	1717.00	1983.67	2162.67	1446.17	793.00	1032.00	1221.17	1478.08
IET31246	1175.39	1636.23	1895.67	2081.67	1549.83	786.67	1136.00	1401.27	1457.84
CR6549	1153.78	2179.91	1914.00	2100.67	1777.17	829.33	1397.67	1358.00	1588.82
IET31220	1434.01	2289.23	2442.00	2019.33	1550.33	815.00	1214.00	1290.63	1631.82
IET33129	1439.97	2223.51	3085.50	1837.00	2206.67	799.00	932.67	1189.83	1714.27
IET33139	1601.77	2248.33	-	-	-	-	821.33	1350.00	1505.36
IR8	993.45	1912.05	1991.00	2081.67	2219.17	808.67	1179.67	1271.53	1557.15
IET32175	1359.76	1796.94	2814.17	1891.67	1969.33	778.00	1329.67	1606.33	1693.23
IET33150	1427.47	2141.72	2838.00	2365.00	2857.33	752.33	906.00	1345.77	1829.20
IET33262	745.85	1840.84	2471.33	2057.00	2474.17	798.00	1289.00	1271.23	1618.43
Mean	1241.06	1851.11	2350.33	1907.27	1832.72	725.37	1123.59	1384.75	
Low light stress									
IET31237	359.05	1476.04	2724.33	1703.33	685.67	652.00	938.33	1214.60	1219.17
IET33125	563.69	1299.61	2442.00	1566.67	1026.83	639.33	857.00	1577.07	1246.52
IET33159	567.92	1766.37	2662.00	1627.67	469.00	673.67	998.67	1597.63	1295.37
IET33264	343.57	1343.38	2222.00	1538.00	857.17	648.33	900.67	1410.63	1157.97
IET32134	438.59	1516.27	1899.33	1869.67	903.17	715.00	826.00	1070.97	1154.87
Swarnaprava	387.09	1370.37	2361.33	1848.33	628.67	652.33	557.67	1082.10	1110.99
IET33127	455.24	1461.48	2328.33	1862.00	665.83	600.67	1026.67	1215.67	1201.99
IET32150	277.40	1362.21	1697.67	1864.33	426.67	680.00	985.33	955.57	1031.15
IET31246	423.10	1129.08	1848.00	1985.00	635.33	659.33	885.67	969.20	1066.84
CR6549	343.78	1599.18	1818.67	1511.67	1004.50	665.33	1055.67	1372.70	1171.44
IET31220	592.31	1791.65	2350.33	1699.00	458.83	745.33	925.00	1108.40	1208.86
IET33129	256.38	1679.98	2464.00	1783.33	645.33	747.00	727.00	1046.80	1168.73
IET33139	378.51	1434.83	-	-	-	-	626.67	1291.27	932.82
IR8	361.67	1367.32	1855.33	1980.00	768.67	750.67	890.00	1239.93	1151.70
IET32175	566.84	1810.53	2495.17	1783.00	750.17	664.33	1014.00	1351.87	1304.49
IET33150	1057.59	1564.88	2412.67	1941.67	881.08	724.67	680.33	1037.53	1287.55
IET33262	374.60	1412.86	1866.33	1903.33	689.33	657.33	945.33	1053.00	1112.77
Mean	455.73	1493.30	2085.15	1674.53	676.25	639.73	872.94	1211.47	
LSD (Treatment)						22.88			
LSD (Location × Treatment)						64.72			
LSD (Genotype)						68.65			
LSD (Location × Genotype)						194.17			
LSD (Treatment × Genotype)						97.09			
LSD (Location × Treatment × Genotype)						274.60			
CV (Residual) %						13.48			

Table 6.6.12: Influence of low light stress on 1000 grain weight (g) at different locations during Kharif 2025

