PLANT PHYSIOLOGY

6. PLANT PHYSIOLOGY

CONTENTS

6. Plant Physiology

Summary

Physiological studies under All India Co-ordinated Rice Improvement Program were conducted at eight funded centres in Plant Physiology, (Coimbatore, Maruteru, Pantnagar, Pattambi, Rewa, Raipur, Karjat and Titabar), two ICAR institutions (IIRR Hyderabad and NRRI Cuttack) and six voluntary centres (RARS Chinsurah, NDUAT Faizabad, PJNAR Karaikal, IGKV RAIPUR and BAU Ranchi). The trials conducted during2021 are given as below.

Plant Physiology Coordinated Studies for the Year Kharif 2021

Locations	Trials						Allotted	Conducted	Conducted (%)	Not conducted	Grand Total
	Silicon	Heat Tolerance	RFU	MAS	SUB	LLS					
CHN	√	√	-	-	-	-	2	1	50	1	2
CBT	√	-	√	√	√	-	4	3	75	1	4
NRRI	-	-	√	√	√	√	4	4	100	-	4
IIRR	√	√	-	-	-	√	3	3	100	-	3
FZB	-	-	-	√	-	-	1	1	100	-	1
KJT	√	-	-	√	-	√	3	3	100	-	3
KRK	√	-	-	√	-	-	2	2	100	-	2
MTU	√	√	-	√	-	√	4	4	75	-	4
PNR	√	√	-	-	-	√	3	3	100	-	3
PTB	√	√	√	√	√	-	5	5	100	-	5
REWA	√	√	√	√	-	-	4	4	100	-	4
TTB	√	√	√	√	√	√	6	6	100	-	6
RPUR	-	-	√	-	-	√	2	2	100	-	2

The salient findings of the experimental research are presented below:

6.1 Influence of Silicon on improving abiotic stress tolerance in rice genotypes

The experiment was conducted to ascertain in the role of silicon in induced tolerance to water stress in rice, with four treatments and eight genotypes consisting of hybrid and high yielding varieties. There is a continuous study to find out the effect of water stress and role of silicon on yield and yield attributes. The results support that there was an increase in biomass, leaf area index, stem weight, grain number per panicle, 1000 grain weight, harvest index and grain yield when silicon granules were applied (0.08% orthosilicic acid) @5kg/acre at active tillering and flowering stages. The study was conducted at ten locations spread over the country. When silicon was applied to water-stressed plants (22 days water stress was imposed) there was less damage and yield attributes were better under silicon applied plots. In overall situation, there

was 5% increase in yield under silicon applied plots. The best performing entries are 27P63, DRR Dhan-48, Sahabhagadhan and US-312.

6.2 Screening of elite rice cultures for drought tolerance

A trial to study the drought tolerance traits of rice cultures with respect to yield and other attributes under dry spells was conducted with 36 introgression lines derived from multi-parent inter-crosses in the background of Krishna Hamsa during kharif-2021 season. At TTB centre the trial was conducted during Rabi (dry) season with 26 advanced breeding lines taken from AVT-1E-DS set of 2020. Results of Analysis of variance revealed that the mean grain yield (g/m2) (mean of all locations) show >15% reduction under rainfed condition in comparison with irrigated control. Maximum reduction in mean grain yield (mean of all genotypes) was observed at PTB centre(>48%) followed by NRRI (22%) and REWA. Minimum reduction in grain yield was observed in IL-19206, Krishna Hamsa, IL-19204, IL-19185, IL-19198, IL-19181 and IL-19347 in which the reduction in grain yield is <10% under rainfed condition. These genotypes could be identified as relatively tolerant to drought and suitable for rainfed cultivation. Based on drought indices computed from grain yield recorded under both irrigated as well as rainfed condition,IL-19206, Krishna Hamsa, IL-19096 and IL-19279, have high mean rank with low SEm± and may be considered as relatively drought tolerant. In order to simultaneously select genotypes with higher yield and stability of performance across locations under rain fed condition, a parametric model for simultaneous selection in yield and stability "Shukla's stability variance and Kang's" statistic was performed. Based on their performance across locations and YSi values IL-19072, IL-19081, IL-18085, IL-19092, IL-190208, IL-19211, IL-19247, IL-19273, IL-19279, IL-19283, IL-19347, IL-19206, Krishna Hamsa and WGL-14 could be identified as stable. Amongst the selected genotypes IL-19072, IL-19081, IL-19082, IL-19132 and WGL-14 show non-significant stability variance (σ_i^2). These genotypes have a higher yield and a lower variation and could be identified as relatively drought tolerant genotypes suitable for rainfed cultivation. At TTB centre, based on yield under rainfed condition and drought indices the genotypes IET28836, IET28825 and IET28834, IET27523, IET28241, IET28242 could be identified as drought tolerant. Multiple correlation analysis between yield obtained under rainfed condition and the computed yield indices revealed a strong positive association between yield for BMP, MP, YSI, YI and strong negative relation was observed for DSI, TOL and, SDI these indices are useful for identification drought tolerant genotype.

6.3. Evaluation of rice genotypes for heat tolerance suitable for future climate

Heat stress (HS) caused by rapidly warming climate has become a serious threat to global food security. Rice (*Oryzasativa* L.) is a staple food crop for over half of the world's population, and its yield and quality are often reduced by HS. There is an urgent need for breeding heat-tolerant rice cultivars. Rice plants show various morphological and physiological symptoms under HS. Precise analysis of the symptoms (phenotyping) is essential for the selection of elite germplasm and the identification of thermo-tolerance genes. The objectives of this work is to screen rice cultivars for high temperature tolerance and to understand the impact of high temperature stress on rice.The trial was conducted in 7 AICRIP centres with 25 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. In order to simultaneously select genotypes with higher yield and stability of performance across locations under elevated temperature conditions, a parametric model for simultaneous selection in yield and stability "Shukla's stability variance and Kang's" statistic was performed and the results are presented in *(Table 6.3.15).* Based on their performance across locations and YSi values under elevated temperature conditions genotypes IET29943, IET29946, IET22946, 29947, 29948, IET29949, IET29952, IET29956 and 29958 can be selected as they produced relatively higher yield under heat stress condition and also they show non-significant stability variance (σ_i^2). These genotypes have a higher yield and a lower variation. According to the ANOVA, the interaction is significant.

6.4. Physiological Characterization of selected rice genotypes for multiple abiotic stress tolerance

Screening of 25 rice accessions for multiple abiotic stress tolerance was conducted at 7 AICRIP centers for their anaerobic germination potential and tolerant against salinity (12 dS m^{-1}) and osmotic/dehydration (1 and 2% mannitol) stresses at seedling stage. All the genotypes including tolerant checks recorded reduction in key physiological traits *viz*. germination percentage, epicotyl length, shoot and root dry weight, shoot and root length, leaf chlorophyll content and shoot Na^+/K^+ ratio in response to different abiotic stresses. Based on the multi-locational performance (considering all studied traits) of these genotypes under AG stress, we found Kalakeri, Dular, IET-27051, CR-2862-IC-10, Black Gora and IET-27865 are highly tolerant to AG stress, besides two tolerant checks Rashpanjor and IR64-AG. Hence, these

genotypes may be recommended as suitable donors having high anaerobic germination potential. Similarly, genotypes *viz*., FL478, AC43037, CR-2862-IC-10, CR-3818-IC-225 and AC43025 were found to be tolerant to seedling stage salinity stress with relatively less shoot Na^+/K^+ ratio and lower VSI score. Besides, genotypes *viz*., AC43037, AC43012, Dular, CR-3818-IC-225, IET-27051 and CR-2862-IC-10 showed considerable osmotic stress tolerance under 1% and 2% mannitol stress in this multi-locational trial. Considering the performance of these 25 tested entries, one entry CR-2862-IC-10 was tolerant to all the abiotic stresses (AG, salinity and osmotic), while three genotypes (IET-27051, CR-2862-IC-10, Dular) were found tolerant to both AG and osmotic stresses and three genotypes (AC43037, CR-3818-IC-225, CR-2862-IC-10) were tolerant to salinity and osmotic stresses (Table 6.4.1).

6.5. Screening for submergence tolerance in Rice

Thirty different rice genotypes were included in the trial which was conducted at four different locations (NRRI, TTB, PTB and CBT), out of which the data received from CBT center was not included in the final analysis due to inconsistent performance of the check genotypes. The survival rate was found to be highest in Swarna-SUB1 (tolerant check) across different locations, while susceptible check Naveen showed only 15% survival. The center wise mean survival rate (%) varied from 48.18% (CTC) to 62.2% (PTB) with mean of 54.71% for all genotypes across all the locations. Among the tested entries, four genotypes i.e., AC43025, Dular, NPS17 and NPS18 showed more than 70% survival under 14 days of complete submergence and their survival rate was statistically at par with tolerant check. Five other entries *viz*. AC43037, Black Gora, Mahulata, Gurjari and Pani Kekua showed 60-70% survival, while four other entries viz., NPS71, Ampaki Bora, Mian Sali and Boga Amona showed 55-60% survival under stress. Hence, these three group of genotypes can be considered as highly tolerant, tolerant and moderately tolerant to submergence stress, respectively, based on the mean survival data of all locations. These genotypes may be used as potential donors for improving submergence tolerance trait in high yielding cultivars.

6.6 Screening of rice varieties for tolerance to low light stress

Light is the single most important environmental factors regulating various plant growth and development processes of rice. In view of the importance of low light tolerance in rice crop a new trial was formulated during the 51st Annual Rice Workers Group Meeting of AICRIP. During this year 15 AVT entries were tested at 7 locations varieties including Swarnaprabha as check variety. Result indicated low light stress resulted in significant loss in yield and its components. The mean grain yield was reduced by 54% under low light stress treatment.

Maximum reduction in grain yield under low light treatment was observed at NRRI (80%) followed by IIRR and KJT where the reduction in grain yield is >40%. The reduction in grain yield was highest in Sarala, followed by IET 29026 and IR8. The reduction was minimum in case of IET28276 (<20% reduction) over control. In case of the remaining genotypes the reduction in grain yield is very high <30% over control, suggesting that none of the tested genotypes are tolerant to low light stress. Amongst the 21 entries tested only IET28276 and IET29031 show relative tolerance to low light stress.

6.1 Role of Silicon in inducing abiotic stress tolerance in rice

Locations: CBT, IIRR, KJT, KRK, MTU, PNR, PTB, Ranchi, REWA, TTB (10)

The beneficial effects of Si to plants under biotic and/or abiotic stresses have been reported to occur in a wide variety of crop such as rice, oat, barley, wheat, cucumber and sugarcane. Leaves, stems and culms of plants, especially rice grown in the presence of Si, show an erect growth; thereby the distribution of light within the canopy is greatly improved. Silicon increases rice resistance to lodging and drought and dry matter accumulation in cucumber and rice. Silicon can positively affect the activity of some enzymes involved in the photosynthesis in rice and turf grass as well as reduce the senescence of rice leaves. Silicon can lower the electrolyte leakage from rice leaves and therefore, promote greater photosynthetic activity in plant grown under water deficit or heat stress. Silicon increases the oxidation power of rice roots, decreases injury caused by climate stress such as typhoons and cool summer damage in rice, alleviates freezing damage in sugarcane, and favors super cooling of palm leaves and increase tolerance to freezing stress in some plants. Silicon reduces the availability of toxic elements such as manganese, iron and aluminium to roots of plants such as rice and sugarcane and increase rice and barley resistance to salt stress.

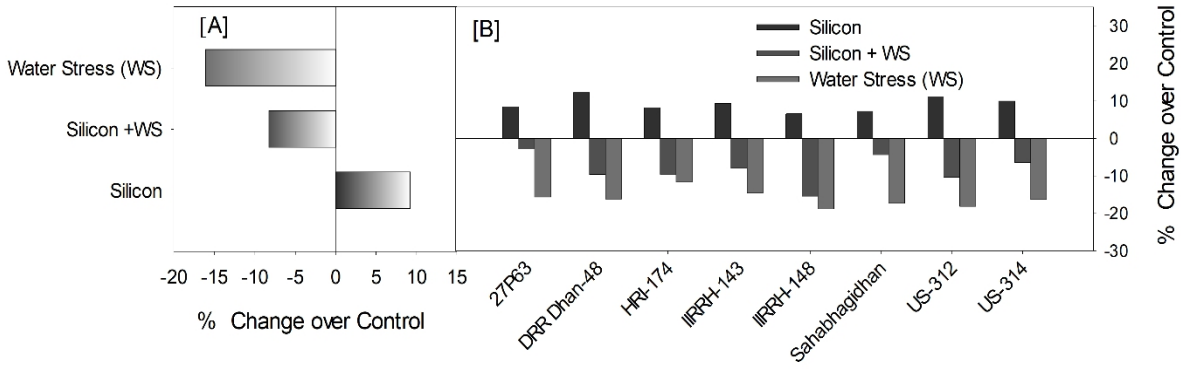
With the above objectives an experiment was conducted at 10 locations, with eight varieties with RBD/split plot design having four replications was led out with four silicon treatments. T1control (do not apply any silicon), T2 apply silicon granules (0.08% orthosilicic acid) 2g/m^2 at tillering and 50% flowering stage, In T3 treatment silicon plus water stress imposed by withholding irrigation 12 days before flowering and again 10 days after anthesis. Total duration of stress will be 22 days and last T4 treatment consists of only water stress. The eight varieties consist of hybrids and high yielding varieties.

The results revolved that, silicon had no influences on Days to 50% flowering and days to maturity (Tables 6.1.1 to 6.1.18). However, location x silicon x varieties were significantly showing that there was difference in 50% flowering and days to maturity varied from location to location and variety to variety leaf area index (LAI) concerned silicon treatment did not have any influenced and was non-significant at tillering stage. But the LAI at panicle initiation stage was found to be significant with application of silicon.