Genotype	CRRI	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	32.40	30.24	26.23	29.60	29.13	24.13	28.03	30.20	28.75
IET33125	12.76	22.26	20.43	20.20	21.93	21.63	28.50	24.50	21.53
IET33159	13.71	18.56	17.57	18.50	18.00	16.30	26.63	22.33	18.95
IET33264	16.50	18.97	20.27	19.67	15.74	15.47	29.60	29.70	20.74
IET32134	19.30	31.07	21.43	21.70	17.53	21.10	30.50	20.67	22.91
Swarnaprava	15.12	24.08	22.33	26.90	27.83	21.30	24.63	22.30	23.06
IET33127	16.93	22.68	21.67	17.30	20.97	18.13	27.17	29.10	21.74
IET32150	20.87	22.45	20.13	20.00	23.93	17.23	30.90	25.57	22.64
IET31246	18.20	21.25	18.13	22.00	20.10	19.33	26.30	24.17	21.19
CR6549	16.17	21.66	17.93	15.60	14.90	16.67	24.93	26.27	19.27
IET31220	23.41	23.82	20.70	20.80	25.77	19.33	23.70	30.50	23.50
IET33129	17.93	20.10	18.93	19.87	20.90	13.27	24.50	26.20	20.21
IET33139	15.42	18.07	-	-	-	-	18.83	24.30	19.16
IR8	14.85	17.70	16.37	17.60	17.43	19.47	23.77	22.80	18.75
IET32175	22.68	19.63	20.27	21.80	20.80	22.93	29.60	22.57	22.53
IET33150	18.90	21.07	21.10	18.57	21.13	21.17	19.60	25.00	20.82
IET33262	23.28	18.39	17.03	18.53	20.53	12.40	20.67	22.57	19.18
Mean	18.73	21.88	18.85	19.33	19.80	17.64	25.76	25.22	
Low light stress									
IET31237	27.22	28.62	26.07	29.08	24.67	21.00	26.70	27.83	26.40
IET33125	7.20	20.60	20.20	21.21	18.34	19.37	27.27	21.83	19.50
IET33159	11.80	16.53	17.27	17.52	14.43	15.20	26.30	22.07	17.64
IET33264	9.23	19.25	20.10	18.87	9.43	11.10	29.37	26.03	17.92
IET32134	11.14	25.78	21.33	20.81	18.10	18.33	29.27	19.40	20.52
Swarnaprava	10.27	24.74	22.23	25.68	24.90	18.73	23.63	20.47	21.33
IET33127	9.16	21.57	22.47	17.49	22.00	15.43	26.70	26.97	20.22
IET32150	10.25	21.04	20.10	19.61	18.13	15.30	28.87	19.80	19.14
IET31246	12.35	19.02	18.17	21.57	21.30	15.03	21.63	22.33	18.93
CR6549	10.69	20.44	17.53	15.18	15.33	14.10	22.90	23.23	17.43
IET31220	15.48	21.14	20.57	19.37	17.17	18.73	20.73	27.30	20.06
IET33129	14.15	18.48	18.30	19.33	17.73	12.63	19.70	23.87	18.02
IET33139	12.13	17.21	-	-	-	-	17.83	24.40	17.89
IR8	7.63	15.97	15.87	16.56	16.37	18.63	21.53	19.53	16.51
IET32175	13.03	18.14	19.90	20.45	17.70	21.13	25.17	19.10	19.33
IET33150	17.70	21.44	20.70	17.48	21.67	17.33	18.50	23.93	19.84
IET33262	11.91	17.95	16.80	19.78	16.37	11.27	20.40	22.33	17.10
Mean	12.43	20.47	18.68	18.82	17.27	15.49	23.91	22.97	
LSD (Treatment)						0.28			
LSD (Location × Treatment)						0.80			
LSD (Genotype)						0.85			
LSD (Location × Genotype)						2.41			
LSD (Treatment × Genotype)						1.20			
LSD (Location × Treatment × Genotype)						3.41			
CV (Residual) %						11.34			

Table 6.6.13: Influence of low light stress on Harvest index (%) at different locations during Kharif 2025