There was an increase in leaf area index between control and Silicon treated plots and similarly leaf area index at flowering stage was also significantly different with application of silicon. There was an increase in LAI significantly between varieties and locations. Plant height also showed significant difference between treatments, varieties and locations. However, the grand

mean value shown that there was no significant difference between T1, T2, T3 and T4. Since, plant height is genetic character in nature, there was no influence on silicon on plant height, and we observed tiller number for plant, it was found that silicon did favours tiller development especially under stress imposed plants with application of silicon granules.

Fig: 1 (A) Mean of all Locations, (B) Mean of all varieties



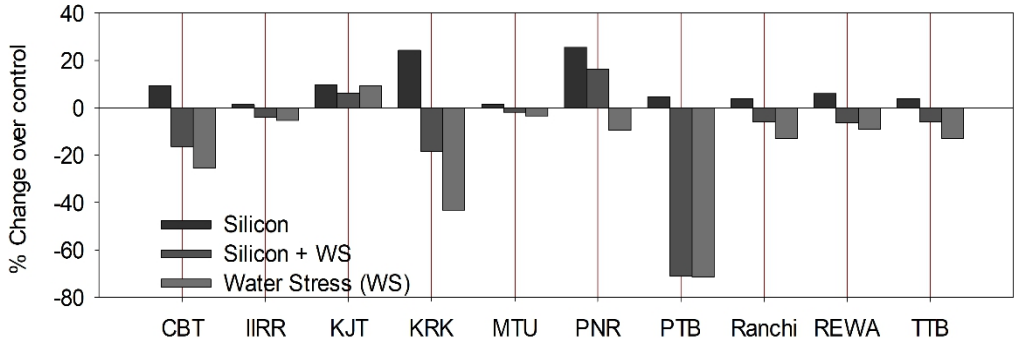


Fig: 2 Percentage change in grain number per panicle with respect to control. Each value represents mean of all varieties

Figure 1 shows that, percent changes in grain number per panicle, Figure (A) shows that mean of all locations, Figure (B) shows that mean of all varieties. From the graph, is very clearly shown that, there was 10% increase in grain number per panicle in silicon treated plots. It is clearly understood from graph that, water stress alone causes 20% reduction in grain number per panicle; but when silicon granules were applied for water stressed plants, the percent decreased in grain number per panicle was only 10%. Similarly, when varieties were tested irrespective of locations, there was gain in grain number per panicle with application of silicon, under water stressed situation. The same effect of inducing abiotic stress tolerant was found with application of silicon granules.

Figure 2 represents grain number per panicle with respect to control at different locations, the same effect was found.

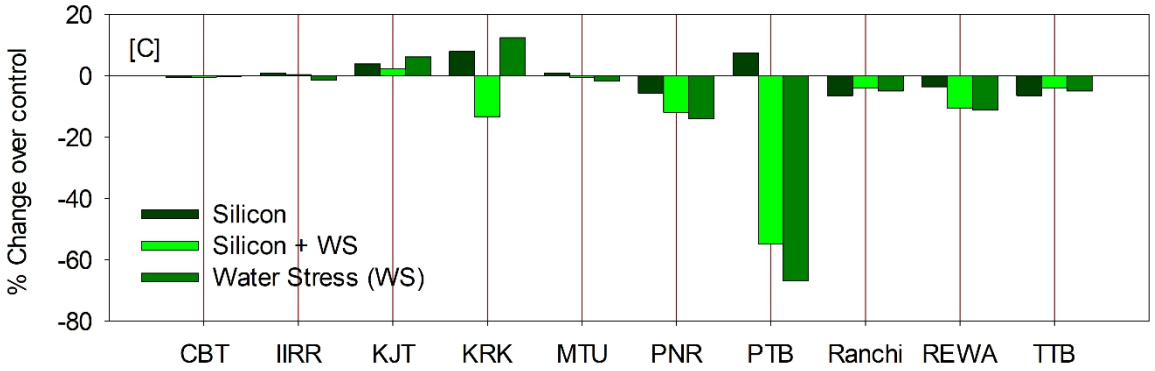


Fig: 3. Percentage change in harvest index with respect to control. Each value represents mean of all centers

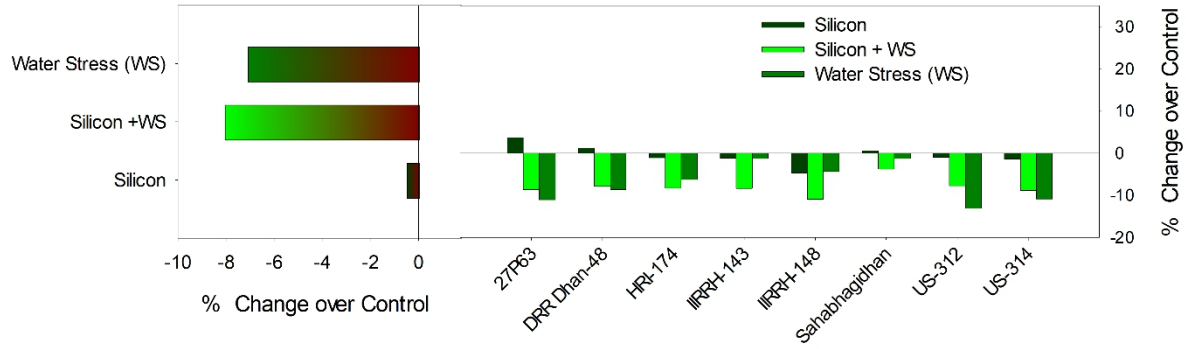


Fig: 4 (A) HI mean of all Locations, (B) HI mean of all varieties

Figures 3 and 4 represents percent change in harvest index with respect to control and it was found that, at same location, particularly at KRK, there was increase in harvest index under stress imposed treatments, invariably the HI decreased. However, in water stressed plants, when silicon granules were applied, there was positive response of HI with application of silicon.

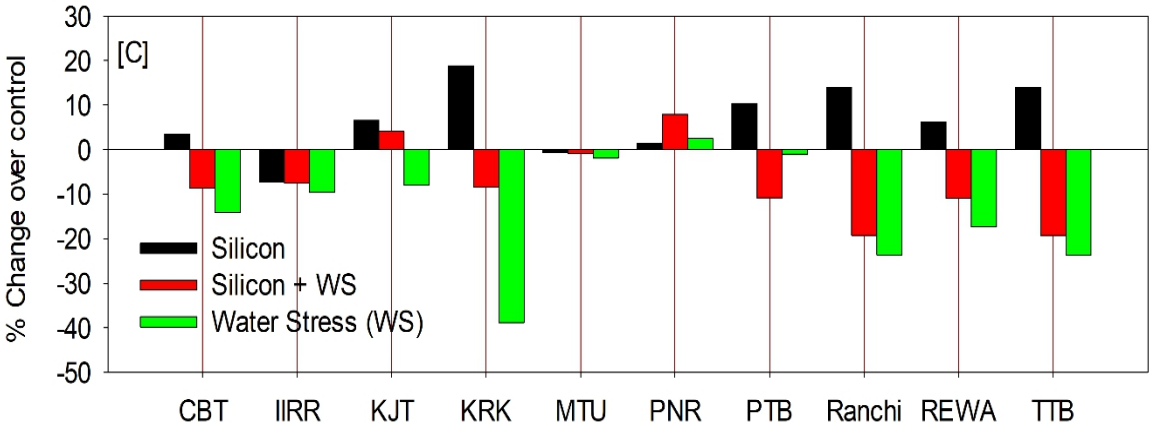


Fig: 5 Percentage change in total dry matter with respect to control. Each value represents mean of all centers

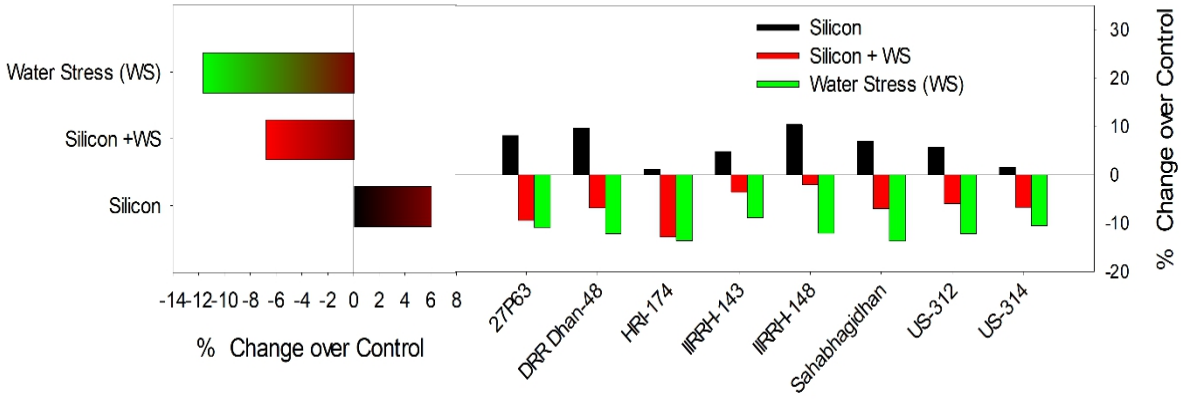


Fig: 6 Percentage change in total dry matter (g/m2) with respect to control. Each value represents mean of all varieties

Figure 5 represents the percent changing total dry matter (TDM) i.e. biomass at different locations. Figure 6 represents TDM at mean of all varieties. With the application of silicon it was found that, there was 6-7% increase in biomass and under water stress situation, there was 14% negative i.e. biomass decreased by 14% means there was imposed and glaringly it was fond that, when silicon was applied to the water stressed plots, the percent change over the control was only 6%, this shows that, under stressed situation, application of silicon granules leads to less decrease in biomass as compared to water stress treatment alone as shown in figure 5 and 6.

Fig: 7 (A) 1000 grain weight, mean of all Locations, (B) 1000 grain weight, mean of all varieties

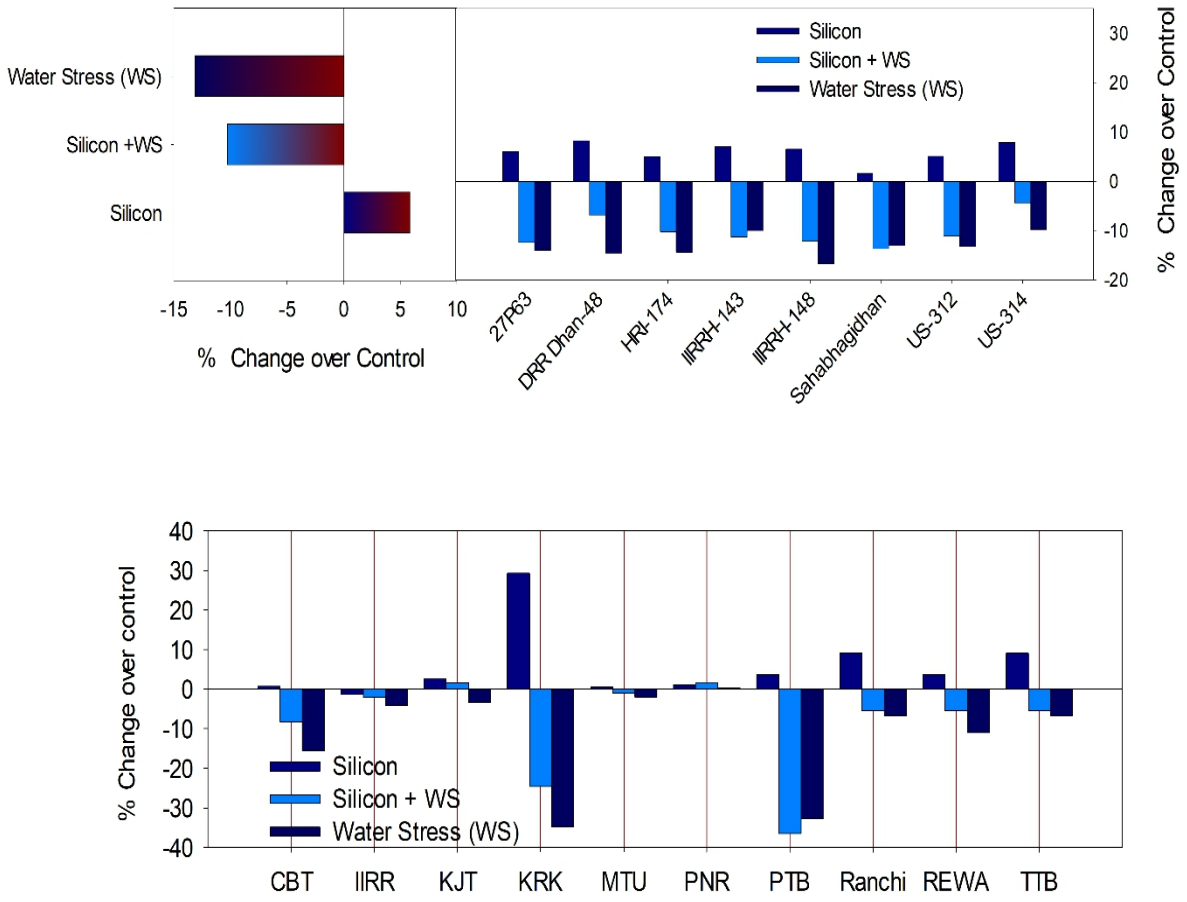


Fig: 8 Percentage change in 1000 grain weight with respect to control. Each value represents mean of all locations

Figure 7 and 8 clearly shows the effect of water stress and application of silicon in different locations and varieties. Silicon application caused an increase in 1000 grain weight across the location. However, the 1000 grain weight decreased in water stressed plants with marginal increase in grain weight improved with silicon application under water stress situation.

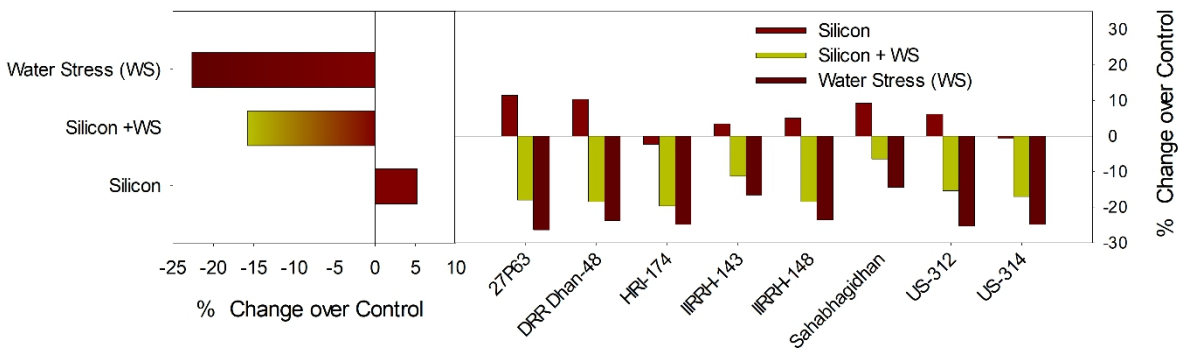


Fig: 9(A) Grain yield, mean of all Locations, (B) Grain yield, mean of all varieties

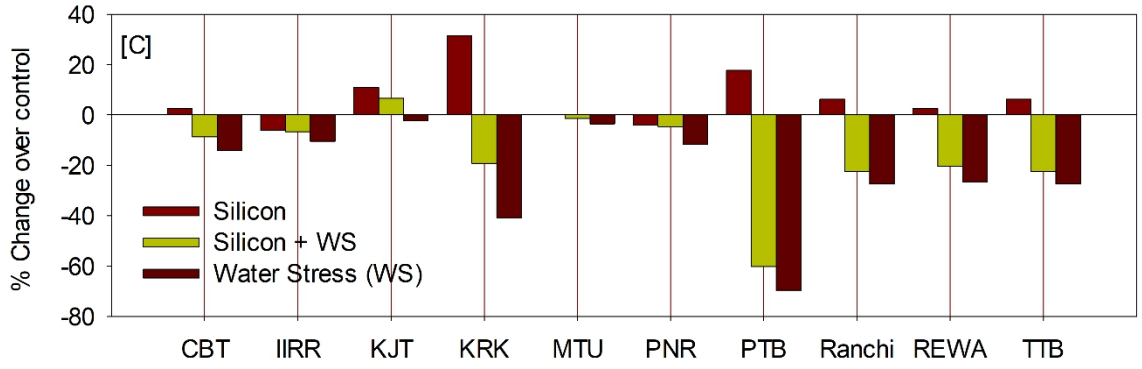


Fig: 10 Percentage change in grain yield with respect to control. Each value represents mean of all locations

Figure 9 and 10 shows the effect of water stress alone and water stress and silicon applied plots on grain yield. The mean value shows that, there was 5% increase in yield which was a mean of locations and varieties with the application of silicon i.e. T2 treatment. However, water stress caused decrease in yield by 25%, but when silicon was applied to water stressed plants, the decrease in yield was only 15% as shown in figure 9. Among the locations studied, KRK location shown the highest increase in yield by 32% followed by PTB. Under silicon applied plots, the best performing entries are 27P63, DRR Dhan-48, Sahabhagidhan and US-312.

Summary and Conclusion

The experiment was conducted to ascertain in the role of silicon in induced tolerance to water stress in rice, with four treatments and eight genotypes consisting of hybrid and high yielding varieties. There is a continuous study to find out the effect of water stress and role of silicon on yield and yield attributes. The results support that there was an increase in biomass, leaf area index, stem weight, grain number per panicle, 1000 grain weight, harvest index and grain yield when silicon granules were applied (0.08% OrthoSilicic acid) @5kg/acre at active tillering and flowering stages. The study was conducted at ten locations spread over the country. When silicon was applied to water-stressed plants (22 days' water stress was imposed) there was less damage and yield attributes were better under silicon applied plots. In overall situation, there was 5% increase in yield under silicon applied plots. The best performing entries are 27P63, DRR Dhan-48, Sahabhagidhan and US-312.

Table: 6.1.1 Influence of Silica application days to flowering at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	97	110	103	97	98	101	98	100	94	100	100
	2	DRR Dhan-48	99	107	105	98	96	100	100	101	91	101	100
	3	HRI-174	97	111	106	99	95	98	97	99	100	99	100
	4	IIRRH-143	88	97	96	87	85	86	89	97	91	97	91
	5	IIRRH-148	118	100	99	91	87	91	90	463	90	463	169
	6	Sahabhagidhan	75	105	83	87	79	85	87	91	90	91	87
	7	US-312	96	98	98	90	85	90	97	97	91	97	94
	8	US-314	75	94	87	88	85	82	85	87	95	87	86
		T1 Mean	**93**	**103**	**97**	**92**	**89**	**92**	**93**	**142**	**93**	**142**	**104**
T2 (0.08% Ortho silicic acid)	1	27P63	97	109	105	94	97	102	97	100	94	100	99
	2	DRR Dhan-48	99	102	109	98	95	100	96	101	90	101	99
	3	HRI-174	97	112	107	99	95	100	98	99	97	99	100
	4	IIRRH-143	88	98	97	86	85	87	87	97	92	97	91
	5	IIRRH-148	118	103	98	91	87	89	90	98	89	98	96
	6	Sahabhagidhan	75	104	84	89	78	86	88	96	91	96	89
	7	US-312	96	98	92	93	85	88	92	97	89	97	93
	8	US-314	75	96	89	89	84	81	85	87	94	87	87
		T2 Mean	**93**	**103**	**98**	**92**	**88**	**92**	**92**	**97**	**92**	**97**	**94**
T3 (silicon+ water stress)	1	27P63	98	111	103	91	97	101	94	103	93	103	99
	2	DRR Dhan-48	102	101	106	98	96	100	91	105	89	105	99
	3	HRI-174	98	113	104	99	94	98	88	101	97	101	99
	4	IIRRH-143	118	96	98	86	86	86	76	100	91	100	94
	5	IIRRH-148	95	103	97	90	86	92	80	100	88	100	93
	6	Sahabhagidhan	75	104	83	86	79	86	72	98	89	98	87
	7	US-312	96	100	98	94	85	88	84	99	89	99	93
	8	US-314	75	96	88	89	84	81	75	89	94	89	86
		T3 Mean	**95**	**103**	**97**	**92**	**88**	**91**	**83**	**99**	**91**	**99**	**94**
T4 (water stress)	1	27P63	98	109	104	95	97	102	98	103	93	103	100
	2	DRR Dhan-48	102	101	108	98	95	100	92	105	88	105	99
	3	HRI-174	98	110	105	99	95	98	95	101	95	101	100
	4	IIRRH-143	118	96	100	86	85	87	81	100	90	100	94
	5	IIRRH-148	95	103	98	90	87	91	88	100	89	100	94
	6	Sahabhagidhan	75	100	85	87	78	85	73	98	88	98	87
	7	US-312	96	100	100	93	85	89	87	99	89	99	94
	8	US-314	75	96	90	89	85	80	77	89	91	89	86
		T4 Mean	**95**	**102**	**99**	**92**	**88**	**91**	**86**	**99**	**90**	**99**	**94**
		Grand Mean	**94**	**103**	**98**	**92**	**88**	**91**	**88**	**109**	**92**	**109**	**96**
		LSD (Silicon)				ns		LSD (Silicon x Variety)				1.37**	
		LSD (Location x Silicon)				0.82**		LSD (Location x Silicon x Variety)				4.33	
		LSD (Variety)				0.69**		CV(Silicon) %				1.11	
		LSD (Location x Variety)				2.17**		CV(Residual) %				2.13	

Table: 6.1.2 Influence of Silica application days to maturity at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Total
T1 (Control)	1	27P63	128	137	135	127	127	145	133	135	122	135	132
	2	DRR Dhan-48	129	135	137	127	127	145	130	135	119	135	132
	3	HRI-174	128	138	140	127	125	143	128	131	113	131	130
	4	IIRRH-143	119	127	127	127	116	131	119	132	119	132	125
	5	IIRRH-148	148	131	129	127	117	134	120	133	117	133	129
	6	Sahabhagidhan	105	135	113	127	109	130	117	125	118	125	120
	7	US-312	127	129	125	127	116	135	127	131	117	131	127
	8	US-314	106	125	117	127	116	127	115	122	122	122	120
		T1 Mean	**124**	**132**	**128**	**127**	**119**	**136**	**124**	**131**	**119**	**131**	**127**
T2 (0.08% Ortho silicic acid)	1	27P63	108	139	135	127	127	147	135	135	122	135	131
	2	DRR Dhan-48	129	131	142	127	126	145	126	135	117	135	131
	3	HRI-174	108	143	138	127	125	145	128	131	125	131	130
	4	IIRRH-143	122	129	127	127	116	133	117	132	119	132	125
	5	IIRRH-148	150	133	128	127	118	134	120	133	118	133	129
	6	Sahabhagidhan	105	136	114	127	108	131	118	125	123	125	121
	7	US-312	127	128	122	127	115	134	122	131	121	131	126
	8	US-314	106	126	120	127	115	125	115	122	122	122	120
		T2 Mean	**119**	**133**	**128**	**127**	**119**	**137**	**123**	**131**	**121**	**131**	**127**
T3 (silicon+ water stress)	1	27P63	129	142	133	127	127	146	133	134	120	134	133
	2	DRR Dhan-48	133	132	142	127	126	145	134	137	118	137	133
	3	HRI-174	129	143	134	127	124	144	134	132	125	132	132
	4	IIRRH-143	150	127	136	127	116	132	134	130	118	130	130
	5	IIRRH-148	127	133	127	127	117	137	133	132	118	132	128
	6	Sahabhagidhan	105	135	113	127	109	131	130	127	119	127	122
	7	US-312	127	129	128	127	116	133	133	131	117	131	127
	8	US-314	106	125	118	127	114	126	131	122	121	122	121
		T3 Mean	**126**	**133**	**129**	**127**	**119**	**137**	**133**	**131**	**119**	**131**	**128**
T4 (water stress)	1	27P63	129	139	136	127	127	147	134	134	122	134	133
	2	DRR Dhan-48	133	130	139	127	126	144	134	137	118	137	133
	3	HRI-174	129	139	135	127	126	141	133	133	123	133	132
	4	IIRRH-143	150	127	132	127	115	132	134	130	119	130	130
	5	IIRRH-148	127	133	128	127	118	136	129	132	117	132	128
	6	Sahabhagidhan	105	129	112	127	109	130	130	128	120	128	122
	7	US-312	127	129	126	127	116	134	133	131	119	131	127
	8	US-314	106	125	119	127	115	125	130	122	124	122	122
		T4 Mean	**126**	**132**	**128**	**127**	**119**	**136**	**132**	**131**	**120**	**131**	**128**
		Grand Mean	**124**	**133**	**128**	**127**	**119**	**136**	**128**	**131**	**120**	**131**	**128**
		LSD (Silicon)		ns		LSD (Silicon x Variety)				ns			
		LSD (Location x Silicon)		1.02**		LSD (Location x Silicon x Variety)				4.3**			
		LSD (Variety)		0.68**		CV(Silicon) %				1.04			
		LSD (Location x Variety)		2.14**		CV(Residual) %				1.6			

Table: 6.1.3 Influence of Silica application on Leaf Area Index at tillering at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Total
T1 (Control)	1	27P63	3.63	0	3.68	4.28	0.00	1.23	8.17	2.42	0.00	2.42	2.58
	2	DRR Dhan-48	4.59	0	2.71	2.61	0.00	1.31	10.15	2.65	0.00	2.65	2.67
	3	HRI-174	3.93	0	3.56	3.56	0.00	1.46	9.79	3.75	0.00	3.75	2.98
	4	IIRRH-143	3.52	0	3.77	5.38	0.00	1.86	5.23	2.47	0.00	2.47	2.47
	5	IIRRH-148	2.63	0	2.37	3.01	0.00	1.41	2.66	2.61	0.00	2.61	1.73
	6	Sahabhagidhan	3.12	0	2.71	3.33	0.00	1.64	4.62	2.41	0.00	2.41	2.02
	7	US-312	5.03	0	2.82	3.48	0.00	1.88	9.25	3.18	0.00	3.18	2.88
	8	US-314	2.92	0	1.56	4.75	0.00	1.51	4.98	3.01	0.00	3.01	2.18
		T1 Mean	**3.67**	**0**	**2.90**	**3.80**	**0.00**	**1.54**	**6.86**	**2.81**	**0.00**	**2.81**	**2.44**
T2 (0.08% Ortho silicic acid)	1	27P63	4.06	0	3.81	5.78	0.00	1.32	9.37	3.14	0.00	3.14	3.06
	2	DRR Dhan-48	5.03	0	2.45	4.35	0.00	1.32	6.90	2.43	0.00	2.43	2.49
	3	HRI-174	4.37	0	3.83	4.20	0.00	1.48	9.92	3.48	0.00	3.48	3.08
	4	IIRRH-143	3.96	0	3.84	5.94	0.00	2.03	5.63	3.34	0.00	3.34	2.81
	5	IIRRH-148	3.07	0	2.92	6.57	0.00	1.56	3.07	2.79	0.00	2.79	2.28
	6	Sahabhagidhan	3.30	0	2.73	4.51	0.00	1.63	4.20	2.49	0.00	2.49	2.14
	7	US-312	5.46	0	3.14	6.33	0.00	2.01	7.67	3.28	0.00	3.28	3.12
	8	US-314	3.36	0	2.14	8.08	0.00	1.83	5.49	3.40	0.00	3.40	2.77
		T2 Mean	**4.08**	**0**	**3.11**	**5.72**	**0.00**	**1.65**	**6.53**	**3.04**	**0.00**	**3.04**	**2.72**
T3 (silicon+ water stress)	1	27P63	3.26	0	3.76	2.38	0.00	1.46	9.79	1.99	0.00	1.99	2.46
	2	DRR Dhan-48	4.23	0	3.25	2.93	0.00	1.49	9.40	1.92	0.00	1.92	2.51
	3	HRI-174	3.57	0	3.00	2.61	0.00	1.93	9.64	2.75	0.00	2.75	2.62
	4	IIRRH-143	3.16	0	3.61	2.61	0.00	1.62	5.25	2.01	0.00	2.01	2.03
	5	IIRRH-148	2.37	0	2.77	3.64	0.00	1.60	2.55	1.62	0.00	1.62	1.62
	6	Sahabhagidhan	2.48	0	2.56	2.38	0.00	1.67	4.21	1.83	0.00	1.83	1.70
	7	US-312	4.67	0	2.94	3.17	0.00	2.33	4.56	2.00	0.00	2.00	2.17
	8	US-314	2.56	0	2.11	4.67	0.00	1.53	4.51	2.58	0.00	2.58	2.05
		T3 Mean	**3.29**	**0**	**3.00**	**3.05**	**0.00**	**1.70**	**6.24**	**2.09**	**0.00**	**2.09**	**2.15**
T4 (water stress)	1	27P63	3.23	0	2.40	3.40	0.00	1.57	9.27	1.83	0.00	1.83	2.35
	2	DRR Dhan-48	4.20	0	2.10	2.77	0.00	1.19	8.87	2.32	0.00	2.32	2.38
	3	HRI-174	3.53	0	2.38	2.77	0.00	1.86	8.62	2.60	0.00	2.60	2.44
	4	IIRRH-143	3.13	0	3.03	4.67	0.00	2.07	4.43	1.96	0.00	1.96	2.12
	5	IIRRH-148	2.22	0	2.42	5.07	0.00	1.30	2.30	1.51	0.00	1.51	1.63
	6	Sahabhagidhan	2.33	0	2.17	2.77	0.00	1.65	4.01	2.34	0.00	2.34	1.76
	7	US-312	4.63	0	2.25	4.04	0.00	2.05	6.40	2.11	0.00	2.11	2.36
	8	US-314	2.55	0	1.95	3.96	0.00	1.40	4.00	2.35	0.00	2.35	1.86
		T4 Mean	**3.23**	**0**	**2.34**	**3.68**	**0.00**	**1.63**	**5.99**	**2.13**	**0.00**	**2.13**	**2.11**
		Mean	**3.57**	**0**	**2.84**	**4.06**	**0.00**	**1.63**	**6.40**	**2.52**	**0.00**	**2.52**	**2.35**