Genotype	CRRI	RPUR	PTB	KJT	PNR	MTU	CHN	TTB	Mean
Control									
IET31237	68.26	38.56	44.18	35.45	30.81	40.90	42.80	39.35	42.54
IET33125	37.16	38.72	47.27	36.17	30.88	43.24	36.87	42.99	39.16
IET33159	46.10	37.43	49.66	35.84	19.52	41.72	45.90	47.18	40.42
IET33264	38.38	30.29	42.48	36.10	12.68	40.63	41.70	38.95	35.15
IET32134	42.13	37.39	45.38	36.03	49.78	41.10	34.70	44.91	41.43
Swarnaprava	33.72	23.86	47.18	36.73	31.30	42.40	32.83	41.17	36.15
IET33127	37.13	25.84	44.26	36.26	37.18	43.37	46.90	45.81	39.59
IET32150	42.79	35.98	43.33	34.63	46.08	43.31	36.50	40.48	40.39
IET31246	40.65	40.43	49.01	35.72	31.50	41.77	38.20	42.82	40.01
CR6549	46.88	26.57	48.26	34.13	16.70	42.03	47.93	48.42	38.87
IET31220	42.74	39.26	46.46	35.91	35.99	42.54	39.60	39.35	40.23
IET33129	37.11	32.46	32.63	35.56	31.49	41.51	35.50	40.31	35.82
IET33139	43.81	45.36	-	-	-	-	33.57	38.22	40.24
IR8	40.29	48.65	45.85	35.52	33.67	42.19	37.80	40.90	40.61
IET32175	37.61	26.02	30.48	34.49	23.73	41.24	46.03	40.57	35.02
IET33150	42.15	45.91	47.38	36.14	31.28	41.90	33.83	44.17	40.34
IET33262	39.24	61.61	43.20	35.52	29.85	42.69	45.23	38.23	41.95
Mean	42.13	37.32	41.59	33.54	28.97	39.56	39.76	41.99	
Low light stress									
IET31237	46.84	37.23	42.61	34.51	23.84	34.61	41.50	41.02	37.77
IET33125	24.03	26.91	43.91	33.78	15.32	39.95	31.67	34.39	31.24
IET33159	43.03	29.87	43.49	33.79	15.83	39.25	43.17	42.34	36.35
IET33264	24.54	27.15	40.57	36.34	9.40	36.63	42.33	42.20	32.40
IET32134	32.10	25.95	45.07	35.11	15.32	35.89	29.53	47.38	33.29
Swarnaprava	31.73	21.34	46.67	35.52	33.38	37.32	27.87	43.63	34.68
IET33127	32.04	26.14	43.57	33.90	33.10	37.84	44.50	36.72	35.98
IET32150	36.67	20.86	38.47	34.17	27.31	36.43	32.40	39.99	33.29
IET31246	42.45	37.42	49.03	36.90	19.39	37.38	37.67	32.00	36.53
CR6549	40.66	26.85	46.56	34.17	13.89	37.42	44.23	44.00	35.97
IET31220	38.05	18.42	46.37	34.52	24.67	41.72	37.17	34.61	34.44
IET33129	31.34	27.21	25.70	35.11	30.16	40.57	30.47	35.54	32.01
IET33139	37.66	40.43	-	-	-	-	28.40	36.42	35.73
IR8	35.95	43.03	43.01	35.11	22.48	40.79	35.30	34.76	36.30
IET32175	33.54	19.06	26.39	33.78	11.42	40.30	42.67	32.79	29.99
IET33150	38.34	27.99	47.73	33.43	29.32	34.35	30.27	42.39	35.48
IET33262	35.40	46.55	35.06	35.43	21.66	37.40	42.30	33.99	35.98
Mean	35.55	29.55	39.07	32.68	20.38	35.76	36.55	38.48	
LSD (Treatment)						0.54			
LSD (Location × Treatment)						1.52			
LSD (Genotype)						1.61			
LSD (Location × Genotype)						4.55			
LSD (Treatment × Genotype)						2.28			
LSD (Location × Treatment × Genotype)						6.44			
CV (Residual) %						11.87			

Rice cultures of Physiology AICRPR trials, Kharif 2025

RFU/Drought		High Temperature		Multiple Abiotic Stress		Submergence tolerance		Low Light Stress	
S.No	Entries	S.No	Entries	S.No.	Entries	S.No.	Entries	S.No	Entries
RFU 101	JBB 5952	HT-101	JBB-FBL 19020	1	MTU 2795-86-1-1-1	1	CR 4510-BC-1-4-SU-1-2	1	IET31237
RFU 102	JBB-ABL 80	HT-102	JBB-FBL 19023	2	NICRA 19	2	CR 4532-4-B-SU-2-1	2	IET33125
RFU 103	JBB-ABL 111	HT-103	JBB-FBL 19093	3	NICRA 20	3	CR-4536-3-1-SU-B	3	IET33159
RFU 104	JBB-ABL 128	HT-104	JBB-FBL 19103	4	CBMAS22041	4	CR-4531-2-2-SU-1-B	4	IET33264
RFU 105	JBB 660-3	HT-105	JBB-FBL 19180	5	CBMAS22042	5	CR 3477-1-M-1-B-SU-95-S-3	5	IET32134
RFU 106	JBB-ABL 29	HT-106	JBB-FBL 19206	6	CO59	6	FR 13 A	6	Swarnaprava
RFU 107	JBB 6315	HT-107	JBB-FBL 19210	7	FL 478	7	AC 42088	7	IET33127
RFU 108	JBB-FBL 19408-3	HT-108	JBB-FBL 19378	8	RP 6469- 131	8	AC 1303	8	IET32150
RFU 109	JBB 6728-2	HT-109	JBB-FBL 19485	9	RP 6469- 56	9	AC 1996	9	IET31246
RFU 110	JBB-FBL 19344-4	HT-110	JBB-FBL 19487	10	RP 6469- 143	10	AC 34300	10	CR6549
RFU 111	JBB-FBL 19100-5	HT-111	JBB 4513	11	CRAC-4424-63	11	MTU 1387	11	IET31220
RFU 112	JBB 6739-2	HT-112	JBB-ABL 58	12	RAHASPANJAR	12	MTU 2795-86-1-1-1	12	IET33129
RFU 113	IET 31105-4	HT-113	JBB-FBL 19408-2	13	CRAC-6459-96	13	NICRA 19	13	IET33139
RFU 114	JBB-FBL 193344-2	HT-114	JBB 6411	14	CRAC-3995-68	14	Naveen	14	IR8
RFU 115	JBB-FBL 19396-3	HT-115	NSR23 (IET31855)	15	CRAC-3994-1-1	15	NICRA 20	15	IET32175
RFU 116	JBB-FBL 19345	HT-116	NPS58-1-2(IET 31022)	16	CRAC-4423-70	16	CBMAS22063	16	IET33150
RFU 117	JBB 2949	HT-117	DB12	17	VANDANA	17	CBMAS14110	17	IET33262
RFU 118	JBB-ABL 9	HT-118	NPK18(IET 31315)	18	AC 42088	18	ASD16	18	
RFU 119	IET 30245			19	AC 1303	19	CBMAS22064	19	
				20	AC 40331	20	CRR 835-8-5-B	20	
				21	AC 39390	21	Naveen Sub-1	21	
				22	AC 41644	22	Swarna Sub1	22	
				23	IR 29	23	Recurrent Naveen	23	
				24	AC 34289	24	CR 4698-K21-SRP1-232-12-5-4-2-#	24	

RFU/Drought		High Temperature		Multiple Abiotic Stress		Submergence tolerance		Low Light Stress	
S.No	Entries	S.No	Entries	S.No.	Entries	S.No.	Entries	S.No	Entries
				25	CRR 836-1-IR 116709-B-B	25	CR 4698-K21-SRP1-26-8-4-4-1-#	25	
				26	CBMAS22071	26	RP 6469- 131	26	
				27	CBMAS22072	27	RP 6469- 56	27	
				28	CBMAS22081	28	Swarna	28	
				29	CBMAS22082	29	RP 6469- 143	29	
				30	NAVEEN	30	CRAC-4423-1	30	
				31	CR 6509-300gy-11-Sal-4-3-B	31	CRAC-6466-2	31	
				32	CR 6509-400gy-6-Sal-3-5-B	32	CRAC-6466-22	32	
				33	CR -3438-1-M-3-1-Sal-1-2	33	CRAC-6466-90	33	
				34	CR-4084-2-1-Sal-1	34	CRAC-4423-2		
				35	CR-4556-3-1				