		LSD (Silicon)	ns		LSD (Silicon x Variety)	ns	
		LSD (Location x Silicon)	0.8**		LSD (Location x Silicon x Variety)	1.09**	
		LSD (Variety)	ns		CV(Silicon) %	44.2	
		LSD (Location x Variety)	0.54**		CV(Residual) %	22	

Table: 6.1.4 Influence of Silica application on Leaf Area Index at Panicle Initiation at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	4.38	4.69	4.49	4.69	0.00	3.72	9.22	4.47	0.00	4.47	4.01
	2	DRR Dhan-48	5.55	4.28	3.30	2.96	0.00	3.04	11.20	4.25	0.00	4.25	3.88
	3	HRI-174	4.75	4.18	4.35	3.32	0.00	3.02	10.84	4.77	0.00	4.77	4.00
	4	IIRRH-143	4.26	4.83	4.59	3.65	0.00	2.78	6.28	3.64	0.00	3.64	3.37
	5	IIRRH-148	3.18	3.89	2.89	2.51	0.00	2.63	3.71	4.36	0.00	4.36	2.75
	6	Sahabhagidhan	3.77	4.77	3.31	2.35	0.00	3.30	5.67	3.50	0.00	3.50	3.02
	7	US-312	6.08	4.98	3.44	3.62	0.00	3.64	10.30	4.64	0.00	4.64	4.13
	8	US-314	3.53	4.93	1.91	1.78	0.00	3.45	6.03	4.32	0.00	4.32	3.03
		T1 Mean	**4.44**	**4.57**	**3.53**	**3.11**	**0.00**	**3.20**	**7.91**	**4.24**	**0.00**	**4.24**	**3.52**
T2 (0.08% Ortho silicic acid)	1	27P63	4.91	5.21	4.92	5.01	0.00	4.67	10.42	4.72	0.00	4.72	4.46
	2	DRR Dhan-48	6.08	3.58	3.17	3.73	0.00	3.85	7.95	4.39	0.00	4.39	3.71
	3	HRI-174	5.28	3.87	4.95	4.37	0.00	3.87	10.97	5.06	0.00	5.06	4.34
	4	IIRRH-143	4.79	4.80	4.96	4.63	0.00	3.00	6.68	3.75	0.00	3.75	3.64
	5	IIRRH-148	3.71	4.70	3.77	4.29	0.00	3.75	4.12	4.56	0.00	4.56	3.35
	6	Sahabhagidhan	3.99	3.48	3.52	3.78	0.00	3.43	5.25	3.83	0.00	3.83	3.11
	7	US-312	6.60	4.13	4.06	4.80	0.00	4.10	8.72	4.92	0.00	4.92	4.22
	8	US-314	4.06	4.05	2.76	4.13	0.00	4.13	6.54	4.62	0.00	4.62	3.49
		T2 Mean	**4.93**	**4.23**	**4.01**	**4.34**	**0.00**	**3.85**	**7.58**	**4.48**	**0.00**	**4.48**	**3.79**
T3 (silicon+ water stress)	1	27P63	3.95	3.90	4.66	4.35	0.00	4.47	11.05	3.35	0.00	3.35	3.91
	2	DRR Dhan-48	5.12	2.65	4.03	2.69	0.00	3.13	10.66	3.65	0.00	3.65	3.56
	3	HRI-174	4.32	3.27	3.71	3.00	0.00	4.61	10.90	4.14	0.00	4.14	3.81
	4	IIRRH-143	3.82	3.58	4.47	2.31	0.00	2.75	6.51	2.60	0.00	2.60	2.86
	5	IIRRH-148	2.86	3.22	3.44	2.67	0.00	3.79	3.81	3.19	0.00	3.19	2.62
	6	Sahabhagidhan	3.00	3.04	3.18	2.67	0.00	3.98	5.47	2.46	0.00	2.46	2.63
	7	US-312	5.64	3.82	3.65	3.78	0.00	4.00	5.82	4.08	0.00	4.08	3.49
	8	US-314	3.10	3.52	2.61	2.95	0.00	3.41	5.77	4.01	0.00	4.01	2.94
		T3 Mean	**3.97**	**3.38**	**3.72**	**3.05**	**0.00**	**3.77**	**7.50**	**3.44**	**0.00**	**3.44**	**3.23**
T4 (water stress)	1	27P63	3.90	3.91	2.83	2.46	0.00	4.44	10.53	3.19	0.00	3.19	3.45
	2	DRR Dhan-48	5.07	2.83	2.47	1.90	0.00	3.16	10.13	3.40	0.00	3.40	3.24
	3	HRI-174	4.27	3.71	2.81	3.02	0.00	3.71	9.88	3.89	0.00	3.89	3.52
	4	IIRRH-143	3.78	2.89	3.57	2.00	0.00	3.67	5.69	2.45	0.00	2.45	2.65
	5	IIRRH-148	2.68	2.83	2.86	1.72	0.00	3.98	3.56	2.73	0.00	2.73	2.31
	6	Sahabhagidhan	2.82	3.18	2.56	1.80	0.00	3.73	5.27	2.32	0.00	2.32	2.40
	7	US-312	5.59	4.19	2.65	2.03	0.00	3.61	7.66	3.94	0.00	3.94	3.36
	8	US-314	3.08	4.65	2.30	1.33	0.00	2.80	5.26	3.21	0.00	3.21	2.58
		T4 Mean	**3.90**	**3.53**	**2.76**	**2.03**	**0.00**	**3.64**	**7.25**	**3.14**	**0.00**	**3.14**	**2.94**
		Grand Mean	**4.31**	**3.93**	**3.51**	**3.13**	**0.00**	**3.61**	**7.56**	**3.82**	**0.00**	**3.82**	**3.37**
		LSD (Silicon)			0.21**			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			0.68**			LSD (Location x Silicon x Variety)				1.19**	
		LSD (Variety)			0.19**			CV(Silicon) %				26.3	
		LSD (Location x Variety)			0.59**			CV(Residual) %				16.7	

Table: 6.1.5 Influence of Silica application on Leaf Area Index at flowering at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	4.69	7.12	5.08	3.49	0.00	6.08	9.37	4.59	0.00	4.59	4.50
	2	DRR Dhan-48	5.94	4.54	3.73	4.29	0.00	3.55	8.42	4.24	0.00	4.24	3.90
	3	HRI-174	5.09	5.33	5.11	4.37	0.00	4.39	9.52	4.87	0.00	4.87	4.35
	4	IIRRH-143	4.56	5.12	5.31	4.45	0.00	4.59	6.23	3.62	0.00	3.62	3.75
	5	IIRRH-148	3.40	5.77	3.51	3.97	0.00	3.26	2.48	4.22	0.00	4.22	3.08
	6	Sahabhagidhan	4.03	2.77	3.74	2.70	0.00	3.66	4.60	3.68	0.00	3.68	2.89
	7	US-312	6.50	3.59	4.55	3.57	0.00	4.68	9.47	5.06	0.00	5.06	4.25
	8	US-314	3.78	3.89	2.16	3.65	0.00	4.63	6.09	4.32	0.00	4.32	3.28
		T1 Mean	**4.75**	**4.77**	**4.15**	**3.81**	**0.00**	**4.36**	**7.02**	**4.32**	**0.00**	**4.32**	**3.75**
T2 (0.08% Ortho silicic acid)	1	27P63	5.26	7.53	5.85	4.76	0.00	5.98	8.23	4.83	0.00	4.83	4.73
	2	DRR Dhan-48	6.51	6.49	3.77	6.48	0.00	4.19	8.41	4.32	0.00	4.32	4.45
	3	HRI-174	5.65	6.88	5.89	5.87	0.00	4.66	9.87	5.29	0.00	5.29	4.94
	4	IIRRH-143	5.13	5.27	5.90	5.24	0.00	3.64	4.08	3.79	0.00	3.79	3.68
	5	IIRRH-148	3.96	6.61	4.49	7.62	0.00	4.99	2.81	4.73	0.00	4.73	3.99
	6	Sahabhagidhan	4.28	5.64	4.19	5.08	0.00	3.35	5.35	4.23	0.00	4.23	3.63
	7	US-312	7.07	6.26	4.83	5.95	0.00	5.66	9.77	5.20	0.00	5.20	4.99
	8	US-314	4.35	4.48	3.62	4.76	0.00	5.41	4.45	4.46	0.00	4.46	3.60
		T2 Mean	**5.27**	**6.14**	**4.82**	**5.72**	**0.00**	**4.74**	**6.62**	**4.61**	**0.00**	**4.61**	**4.25**
T3 (silicon+ water stress)	1	27P63	4.22	6.64	5.41	3.41	0.00	6.25	11.77	4.24	0.00	4.24	4.62
	2	DRR Dhan-48	5.48	5.93	4.67	3.89	0.00	4.81	11.38	3.85	0.00	3.85	4.39
	3	HRI-174	4.62	6.57	4.31	4.05	0.00	5.80	11.62	4.82	0.00	4.82	4.66
	4	IIRRH-143	4.09	4.15	5.19	3.65	0.00	3.77	7.23	3.22	0.00	3.22	3.45
	5	IIRRH-148	3.06	5.61	4.72	4.71	0.00	4.25	4.54	3.24	0.00	3.27	3.34
	6	Sahabhagidhan	3.21	6.20	3.69	3.25	0.00	3.41	6.20	3.44	0.00	3.44	3.28
	7	US-312	6.03	4.30	4.23	3.41	0.00	6.08	6.54	4.47	0.00	4.47	3.95
	8	US-314	3.31	3.59	3.03	3.10	0.00	5.55	6.49	3.81	0.00	3.81	3.27
		T3 Mean	**4.25**	**5.37**	**4.41**	**3.68**	**0.00**	**4.99**	**8.22**	**3.88**	**0.00**	**3.89**	**3.87**
T4 (water stress)	1	27P63	4.18	6.77	3.14	1.98	0.00	6.06	11.25	3.88	0.00	3.88	4.11
	2	DRR Dhan-48	5.43	4.99	2.75	2.78	0.00	3.29	10.86	3.52	0.00	3.52	3.71
	3	HRI-174	4.57	5.90	3.12	3.02	0.00	5.63	10.60	4.56	0.00	4.56	4.20
	4	IIRRH-143	4.04	3.84	3.96	2.78	0.00	4.82	6.42	3.42	0.00	3.42	3.27
	5	IIRRH-148	2.87	5.87	3.17	2.86	0.00	3.34	4.28	3.20	0.00	3.20	2.88
	6	Sahabhagidhan	3.02	3.51	2.84	1.83	0.00	3.19	5.99	2.93	0.00	2.93	2.62
	7	US-312	5.99	3.76	2.94	2.05	0.00	4.92	8.39	4.18	0.00	4.18	3.64
	8	US-314	3.30	5.75	2.55	1.59	0.00	3.20	5.98	3.66	0.00	3.66	2.97
		T4 Mean	**4.18**	**5.05**	**3.06**	**2.36**	**0.00**	**4.31**	**7.97**	**3.67**	**0.00**	**3.67**	**3.43**
		Grand Mean	**4.61**	**5.33**	**4.11**	**3.89**	**0.00**	**4.60**	**7.46**	**4.12**	**0.00**	**4.12**	**3.82**
		LSD (Silicon)			0.104*			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			0.44**			LSD (Location x Silicon x Variety)				1.32**	
		LSD (Variety)			0.21**			CV(Silicon) %				14.9	
		LSD (Location x Variety)			0.66**			CV(Residual) %				16.4	

Table: 6.1.6 Influence of Silica application on Plant height (cm) at flowering at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	97.3	117.3	129.3	121.7	132.7	114.0	84.3	107.0	0.0	107.0	101.1
	2	DRR Dhan-48	88.3	94.0	110.3	99.7	127.0	100.0	67.7	95.3	0.0	95.3	87.8
	3	HRI-174	98.7	115.3	138.0	115.0	130.3	108.0	84.7	111.3	0.0	111.3	101.3
	4	IIRRH-143	102.3	111.2	128.7	105.3	115.7	103.0	73.7	111.3	0.0	111.3	96.3
	5	IIRRH-148	99.7	101.2	124.7	116.7	113.3	99.0	69.3	112.0	0.0	112.0	94.8
	6	Sahabhagidhan	97.7	99.3	127.7	120.0	131.3	104.0	69.3	101.7	0.0	101.7	95.3
	7	US-312	97.0	102.7	128.7	111.3	124.7	103.0	70.0	119.7	0.0	119.7	97.7
	8	US-314	86.7	90.0	128.0	116.3	124.0	99.3	66.7	109.3	0.0	109.3	93.0
		T1 Mean	**96.0**	**103.9**	**126.9**	**113.3**	**124.9**	**103.8**	**73.2**	**108.5**	**0.0**	**108.5**	**95.9**
T2 (0.08% Ortho silicic acid)	1	27P63	98.0	109.5	126.7	121.0	134.3	123.0	78.7	121.3	0.0	121.3	103.4
	2	DRR Dhan-48	89.3	90.0	106.3	99.0	125.3	100.7	72.3	100.7	0.0	100.7	88.4
	3	HRI-174	99.0	99.5	135.3	114.3	133.3	109.0	79.3	120.7	0.0	120.7	101.1
	4	IIRRH-143	103.0	100.3	125.0	104.7	116.3	116.7	70.7	110.0	0.0	110.0	95.7
	5	IIRRH-148	100.7	97.2	121.3	116.0	114.0	103.3	67.3	110.7	0.0	110.7	94.1
	6	Sahabhagidhan	98.7	96.3	122.0	119.3	133.7	105.3	70.0	110.7	0.0	110.7	96.7
	7	US-312	98.3	97.3	127.0	110.7	126.0	105.3	70.3	124.7	0.0	124.7	98.4
	8	US-314	89.7	97.2	125.3	115.7	122.7	102.0	69.7	112.0	0.0	112.0	94.6
		T2 Mean	**97.1**	**98.4**	**123.6**	**112.6**	**125.7**	**108.2**	**72.3**	**113.8**	**0.0**	**113.8**	**96.6**
T3 (silicon+ water stress)	1	27P63	94.7	101.3	121.3	118.7	134.7	109.0	82.0	105.7	0.0	105.7	97.3
	2	DRR Dhan-48	85.7	88.2	112.3	96.7	126.7	98.7	65.7	108.0	0.0	108.0	89.0
	3	HRI-174	96.3	108.2	127.0	112.0	133.0	113.7	79.3	109.3	0.0	109.3	98.8
	4	IIRRH-143	99.3	95.2	125.0	102.3	116.3	101.0	63.0	115.3	0.0	115.3	93.3
	5	IIRRH-148	96.3	93.5	118.0	113.7	114.7	104.3	68.7	110.3	0.0	110.3	93.0
	6	Sahabhagidhan	91.7	95.5	121.3	117.0	132.3	105.3	69.0	105.3	0.0	105.3	94.3
	7	US-312	95.7	102.5	128.3	108.3	125.3	111.0	74.3	108.0	0.0	108.0	96.2
	8	US-314	83.7	88.3	115.0	113.3	123.7	103.7	70.3	107.3	0.0	107.3	91.3
		T3 Mean	**92.9**	**96.6**	**121.0**	**110.3**	**125.8**	**105.8**	**71.5**	**108.7**	**0.0**	**108.7**	**94.1**
T4 (water stress)	1	27P63	93.3	104.2	116.7	117.3	134.7	108.0	78.0	108.7	0.0	108.7	97.0
	2	DRR Dhan-48	84.0	88.7	108.7	100.0	126.0	100.0	67.3	112.7	0.0	112.7	90.0
	3	HRI-174	93.7	102.0	120.7	107.3	132.0	105.0	76.7	111.0	0.0	111.0	95.9
	4	IIRRH-143	96.7	88.2	117.3	100.0	114.0	100.7	73.3	109.7	0.0	109.7	91.0
	5	IIRRH-148	92.7	97.2	112.7	114.0	115.0	101.0	63.7	118.0	0.0	118.0	93.2
	6	Sahabhagidhan	89.7	94.5	114.0	122.3	132.0	100.7	73.3	108.3	0.0	108.3	94.3
	7	US-312	92.0	98.7	122.0	107.0	126.7	101.3	69.7	120.0	0.0	120.0	95.7
	8	US-314	80.0	89.2	115.0	111.0	125.0	88.3	62.3	111.0	0.0	111.0	89.3
		T4 Mean	**90.3**	**95.3**	**115.9**	**109.9**	**125.7**	**100.6**	**70.5**	**112.4**	**0.0**	**112.4**	**93.3**
		Grand Mean	**94.1**	**98.5**	**121.9**	**111.5**	**125.5**	**104.6**	**71.9**	**110.8**	**0.0**	**110.8**	**95.0**
		LSD (Silicon)			1.49*			LSD (Silicon x Variety)				2.49*	
		LSD (Location x Silicon)			6.24**			LSD (Location x Silicon x Variety)				ns	
		LSD (Variety)			1.64**			CV(Silicon) %				8.57	
		LSD (Location x Variety)			5.19**			CV(Residual) %				5.18	

Table: 6.1.7 Influence of Silica application on tiller number/m2 at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	19.3	195.8	400.0	11.3	374.0	276.7	1183.3	219.0	0.0	219.0	289.9
	2	DRR Dhan-48	19.3	166.7	316.7	11.7	308.0	358.3	1116.7	228.3	0.0	228.3	275.4
	3	HRI-174	20.0	150.0	366.7	10.7	374.0	355.7	1416.7	213.3	0.0	213.3	312.0
	4	IIRRH-143	24.7	158.3	450.0	9.7	319.0	354.3	900.0	257.0	0.0	257.0	273.0
	5	IIRRH-148	23.0	245.8	366.7	9.7	385.0	346.0	750.0	192.0	0.0	192.0	251.0
	6	Sahabhagidhan	25.3	166.7	416.7	9.3	385.0	358.7	716.7	182.3	0.0	182.3	244.3
	7	US-312	19.7	133.3	416.7	9.7	286.0	349.0	1233.3	185.0	0.0	185.0	281.8
	8	US-314	25.7	170.8	350.0	10.0	253.0	358.7	983.3	247.7	0.0	247.7	264.7
		T1 Mean	**22.1**	**173.4**	**385.4**	**10.3**	**335.5**	**344.7**	**1037.5**	**215.6**	**0.0**	**215.6**	**274.0**
T2 (0.08% Ortho silicic acid)	1	27P63	20.3	204.2	383.3	12.0	396.0	341.3	1100.0	310.7	0.0	310.7	307.9
	2	DRR Dhan-48	20.3	175.0	366.7	12.0	319.0	441.7	1550.0	238.7	0.0	238.7	336.2
	3	HRI-174	21.3	204.2	366.7	15.7	352.0	375.0	1166.7	285.0	0.0	285.0	307.2
	4	IIRRH-143	25.0	166.7	450.0	14.0	330.0	408.3	1083.3	323.0	0.0	323.0	312.3
	5	IIRRH-148	25.0	233.3	366.7	13.7	385.0	366.7	633.3	227.7	0.0	227.7	247.9
	6	Sahabhagidhan	25.7	237.5	333.3	12.7	396.0	377.7	750.0	279.0	0.0	279.0	269.1
	7	US-312	20.0	175.0	366.7	14.0	308.0	391.7	716.7	267.3	0.0	267.3	252.7
	8	US-314	26.7	200.0	383.3	12.0	275.0	375.0	866.7	269.3	0.0	269.3	267.7
		T2 Mean	**23.0**	**199.5**	**377.1**	**13.3**	**345.1**	**384.7**	**983.3**	**275.1**	**0.0**	**275.1**	**287.6**
T3 (silicon+ water stress)	1	27P63	18.0	212.5	400.0	10.3	363.0	358.3	1116.7	188.7	0.0	188.7	285.6
	2	DRR Dhan-48	17.0	200.0	450.0	10.0	308.0	369.0	1183.3	207.3	0.0	207.3	295.2
	3	HRI-174	17.3	162.5	416.7	11.3	341.0	358.7	1050.0	206.3	0.0	206.3	277.0
	4	IIRRH-143	21.3	220.8	483.3	7.0	308.0	358.3	600.0	224.3	0.0	224.3	244.8
	5	IIRRH-148	20.3	187.5	483.3	11.3	385.0	346.0	716.7	218.7	0.0	218.7	258.8
	6	Sahabhagidhan	22.7	191.7	416.7	8.3	385.0	358.7	566.7	149.0	0.0	149.0	224.8
	7	US-312	17.3	200.0	400.0	8.7	286.0	366.7	783.3	215.3	0.0	215.3	249.3
	8	US-314	22.3	200.0	366.7	9.3	242.0	362.7	600.0	216.0	0.0	216.0	223.5
		T3 Mean	**19.5**	**196.9**	**427.1**	**9.5**	**327.3**	**359.8**	**827.1**	**203.2**	**0.0**	**203.2**	**257.4**
T4 (water stress)	1	27P63	15.7	170.8	366.7	6.7	374.0	319.7	1083.3	178.7	0.0	178.7	269.4
	2	DRR Dhan-48	14.0	187.5	383.3	8.0	308.0	347.0	1133.3	219.7	0.0	219.7	282.1
	3	HRI-174	14.3	187.5	333.3	8.0	352.0	355.7	1033.3	216.3	0.0	216.3	271.7
	4	IIRRH-143	20.0	208.3	400.0	5.7	308.0	329.0	550.0	226.3	0.0	226.3	227.4
	5	IIRRH-148	19.3	237.5	366.7	8.0	385.0	341.7	600.0	224.3	0.0	224.3	240.7
	6	Sahabhagidhan	21.3	187.5	350.0	4.7	385.0	344.0	583.3	193.0	0.0	193.0	226.2
	7	US-312	16.3	166.7	350.0	6.7	297.0	358.3	883.3	185.7	0.0	185.7	245.0
	8	US-314	20.3	175.0	350.0	7.0	264.0	341.7	550.0	192.7	0.0	192.7	209.3
		T4 Mean	**17.7**	**190.1**	**362.5**	**6.8**	**334.1**	**342.1**	**802.1**	**204.6**	**0.0**	**204.6**	**246.5**
		Grand Mean	**20.6**	**190.0**	**388.0**	**10.0**	**335.5**	**357.8**	**912.5**	**224.6**	**0.0**	**224.6**	**266.4**
		LSD (Silicon)			ns			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			55.2**			LSD (Location x Silicon x Variety)				93.4**	
		LSD (Variety)			ns			CV(Silicon) %				27	
		LSD (Location x Variety)			46.7**			CV(Residual) %				16.6	

Table: 6.1.8 Influence of Silica application Shoot weight (g/m2) at different locations Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	1037	808	2463	242	814	745	1507	526	728	526	939
	2	DRR Dhan-48	913	729	2428	334	911	740	1370	615	480	615	914
	3	HRI-174	1069	899	2693	388	872	684	1430	547	441	547	957
	4	IIRRH-143	1018	690	2200	267	916	742	1250	628	535	628	887
	5	IIRRH-148	1026	641	2780	413	785	640	1210	591	558	591	923
	6	Sahabhagidhan	919	626	1758	333	730	642	1407	546	587	546	809
	7	US-312	1284	857	2003	304	891	693	1693	761	538	761	979
	8	US-314	898	734	2703	338	784	538	1331	847	589	847	961
		T1 Mean	**1021**	**748**	**2379**	**327**	**838**	**678**	**1400**	**633**	**557**	**633**	**921**
T2 (0.08% Ortho silicic acid)	1	27P63	1049	650	3083	404	756	740	1840	634	726	634	1052
	2	DRR Dhan-48	940	756	2935	592	930	793	1463	782	537	782	1051
	3	HRI-174	1122	627	3170	654	889	659	1463	587	518	587	1028
	4	IIRRH-143	1049	612	2753	488	909	724	1110	793	621	793	985
	5	IIRRH-148	1088	663	3128	575	776	838	1368	877	615	877	1081
	6	Sahabhagidhan	974	633	2000	446	734	678	1460	616	654	616	881
	7	US-312	1336	767	2300	363	868	755	1478	1025	680	1025	1060
	8	US-314	925	634	3110	379	765	836	1351	744	602	744	1009
		T2 Mean	**1060**	**668**	**2810**	**488**	**828**	**753**	**1442**	**757**	**619**	**757**	**1018**
T3 (silicon+ water stress)	1	27P63	965	617	2767	238	803	816	1557	482	652	482	938
	2	DRR Dhan-48	831	565	2750	359	871	812	1710	485	444	485	931
	3	HRI-174	983	634	2953	313	893	783	1228	452	434	452	913
	4	IIRRH-143	917	801	2577	250	925	664	1357	541	568	541	914
	5	IIRRH-148	934	576	2923	375	755	869	1795	469	517	469	968
	6	Sahabhagidhan	836	688	1813	175	755	693	1143	513	538	513	767
	7	US-312	1194	813	2215	238	870	840	1618	639	459	639	952
	8	US-314	817	610	2927	271	788	776	1607	630	567	630	962
		T3 Mean	**935**	**663**	**2616**	**277**	**832**	**782**	**1502**	**526**	**523**	**526**	**918**
T4 (water stress)	1	27P63	897	573	1862	167	773	635	2013	467	529	467	838
	2	DRR Dhan-48	773	577	2135	192	891	740	1642	487	376	487	830
	3	HRI-174	914	668	2068	204	885	631	1752	445	421	445	843
	4	IIRRH-143	852	759	2343	213	906	669	1875	489	462	489	906
	5	IIRRH-148	869	782	2430	289	777	603	1615	431	472	431	870
	6	Sahabhagidhan	778	637	1662	63	758	474	843	472	526	472	668
	7	US-312	1111	722	1920	156	889	700	1843	615	419	615	899
	8	US-314	760	631	2570	108	773	552	1873	601	550	601	902
		T4 Mean	**869**	**669**	**2124**	**174**	**831**	**626**	**1682**	**501**	**469**	**501**	**845**
		Grand Mean	**971**	**687**	**2482**	**316**	**833**	**709**	**1506**	**604**	**542**	**604**	**926**
		LSD (Silicon)			25.7*			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			108.1**			LSD (Location x Silicon x Variety)				236.7**	
		LSD (Variety)			ns			CV(Silicon) %				15.2	
		LSD (Location x Variety)			118.3**			CV(Residual) %				12.1	