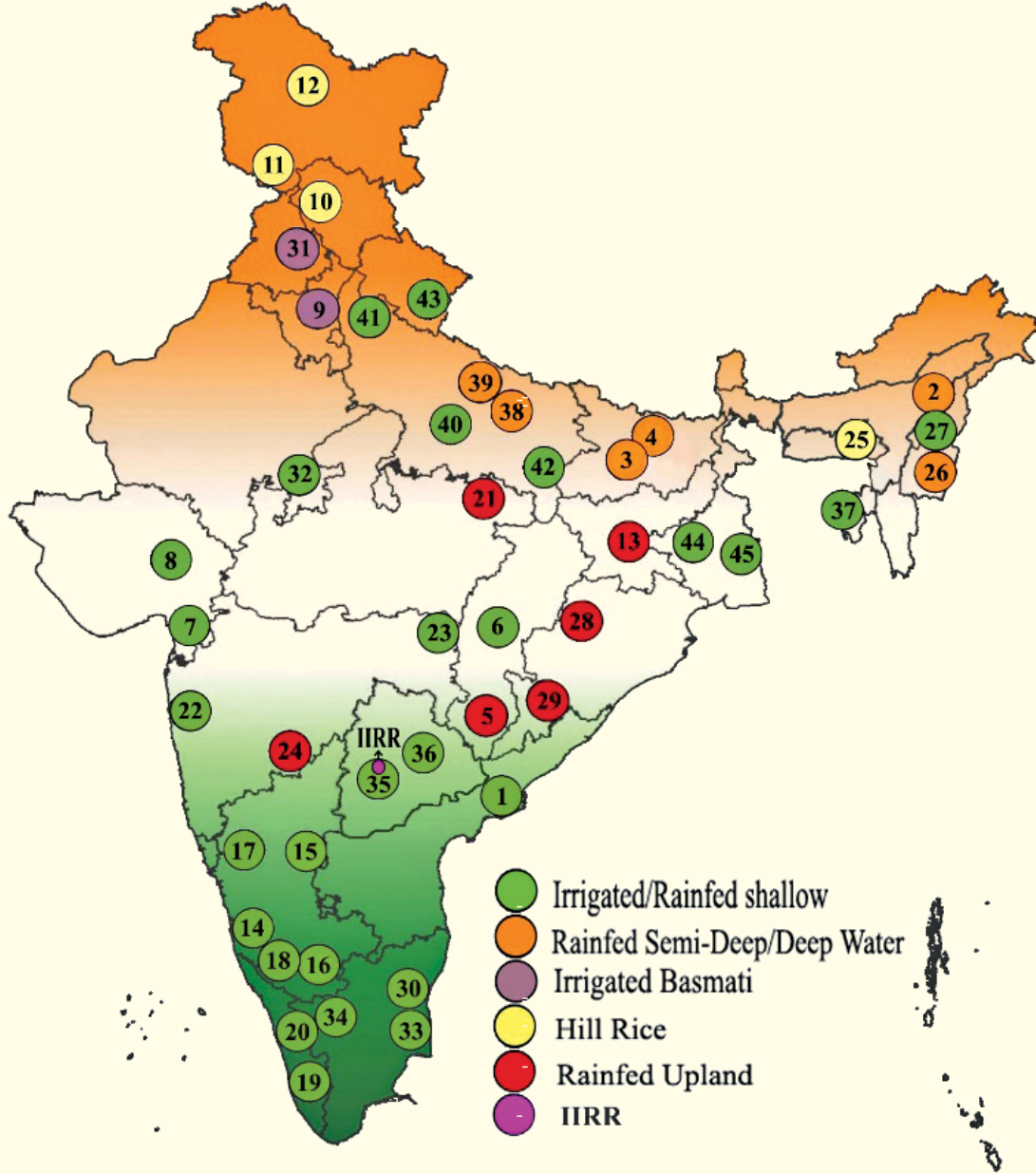
LIST OF PLANT PHYSIOLOGY COOPERATORS 2025

S.No	Address	E-mail	Mobile No. / Whatsapp
Funded Centres			
1	Dr. N Veronica, Scientist, Department of Crop Physiology Regional Agricultural Research Station, MARUTERU-534122, West Godavari Dist., Andhra Pradesh	veronica13agrigo@gmail.com , n.veronica@angrau.ac.in	8985059378 9949599965
2	Dr. Ranjan Das, Principal Scientist Regional Agricultural Station, (AAU), Titabar-785630, Assam.	rdassam1966@gmail.com ranjan.das@aaui.ac.in	7002036209 9435086388
3	Dr. Keluskar Minakshi, Senior Scientist, Regional Agriculture Research Center, Karjat Dist-Raigal (M.S) 410201	keluskar_minakshi@rediffmail.com	8779360215
4	Dr. S. C. Shankhdhar, Professor, Dept.of Plant Physiology, College of Basic Sciences & Humanities, G.B. Pant University of Agri. & Technology, Pantnagar-263 145	shankhdhar.sc@rediffmail.com	9412864897
5	Dr. N. Sritharan Assistant Professor (Crop Physiology), Department of Rice, TNAU, Coimbatore-641003,	sritnau@gmail.com sritharan.n@tnau.ac.in	9865669455
6	Dr. V.B. Kuruwanshi, Senior Scientist, Department of Plant Physiology College of Agriculture, IGKV, Raipur Chhattisgarh	vb_kuruwanshi@rediffmail.com	7000449794
7	Dr. Lakshmi G Ajay Assistant Professor, RARS, KAU Pattambi-679306, Kerala	~~nisharenjith2018@gmail.com~~ Nisha.ns@kau.in lakshmigajaykau@gmail.com	9633604628 9446468950
8	Dr. Radha Singh Assistant Professor, Plant Physiology AICRIP-RICE, JNKVV, College of Agriculture, Rewa-486 001, M.P.	radhasingh18@gmail.com	8839285962
9	Dr. Sukham Madaan, Assistant Scientist, Plant Physiology, Rice Research Station, Kaul (Kaithal), Haryana- 136021	sukham20@gmail.com,	9466744080
Voluntary Centre			
1	Dr. S.Nadaradjan, Professor (Crop Physiology), Pandit Jawaharlal Nehru College of Agril & Research Institute KARAIKAL-609603 U.T. of Pondicherry	nadaradjans@gmail.com	09944015690, 04368-261372

S.No	Address	E-mail	Mobile No. / Whatsapp
2	Dr. Suparna Gupta, Rice Physiologist, Rice Research Station Chinsurah R.S.Dist Hooghly, West Bengal - 712102	drsuparnagupta12@gmail.com	8918615364
3	Dr. Varsha Rani, Assistant Professor, Birsa Agricultural University, Ranchi, Jharkhand-834006	bhardwajvarsha83@gmail.com	9955086568
4	Dr. Shamboo Prasad, Associate Professor N.D. University of Agri. & Technology, Kumarganj, Ayodhya-224229, Uttar Pradesh (Faizabad)	shambhoonduat@gmail.com	9450766603
5	Dr Deepak Kumar Rawat Assistant Physiologist (Crop Research Station Masodha, Ayodhya.) ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh, India, 224229 (Faizabad)	rawatk2233@gmail.com	9559475918
ICAR Collaborating Institutes			
1	Dr. Akshay Sureshrao Sakhare, Senior Scientist, Plant Physiology, ICAR-Indian Institute of Rice Research Rajendranagar, Hyderabad-500 030 Telangana	sakhare.akshaya@gmail.com	9311610065
2	Dr. Koushik Chakraborty (Nodal officer) Senior Scientist, Plant Physiology, Crop Physiology & Biochemistry Division National Rice Research Institute, CUTTACK-753 006, Orissa	koushikiari@gmail.com Koushik.Chakraborty@icar.gov .in	8895838858, 7008513034

ACKNOWLEDGEMENTS

It is our pleasure to thank DG, ICAR, DDG (Crop Science), ADGs, FFC and Seed, our beloved Directors Dr. R.M. Sundaram, ICAR-IIRR, Dr. A.K. Nayak (DDG, NRM), ICAR-CRRI and thank Dr. G. A. Kumar, Acting Director, ICAR-CRRI. We acknowledge the contribution of the scientists and technical personnel of the various institutions to the Co-ordinated Physiology Program of AICRIP in 2024. We wish to thank Dr. S. Sai Praasad, Head, Crop Improvement and staff of Plant Breeding Dr. Divya Balakrishnan, Dr. Jyothi Bhadri, Dr. Arvind Kumar Jukanti and Dr. P. Sengutvel and Head Hybrid Rice Dr. A. S. Hari Prasad for providing seed material. Thanks are due to Dr. V. Prakasam, Dr. Suneetha Kota and Dr. Satendra K Mangrathia for their immense help in writing, editing, typing and setting the manuscript. Special thanks are also due to Dr. Raghuveer Rao and Dr. D. Subrahmanyam for guidance. We profusely thank Mr. Chaitanya U, ACTO for his help during the preparation of this report and carrying out the research data collection, compilation, typing and setting of this report.



भाकृअनुप - भारतीय चावल अनुसंधान संस्थान
भारतीय कृषि अनुसंधान परिषद

ICAR - Indian Institute of Rice Research

Indian Council of Agricultural Research
Rajendranagar, Hyderabad - 500 030