Table:6.1.9 Influence of Silica application onPanicle number/m2 atmaturity at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	300	380	253	233	407	279	450	165	320	165	295
	2	DRR Dhan-48	325	390	303	308	407	338	367	174	357	174	314
	3	HRI-174	350	377	271	258	418	308	350	164	335	164	299
	4	IIRRH-143	300	363	263	242	407	293	433	195	320	195	301
	5	IIRRH-148	350	333	298	275	429	269	417	145	327	145	299
	6	Sahabhagidhan	325	293	258	258	429	225	317	139	335	139	272
	7	US-312	350	393	263	333	407	258	333	141	322	141	294
	8	US-314	325	363	265	267	429	287	350	189	339	189	300
		T1 Mean	**328**	**362**	**272**	**272**	**417**	**282**	**377**	**164**	**332**	**164**	**297**
T2 (0.08% Ortho silicic acid)	1	27P63	344	323	313	308	396	275	417	234	326	234	317
	2	DRR Dhan-48	370	307	329	308	407	294	450	180	334	180	316
	3	HRI-174	420	283	302	342	407	329	350	214	341	214	320
	4	IIRRH-143	351	333	322	367	396	250	400	237	341	237	323
	5	IIRRH-148	401	363	333	383	418	267	417	173	359	173	329
	6	Sahabhagidhan	344	393	295	317	440	283	483	210	323	210	330
	7	US-312	398	370	299	367	396	261	417	201	336	201	324
	8	US-314	376	350	284	350	429	296	367	204	326	204	319
		T2 Mean	**376**	**340**	**310**	**343**	**411**	**282**	**413**	**207**	**336**	**207**	**322**
T3 (silicon+ water stress)	1	27P63	288	303	327	208	352	326	583	143	251	143	292
	2	DRR Dhan-48	306	307	304	192	352	332	767	157	312	157	319
	3	HRI-174	346	313	305	242	374	325	583	158	302	158	311
	4	IIRRH-143	286	400	335	183	374	287	650	170	291	170	315
	5	IIRRH-148	314	353	293	308	396	260	900	167	335	167	349
	6	Sahabhagidhan	298	393	272	167	407	264	983	115	251	115	326
	7	US-312	318	407	244	292	374	291	950	164	295	164	350
	8	US-314	309	403	239	283	407	274	1217	164	264	164	373
		T3 Mean	**308**	**360**	**290**	**234**	**380**	**295**	**829**	**155**	**288**	**155**	**329**
T4 (water stress)	1	27P63	271	263	239	175	341	317	700	135	238	135	281
	2	DRR Dhan-48	288	303	208	175	341	302	817	166	250	166	302
	3	HRI-174	326	327	210	133	363	321	533	164	259	164	280
	4	IIRRH-143	269	383	150	167	352	278	783	173	263	173	299
	5	IIRRH-148	295	407	229	183	396	285	933	169	281	169	335
	6	Sahabhagidhan	276	403	192	133	396	258	1033	145	248	145	323
	7	US-312	299	387	199	267	352	291	667	142	226	142	297
	8	US-314	291	410	191	217	396	256	850	152	231	152	315
		T4 Mean	**289**	**360**	**202**	**181**	**367**	**289**	**790**	**156**	**250**	**156**	**304**
		Grand Mean	**325**	**356**	**268**	**258**	**394**	**287**	**602**	**170**	**301**	**170**	**313**
		LSD (Silicon)			ns			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			58.3**			LSD (Location x Silicon x Variety)				100.6**	
		LSD (Variety)			ns			CV(Silicon) %				24.2	
		LSD (Location x Variety)			50.3**			CV(Residual) %				15.2	

Table: 6.1.10 Influence of Silica application on Panicle weight (g/m2) atmaturity at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	1013	991	887	608	0	864	973	509	833	509	719
	2	DRR Dhan-48	835	880	943	693	0	819	713	521	832	521	676
	3	HRI-174	1184	1018	897	975	0	946	670	554	863	554	766
	4	IIRRH-143	748	989	1117	577	0	772	693	502	865	502	677
	5	IIRRH-148	985	968	970	675	0	613	710	516	936	516	689
	6	Sahabhagidhan	840	876	922	325	0	687	727	449	826	449	610
	7	US-312	1085	1081	1023	623	0	947	910	561	904	561	770
	8	US-314	1294	998	1103	425	0	789	1003	584	917	584	770
		T1 Mean	**998**	**975**	**983**	**613**	**0**	**805**	**800**	**525**	**872**	**525**	**709**
T2 (0.08% Ortho silicic acid)	1	27P63	1021	952	1068	770	0	908	1413	550	866	550	810
	2	DRR Dhan-48	818	736	1140	768	0	966	1000	552	873	552	741
	3	HRI-174	1205	837	1052	1114	0	974	843	578	878	578	806
	4	IIRRH-143	762	968	1212	764	0	1013	754	528	905	528	743
	5	IIRRH-148	1003	932	900	918	0	946	1003	553	938	553	775
	6	Sahabhagidhan	849	1055	1025	516	0	785	1063	488	855	488	712
	7	US-312	1105	1022	1063	692	0	810	915	590	918	590	771
	8	US-314	1280	928	1127	566	0	991	897	625	901	625	794
		T2 Mean	**1005**	**929**	**1073**	**764**	**0**	**924**	**986**	**558**	**892**	**558**	**769**
T3 (silicon+ water stress)	1	27P63	895	906	908	431	0	937	219	404	810	404	591
	2	DRR Dhan-48	730	608	1038	295	0	965	550	422	673	422	570
	3	HRI-174	1046	889	1063	716	0	1028	187	399	715	399	644
	4	IIRRH-143	668	1091	1065	343	0	1172	223	370	727	370	603
	5	IIRRH-148	861	851	763	682	0	866	765	392	792	392	636
	6	Sahabhagidhan	765	994	913	333	0	856	443	402	729	402	584
	7	US-312	938	1018	1012	570	0	744	713	435	736	435	660
	8	US-314	1131	1097	1038	377	0	1046	582	422	709	422	682
		T3 Mean	**879**	**932**	**975**	**468**	**0**	**952**	**460**	**406**	**736**	**406**	**621**
T4 (water stress)	1	27P63	823	720	835	379	0	960	377	393	491	393	537
	2	DRR Dhan-48	672	613	903	266	0	698	585	406	667	406	522
	3	HRI-174	962	839	892	495	0	865	247	375	455	375	550
	4	IIRRH-143	615	1092	857	317	0	927	457	349	691	349	565
	5	IIRRH-148	792	967	735	587	0	589	613	362	696	362	570
	6	Sahabhagidhan	704	918	838	170	0	689	643	391	689	391	543
	7	US-312	863	939	980	268	0	670	353	366	701	366	551
	8	US-314	1041	1015	918	387	0	967	680	407	669	407	649
		T4 Mean	**809**	**888**	**870**	**359**	**0**	**796**	**494**	**381**	**633**	**381**	**561**
		Grand Mean	**923**	**931**	**975**	**551**	**0**	**869**	**685**	**467**	**783**	**467**	**665**
		LSD (Silicon)			31.4**			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			99.1**			LSD (Location x Silicon x Variety)				191.2**	
		LSD (Variety)			ns			CV(Silicon) %				19.4	
		LSD (Location x Variety)			95.6**			CV(Residual) %				13.6	

Table: 6.1.11 Influence of Silica application on Grain number/panicle at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	128	139	200	148	170	167	129	162	166	162	157
	2	DRR Dhan-48	77	127	179	121	162	182	99	136	161	136	138
	3	HRI-174	88	101	171	157	137	153	74	155	161	155	135
	4	IIRRH-143	96	111	114	139	107	181	135	148	167	148	134
	5	IIRRH-148	74	111	144	143	150	175	95	152	170	152	137
	6	Sahabhagidhan	106	109	110	92	147	130	90	134	155	134	121
	7	US-312	144	113	197	111	145	195	92	171	184	171	152
	8	US-314	121	111	183	99	139	162	145	150	189	150	145
		T1 Mean	**104**	**115**	**162**	**126**	**145**	**168**	**107**	**151**	**169**	**151**	**140**
T2 (0.08% Ortho silicic acid)	1	27P63	136	152	211	168	171	219	145	165	171	165	170
	2	DRR Dhan-48	91	137	173	169	164	216	150	136	176	136	155
	3	HRI-174	100	110	157	184	138	180	88	168	170	168	146
	4	IIRRH-143	111	112	137	162	108	250	103	156	175	156	147
	5	IIRRH-148	80	101	142	198	151	191	88	161	182	161	146
	6	Sahabhagidhan	112	98	140	116	151	162	76	135	169	135	129
	7	US-312	151	118	225	150	151	234	128	172	191	172	169
	8	US-314	130	106	238	107	141	233	118	161	199	161	159
		T2 Mean	**114**	**117**	**178**	**157**	**147**	**211**	**112**	**156**	**179**	**156**	**153**
T3 (silicon+ water stress)	1	27P63	109	154	215	128	164	244	33	160	160	160	153
	2	DRR Dhan-48	67	117	193	101	160	188	45	118	141	118	125
	3	HRI-174	73	106	157	124	133	162	26	149	141	149	122
	4	IIRRH-143	81	119	148	104	104	214	34	138	156	138	124
	5	IIRRH-148	63	90	128	103	146	161	25	139	162	139	116
	6	Sahabhagidhan	80	93	145	78	146	191	22	124	153	124	116
	7	US-312	122	104	168	99	149	211	25	158	171	158	137
	8	US-314	102	101	224	87	134	191	39	148	181	148	135
		T3 Mean	**87**	**111**	**172**	**103**	**142**	**195**	**31**	**142**	**158**	**142**	**128**
T4 (water stress)	1	27P63	97	147	195	72	159	175	38	146	152	146	132
	2	DRR Dhan-48	59	113	162	85	156	176	39	113	142	113	116
	3	HRI-174	65	98	189	100	131	155	28	144	139	144	119
	4	IIRRH-143	73	136	193	43	103	139	38	134	156	134	115
	5	IIRRH-148	56	93	163	80	145	161	25	116	154	116	111
	6	Sahabhagidhan	71	85	105	63	144	116	27	120	147	120	100
	7	US-312	109	103	179	100	147	144	22	138	165	138	125
	8	US-314	90	97	233	31	132	149	27	140	173	140	121
		T4 Mean	**78**	**109**	**177**	**72**	**140**	**152**	**31**	**131**	**154**	**131**	**117**
		Grand Mean	**96**	**113**	**172**	**114**	**143**	**181**	**70**	**145**	**165**	**145**	**135**
		LSD (Silicon)			4.17**			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			13.2**			LSD (Location x Silicon x Variety)				29.7**	
		LSD (Variety)			4.7**			CV(Silicon) %				12.8	
		LSD (Location x Variety)			14.9**			CV(Residual) %				10.5	

Table: 6.1.12 Influence of Silica application on Spikelet number/panicle at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	179	170	67	168	179	257	161	182	175	182	172
	2	DRR Dhan-48	157	151	30	156	168	201	128	150	168	150	146
	3	HRI-174	117	136	36	177	143	191	94	163	167	163	139
	4	IIRRH-143	131	156	52	164	112	282	168	161	176	161	156
	5	IIRRH-148	109	153	49	170	156	217	119	167	180	167	149
	6	Sahabhagidhan	129	128	40	145	151	145	127	138	171	138	131
	7	US-312	189	149	25	148	151	228	130	187	193	187	159
	8	US-314	162	142	34	118	143	200	172	162	198	162	149
		T1 Mean	**147**	**148**	**42**	**156**	**150**	**215**	**137**	**164**	**179**	**164**	**150**
T2 (0.08% Ortho silicic acid)	1	27P63	183	186	53	180	180	251	160	187	176	187	174
	2	DRR Dhan-48	152	175	36	194	170	238	169	155	181	155	163
	3	HRI-174	127	150	38	209	145	211	142	181	174	181	156
	4	IIRRH-143	147	164	65	191	113	331	128	174	183	174	167
	5	IIRRH-148	120	135	40	230	158	213	150	178	187	178	159
	6	Sahabhagidhan	149	121	30	128	155	185	111	142	176	142	134
	7	US-312	204	136	49	191	156	264	138	188	198	188	171
	8	US-314	181	129	51	128	145	278	162	174	205	174	163
		T2 Mean	**158**	**150**	**46**	**181**	**153**	**246**	**145**	**173**	**185**	**173**	**161**
T3 (silicon+ water stress)	1	27P63	166	194	53	162	176	333	66	183	172	183	169
	2	DRR Dhan-48	143	139	41	115	168	240	80	148	155	148	138
	3	HRI-174	108	140	49	149	143	195	57	180	151	180	135
	4	IIRRH-143	120	162	46	128	115	283	45	169	171	169	141
	5	IIRRH-148	101	142	50	130	157	208	62	168	175	168	136
	6	Sahabhagidhan	124	113	41	92	154	201	39	139	164	139	121
	7	US-312	177	132	47	126	160	237	51	184	181	184	148
	8	US-314	148	143	36	113	142	215	61	162	190	162	137
		T3 Mean	**136**	**145**	**45**	**127**	**152**	**239**	**58**	**167**	**170**	**167**	**141**
T4 (water stress)	1	27P63	151	180	48	100	173	318	78	170	167	170	155
	2	DRR Dhan-48	130	131	22	126	167	226	68	139	159	139	131
	3	HRI-174	98	133	24	149	141	195	50	168	155	168	128
	4	IIRRH-143	110	202	64	69	115	286	73	161	170	161	141
	5	IIRRH-148	92	126	40	97	157	208	57	154	172	154	126
	6	Sahabhagidhan	112	101	18	96	153	134	43	128	162	128	107
	7	US-312	161	137	38	130	159	171	39	160	179	160	133
	8	US-314	134	134	45	58	141	167	49	152	188	152	122
		T4 Mean	**124**	**143**	**37**	**103**	**151**	**213**	**57**	**154**	**169**	**154**	**131**
		Grand Mean	**141**	**147**	**42**	**142**	**151**	**228**	**99**	**164**	**176**	**164**	**146**
		LSD (Silicon)			4.02**			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			12.7**			LSD (Location x Silicon x Variety)				32.2**	
		LSD (Variety)			5.08**			CV(Silicon) %				11.4	
		LSD (Location x Variety)			16.1**			CV(Residual) %				10.5	

Table: 6.1.13 Influence of Silica application on Grain number/m2 at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	37632	51671	80053	3692	69289	46546	60350	26731	52087	26731	45478
	2	DRR Dhan-48	25799	49122	56950	3017	65780	61462	35500	23662	56926	23662	40188
	3	HRI-174	30870	38034	62617	3917	57200	47280	25450	25354	52416	25354	36849
	4	IIRRH-143	31164	40061	51420	3483	43362	52944	59200	28819	51953	28819	39122
	5	IIRRH-148	30821	36600	53080	3583	64493	46937	38723	21960	54477	21960	37263
	6	Sahabhagidhan	31458	32041	45930	2292	63206	29271	28500	18617	50628	18617	32056
	7	US-312	49392	44262	81603	2775	59048	50243	23500	24056	58252	24056	41719
	8	US-314	33443	40057	64167	2475	59774	46400	52200	28237	62482	28237	41747
		T1 Mean	**33822**	**41481**	**61978**	**3154**	**60269**	**47635**	**40428**	**24679**	**54903**	**24679**	**39303**
T2 (0.08% Ortho silicic acid)	1	27P63	39514	48723	80833	4208	67848	60098	63867	38578	55197	38578	49744
	2	DRR Dhan-48	26572	42189	63527	4233	66704	63321	72383	24350	57720	24350	44535
	3	HRI-174	32722	31093	57343	4592	56034	59364	27400	35821	56572	35821	39676
	4	IIRRH-143	32411	37295	61800	4058	42636	62325	41217	36886	58856	36886	41437
	5	IIRRH-148	32670	36699	51833	4942	63272	51014	37000	27923	64332	27923	39761
	6	Sahabhagidhan	32087	37604	47027	2900	66451	45900	34333	28275	53091	28275	37594
	7	US-312	51862	43457	82143	3742	59664	61129	55350	34412	63198	34412	48937
	8	US-314	35449	36763	91047	2667	60489	68833	43467	32758	63326	32758	46756
		T2 Mean	**35411**	**39228**	**66944**	**3918**	**60387**	**58998**	**46877**	**32375**	**59037**	**32375**	**43555**
T3 (silicon+ water stress)	1	27P63	33869	46315	86053	3192	57607	79508	18900	22879	39333	22879	41053
	2	DRR Dhan-48	23735	35895	86850	2525	56199	62437	34467	18491	43148	18491	38224
	3	HRI-174	28092	33165	65557	3100	49830	52494	16250	23546	41923	23546	33750
	4	IIRRH-143	28359	46843	71743	2592	39017	61491	22000	23529	44410	23529	36351
	5	IIRRH-148	28355	31913	61547	2583	57871	41749	22700	23154	53783	23154	34681
	6	Sahabhagidhan	28941	36570	60383	1942	59301	50493	20667	14264	37686	14264	32451
	7	US-312	45441	41984	67067	2483	55759	61345	24200	25908	49849	25908	39994
	8	US-314	30433	40087	81917	2175	54626	52339	22483	24255	46514	24255	37908
		T3 Mean	**30903**	**39096**	**72640**	**2574**	**53776**	**57732**	**22708**	**22003**	**44581**	**22003**	**36802**
T4 (water stress)	1	27P63	30821	38306	70800	1792	54263	55212	25967	19643	35383	19643	35183
	2	DRR Dhan-48	21599	33926	61933	2117	53064	53152	31467	18689	34730	18689	32937
	3	HRI-174	25563	31926	63667	2500	47553	49558	15433	23655	34992	23655	31850
	4	IIRRH-143	25807	51857	77333	1067	36388	38667	32667	23110	39748	23110	34975
	5	IIRRH-148	25803	37329	59633	2000	57288	45983	23633	19498	42802	19498	33347
	6	Sahabhagidhan	26337	34301	36633	1583	57024	29980	28483	17393	35660	17393	28479
	7	US-312	41351	39243	62650	2508	51854	41850	15500	19617	36458	19617	33065
	8	US-314	27694	39439	81667	767	52404	38229	22500	21061	39486	21061	34431
		T4 Mean	**28122**	**38291**	**64290**	**1792**	**51230**	**44079**	**24456**	**20333**	**37407**	**20333**	**33033**
		Grand Mean	**32064**	**39524**	**66463**	**2859**	**56416**	**52111**	**33617**	**24848**	**48982**	**24848**	**38173**
		LSD (Silicon)			1887.1**			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			5967.4**			LSD (Location x Silicon x Variety)				14972.3**	
		LSD (Variety)			2367.3**			CV(Silicon) %				20.3	
		LSD (Location x Variety)			7486.2**			CV(Residual) %				18.6	

Table: 6.1.14 Influence of Silica application on Spikelet number/m2 at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	50274	63408	26800	4208	72677	71718	75467	29844	55110	29844	47935
	2	DRR Dhan-48	41405	58448	9530	3908	68211	68075	45833	26196	59661	26196	40746
	3	HRI-174	37485	51270	13070	4417	59686	59003	32800	26531	54313	26531	36511
	4	IIRRH-143	36750	56633	23400	4108	45529	82773	72117	31496	54811	31496	43911
	5	IIRRH-148	35672	50052	18083	4242	66781	58267	53667	24096	57929	24096	39288
	6	Sahabhagidhan	36162	37480	16830	3617	64922	32688	39717	19409	55778	19409	32601
	7	US-312	63112	58295	10377	3708	61479	58989	43867	26293	61309	26293	41372
	8	US-314	49368	51815	11877	2958	61490	57576	62617	30534	65628	30534	42440
		T1 Mean	**43778**	**53425**	**16246**	**3896**	**62597**	**61136**	**53260**	**26800**	**58067**	**26800**	**40601**
T2 (0.08% Ortho silicic acid)	1	27P63	51782	59621	20403	4492	71148	69095	68883	43818	56930	43818	48999
	2	DRR Dhan-48	42647	53659	13180	4858	69168	69906	83133	27685	59375	27685	45130
	3	HRI-174	39359	42555	13973	5217	59125	69370	49550	38793	57878	38793	41461
	4	IIRRH-143	38220	54669	29280	4783	44880	82651	50850	41396	61621	41396	44975
	5	IIRRH-148	36742	49057	14700	5758	65934	56693	61800	30741	66152	30741	41832
	6	Sahabhagidhan	37970	46425	9957	3192	68211	52288	53350	30034	55306	30034	38677
	7	US-312	66268	50377	18023	4767	61644	69063	59200	37742	65488	37742	47031
	8	US-314	51342	44771	19483	3192	62205	81961	59683	35294	65206	35294	45843
		T2 Mean	**45541**	**50142**	**17375**	**4532**	**62789**	**68878**	**60806**	**35688**	**60995**	**35688**	**44243**
T3 (silicon+ water stress)	1	27P63	45749	58245	21093	4058	61842	108426	37783	26318	42394	26318	43223
	2	DRR Dhan-48	37265	42612	18600	2883	59026	79560	60733	23219	47364	23219	39448
	3	HRI-174	34486	43682	20497	3733	53581	63372	34417	28476	45011	28476	35573
	4	IIRRH-143	33810	64886	22497	3200	42999	81379	28733	28781	48758	28781	38382
	5	IIRRH-148	32818	49857	24300	3258	62106	54080	56250	28141	57505	28141	39646
	6	Sahabhagidhan	33269	44217	17100	2308	62557	52999	38167	16077	40584	16077	32335
	7	US-312	58063	53332	18773	3142	59741	68942	48883	30277	52724	30277	42415
	8	US-314	44924	56979	13083	2825	57882	58882	42983	26719	48835	26719	37983
		T3 Mean	**40048**	**51726**	**19493**	**3176**	**57467**	**70955**	**43494**	**26001**	**47897**	**26001**	**38626**
T4 (water stress)	1	27P63	42089	46581	17333	2492	59037	103615	54400	22945	38838	22945	41028
	2	DRR Dhan-48	34283	39667	8450	3142	56925	68313	55317	23296	38842	23296	35153
	3	HRI-174	31727	43446	8300	3733	51183	62325	26683	27722	39043	27722	32189
	4	IIRRH-143	31105	76767	25733	1733	40612	79305	60033	27950	43346	27950	41454
	5	IIRRH-148	30193	50750	14500	2433	62172	59158	53583	26175	47547	26175	37269
	6	Sahabhagidhan	30608	40666	6183	2400	60588	34664	45100	18654	39187	18654	29670
	7	US-312	53418	52522	13183	3258	55836	49872	26767	22727	39561	22727	33987
	8	US-314	41330	54709	15633	1458	55968	42839	41617	23312	42920	23312	34310
		T4 Mean	**36844**	**50639**	**13665**	**2581**	**55290**	**62512**	**45438**	**24098**	**41161**	**24098**	**35632**
		Grand Mean	**41553**	**51483**	**16695**	**3546**	**59536**	**65870**	**50749**	**28147**	**52030**	**28147**	**39776**
		LSD (Silicon)			2733.3**			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			8643.5**			LSD (Location x Silicon x Variety)				16397.8**	
		LSD (Variety)			2592.7**			CV(Silicon) %				28.3	
		LSD (Location x Variety)			8198.9**			CV(Residual) %				19.5	

Table: 6.1.15 Influence of Silica application on 1000 grain weight (g) at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	17.1	17.6	16.9	25.0	17.4	15.0	31.3	17.0	16.9	17.0	19.1
	2	DRR Dhan-48	18.2	15.9	17.0	18.3	14.2	16.6	30.0	14.5	18.3	14.5	17.8
	3	HRI-174	25.6	23.8	24.7	30.0	23.1	24.4	36.0	20.0	24.0	20.0	25.2
	4	IIRRH-143	23.3	21.3	21.9	21.7	18.7	20.8	28.8	20.0	23.6	20.0	22.0
	5	IIRRH-148	22.6	23.1	23.0	21.7	16.1	22.1	38.0	21.5	18.9	21.5	22.8
	6	Sahabhagidhan	24.7	24.6	22.9	18.3	22.2	22.9	34.0	23.5	23.7	23.5	24.0
	7	US-312	16.2	21.3	20.7	21.7	20.1	20.0	32.7	20.0	20.1	20.0	21.3
	8	US-314	28.1	22.0	22.9	20.0	21.2	21.7	32.7	18.5	22.8	18.5	22.8
		T1 Mean	**22.0**	**21.2**	**21.3**	**22.1**	**19.1**	**20.4**	**32.9**	**19.4**	**21.0**	**19.4**	**21.9**
T2 (0.08% Ortho silicic acid)	1	27P63	17.3	17.2	18.1	30.0	17.5	16.6	30.7	19.0	17.4	19.0	20.3
	2	DRR Dhan-48	18.2	15.6	18.0	26.7	14.3	16.0	31.3	16.0	20.1	16.0	19.2
	3	HRI-174	25.8	23.7	24.8	35.0	23.2	24.1	36.7	23.0	24.9	23.0	26.4
	4	IIRRH-143	23.4	21.3	22.9	28.3	18.6	20.8	35.3	20.5	23.9	20.5	23.6
	5	IIRRH-148	22.9	22.5	23.6	35.0	16.0	22.4	36.7	22.5	19.2	22.5	24.3
	6	Sahabhagidhan	24.8	23.4	23.1	21.7	22.5	22.4	35.3	23.5	23.8	23.5	24.4
	7	US-312	16.3	21.2	21.0	26.7	20.2	19.8	32.7	22.0	21.7	22.0	22.4
	8	US-314	28.3	22.3	22.9	25.0	21.4	23.2	34.7	22.5	23.6	22.5	24.6
		T2 Mean	**22.1**	**20.9**	**21.8**	**28.5**	**19.2**	**20.7**	**34.2**	**21.1**	**21.8**	**21.1**	**23.1**
T3 (silicon+ water stress)	1	27P63	15.5	17.1	18.6	16.7	17.2	16.2	19.3	15.5	15.9	15.5	16.8
	2	DRR Dhan-48	16.8	15.0	17.9	16.7	14.1	16.9	18.0	15.5	19.2	15.5	16.6
	3	HRI-174	23.5	23.8	23.6	20.0	22.9	24.5	24.0	20.5	22.6	20.5	22.6
	4	IIRRH-143	21.4	20.5	22.5	15.0	18.5	20.6	16.7	19.0	22.3	19.0	19.5
	5	IIRRH-148	20.8	22.6	23.9	13.3	15.8	21.9	26.0	19.5	17.6	19.5	20.1
	6	Sahabhagidhan	22.7	23.4	22.5	18.3	22.0	22.3	22.0	18.0	18.2	18.0	20.7
	7	US-312	14.9	21.3	21.0	16.7	19.9	20.4	20.7	17.5	19.3	17.5	18.9
	8	US-314	25.9	22.2	22.9	16.7	21.1	23.2	20.7	21.0	23.9	21.0	21.8
		T3 Mean	**20.2**	**20.8**	**21.6**	**16.7**	**18.9**	**20.7**	**20.9**	**18.3**	**19.9**	**18.3**	**19.6**
T4 (water stress)	1	27P63	14.2	16.9	17.4	15.0	17.0	16.6	18.7	17.0	14.6	17.0	16.5
	2	DRR Dhan-48	15.4	15.4	16.9	13.3	13.9	14.5	19.3	13.0	16.8	13.0	15.2
	3	HRI-174	21.6	23.1	23.3	15.0	22.8	23.3	24.7	20.0	21.8	20.0	21.5
	4	IIRRH-143	19.7	18.1	20.3	11.7	18.3	21.1	23.3	21.5	22.8	21.5	19.8
	5	IIRRH-148	19.1	22.9	22.8	13.3	15.5	20.8	24.7	17.0	17.3	17.0	19.0
	6	Sahabhagidhan	20.9	23.4	22.0	16.7	21.9	24.5	23.3	19.5	17.2	19.5	20.9
	7	US-312	13.7	21.0	20.0	15.0	19.8	20.9	20.7	17.0	19.6	17.0	18.5
	8	US-314	23.8	21.6	21.6	15.0	20.7	22.3	22.7	19.5	19.5	19.5	20.6
		T4 Mean	**18.6**	**20.3**	**20.5**	**14.4**	**18.7**	**20.5**	**22.2**	**18.1**	**18.7**	**18.1**	**19.0**
		Grand Mean	**20.7**	**20.8**	**21.3**	**20.4**	**19.0**	**20.6**	**27.5**	**19.2**	**20.4**	**19.2**	**20.9**
		LSD (Silicon)			0.43**			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			1.36**			LSD (Location x Silicon x Variety)				4.51**	
		LSD (Variety)			0.71**			CV(Silicon) %				8.47	
		LSD (Location x Variety)			2.25**			CV(Residual) %				10.21	

Table: 6.1.16 Influence of Silica application on total dry matter (g/m2) of maturity at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	1362	1799	1243	1309	1347	1864	2480	985	1975	985	1535
	2	DRR Dhan-48	1161	1609	1083	1248	1517	1937	2083	1089	1699	1089	1451
	3	HRI-174	1333	1917	1400	1313	1488	1957	2100	1050	1634	1050	1524
	4	IIRRH-143	1313	1678	1148	1265	1496	1816	1943	1084	1780	1084	1461
	5	IIRRH-148	1348	1609	1170	1311	1296	1731	1920	1063	1808	1063	1432
	6	Sahabhagidhan	1284	1502	1179	634	1363	1821	2133	952	1742	952	1356
	7	US-312	1161	1938	1327	1125	1406	1969	2603	1274	1819	1274	1590
	8	US-314	1186	1731	1267	1225	1360	1629	2335	1379	1917	1379	1541
		T1 Mean	**1268**	**1723**	**1227**	**1179**	**1409**	**1840**	**2200**	**1109**	**1797**	**1109**	**1486**
T2 (0.08% Ortho silicic acid)	1	27P63	1403	1602	1257	1506	1287	1989	3253	1134	2025	1134	1659
	2	DRR Dhan-48	1196	1492	1169	1651	1534	2046	2463	1283	1802	1283	1592
	3	HRI-174	1386	1465	1337	1527	1503	1895	2307	1113	1778	1113	1542
	4	IIRRH-143	1326	1580	1204	1416	1492	1956	1864	1268	1932	1268	1531
	5	IIRRH-148	1401	1594	1281	1550	1285	1648	2372	1379	1914	1379	1580
	6	Sahabhagidhan	1335	1688	1250	662	1380	1691	2523	1059	1860	1059	1451
	7	US-312	1231	1789	1412	1583	1378	1879	2393	1565	2002	1565	1680
	8	US-314	1221	1562	1549	1312	1344	1836	2248	1312	1958	1312	1565
		T2 Mean	**1313**	**1597**	**1308**	**1401**	**1400**	**1867**	**2428**	**1264**	**1909**	**1264**	**1575**
T3 (silicon+ water stress)	1	27P63	1242	1522	1212	1312	1329	2025	1776	847	1794	847	1391
	2	DRR Dhan-48	1045	1173	1180	1235	1473	1976	2260	867	1447	867	1352
	3	HRI-174	1226	1523	1321	1134	1503	2099	1415	816	1433	816	1328
	4	IIRRH-143	1208	1892	1280	1105	1499	2076	1580	877	1692	877	1408
	5	IIRRH-148	1240	1427	1220	1095	1248	1950	2560	823	1631	823	1402
	6	Sahabhagidhan	1155	1682	1180	512	1385	1756	1587	881	1593	881	1261
	7	US-312	1057	1830	1363	1346	1375	1990	2332	1039	1583	1039	1495
	8	US-314	1091	1707	1460	893	1353	2019	2188	1015	1634	1015	1437
		T3 Mean	**1158**	**1595**	**1277**	**1079**	**1396**	**1986**	**1962**	**896**	**1601**	**896**	**1384**
T4 (water stress)	1	27P63	1168	1293	1095	1052	1288	2167	2390	823	1581	823	1368
	2	DRR Dhan-48	982	1190	1143	946	1478	1732	2227	855	1345	855	1275
	3	HRI-174	1153	1507	1178	797	1485	2070	1998	787	1399	787	1316
	4	IIRRH-143	1136	1851	1138	409	1467	1864	2332	805	1501	805	1331
	5	IIRRH-148	1165	1749	1075	520	1251	1622	2228	759	1462	759	1259
	6	Sahabhagidhan	1086	1555	1088	240	1383	1672	1487	825	1543	825	1170
	7	US-312	993	1661	1148	1146	1385	2064	2197	950	1465	950	1396
	8	US-314	1025	1647	1167	654	1322	1895	2553	971	1583	971	1379
		T4 Mean	**1089**	**1557**	**1129**	**720**	**1383**	**1886**	**2176**	**847**	**1485**	**847**	**1312**
		Grand Mean	**1207**	**1618**	**1235**	**1095**	**1397**	**1895**	**2192**	**1029**	**1698**	**1029**	**1439**
		LSD (Silicon)				49.6**		LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)				156.9**		LSD (Location x Silicon x Variety)				358.4**	
		LSD (Variety)				43.1*		CV(Silicon) %				14.2	
		LSD (Location x Variety)				179.2**		CV(Residual) %				11.8	

Table: 6.1.17 Influence of Silica application on Grain yield (g/m2) at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	470	908	525	459	533	680	693	452	752	452	592
	2	DRR Dhan-48	426	780	509	390	606	577	658	466	731	466	561
	3	HRI-174	564	905	578	476	617	768	612	494	730	494	624
	4	IIRRH-143	609	854	512	353	580	620	509	450	762	450	570
	5	IIRRH-148	487	845	526	331	511	666	717	463	781	463	579
	6	Sahabhagidhan	476	786	502	251	633	561	526	399	680	399	521
	7	US-312	470	943	610	420	515	731	655	502	785	502	613
	8	US-314	598	880	613	422	576	655	686	522	793	522	627
		T1 Mean	**513**	**863**	**547**	**388**	**571**	**657**	**632**	**468**	**752**	**468**	**586**
T2 (0.08% Ortho silicic acid)	1	27P63	487	839	575	664	531	715	1048	491	761	491	660
	2	DRR Dhan-48	436	654	555	522	604	618	1051	492	761	492	618
	3	HRI-174	580	736	626	577	613	744	420	516	766	516	609
	4	IIRRH-143	625	793	569	445	583	726	421	469	797	469	590
	5	IIRRH-148	501	824	587	506	509	588	794	493	791	493	608
	6	Sahabhagidhan	481	881	546	287	646	448	832	436	703	436	570
	7	US-312	487	922	666	607	511	717	748	528	799	528	651
	8	US-314	612	820	724	463	579	491	638	557	787	557	623
		T2 Mean	**526**	**809**	**606**	**509**	**572**	**631**	**744**	**497**	**771**	**497**	**616**
T3 (silicon+ water stress)	1	27P63	426	794	546	355	526	695	144	360	649	360	485
	2	DRR Dhan-48	382	540	537	362	603	635	223	376	539	376	457
	3	HRI-174	515	790	597	363	610	760	112	357	550	357	501
	4	IIRRH-143	548	957	572	314	574	593	183	330	652	330	505
	5	IIRRH-148	454	719	565	247	493	570	329	350	644	350	472
	6	Sahabhagidhan	426	857	531	155	630	540	427	361	591	361	488
	7	US-312	437	894	629	398	505	681	236	390	632	390	519
	8	US-314	556	890	688	312	565	537	357	377	539	377	520
		T3 Mean	**468**	**805**	**583**	**313**	**563**	**626**	**251**	**363**	**599**	**363**	**493**
T4 (water stress)	1	27P63	401	646	491	295	516	672	65	351	575	351	436
	2	DRR Dhan-48	359	524	516	291	588	534	216	363	521	363	427
	3	HRI-174	484	736	550	279	600	735	95	335	536	335	468
	4	IIRRH-143	515	938	536	176	561	639	176	312	590	312	475
	5	IIRRH-148	427	854	519	227	474	521	221	323	538	323	443
	6	Sahabhagidhan	401	802	509	111	625	471	295	347	555	347	446
	7	US-312	411	825	571	274	496	603	176	326	573	326	458
	8	US-314	522	852	587	181	549	474	291	363	522	363	470
		T4 Mean	**440**	**772**	**535**	**229**	**551**	**581**	**192**	**340**	**551**	**340**	**453**
		Grand Mean	**487**	**812**	**568**	**360**	**564**	**624**	**455**	**417**	**668**	**417**	**537**
		LSD (Silicon)				15.28**		LSD (Silicon x Variety)				26.63*	
		LSD (Location x Silicon)				48.33**		LSD (Location x Silicon x Variety)				110.8**	
		LSD (Variety)				ns		CV(Silicon) %				11.7	
		LSD (Location x Variety)				55.41**		CV(Residual) %				9.77	

Table: 6.1.18 Influence of Silica application on Harvest Index (%)at different locations in Kharif 2021

Treat	S.No.	Genotypes	CBT	IIRR	KJT	KRK	MTU	PNR	PTB	Ranchi	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	31.3	50.6	42.2	35.1	39.6	36.5	27.5	45.8	38.1	45.8	39.3
	2	DRR Dhan-48	32.3	48.4	47.1	31.3	39.9	29.8	32.5	42.7	43.0	42.7	39.0
	3	HRI-174	37.4	47.2	41.3	36.2	41.4	39.3	29.2	46.9	44.7	46.9	41.0
	4	IIRRH-143	41.4	50.9	44.6	27.7	38.7	34.1	26.3	41.5	42.7	41.5	39.0
	5	IIRRH-148	32.3	52.6	45.0	25.3	39.4	38.5	38.5	43.4	43.2	43.4	40.2
	6	Sahabhagidhan	32.3	52.4	42.6	44.6	46.4	30.8	24.5	41.9	39.0	41.9	39.7
	7	US-312	35.4	48.6	46.0	41.0	36.6	37.2	24.9	39.4	43.1	39.4	39.2
	8	US-314	44.4	50.8	48.4	34.4	42.3	40.2	30.2	37.8	41.4	37.8	40.8
		T1 Mean	**35.9**	**50.2**	**44.6**	**34.5**	**40.5**	**35.8**	**29.2**	**42.4**	**41.9**	**42.4**	**39.7**
T2 (0.08% Ortho silicic acid)	1	27P63	31.3	52.3	45.7	43.8	41.3	35.9	32.4	43.3	37.6	43.3	40.7
	2	DRR Dhan-48	32.3	43.9	47.5	31.7	39.3	30.2	50.7	38.2	42.2	38.2	39.4
	3	HRI-174	37.4	50.2	46.8	38.1	40.8	39.2	17.9	46.2	43.1	46.2	40.6
	4	IIRRH-143	41.4	50.2	47.3	31.4	39.1	37.2	23.5	36.9	41.2	36.9	38.5
	5	IIRRH-148	31.3	51.6	45.8	32.7	39.6	35.7	33.3	35.6	41.3	35.6	38.3
	6	Sahabhagidhan	31.3	52.2	43.7	45.3	46.8	26.5	33.3	41.0	37.8	41.0	39.9
	7	US-312	35.4	51.6	47.2	39.2	37.0	38.2	31.8	33.7	39.9	33.7	38.8
	8	US-314	44.4	52.5	46.7	35.2	43.1	27.1	27.9	42.5	40.1	42.5	40.2
		T2 Mean	**35.6**	**50.6**	**46.4**	**37.2**	**40.9**	**33.8**	**31.4**	**39.7**	**40.4**	**39.7**	**39.5**
T3 (silicon+ water stress)	1	27P63	30.3	52.1	45.1	27.5	39.6	34.3	8.4	42.5	36.1	42.5	35.9
	2	DRR Dhan-48	31.3	46.0	45.5	29.3	40.9	32.2	9.8	43.4	37.3	43.4	35.9
	3	HRI-174	36.4	51.9	45.2	32.0	40.6	36.2	8.4	43.7	38.4	43.7	37.6
	4	IIRRH-143	40.4	50.7	44.7	28.9	38.3	28.6	11.7	37.6	38.5	37.6	35.7
	5	IIRRH-148	32.7	50.4	46.3	22.2	39.5	29.3	12.9	42.5	39.5	42.5	35.8
	6	Sahabhagidhan	32.3	51.0	45.0	30.4	45.5	30.8	27.5	41.0	37.1	41.0	38.1
	7	US-312	37.4	48.9	46.2	32.6	36.7	34.2	10.1	37.5	39.9	37.5	36.1
	8	US-314	44.4	52.1	47.1	35.8	41.7	26.6	16.6	37.1	33.0	37.1	37.2
		T3 Mean	**35.7**	**50.4**	**45.6**	**29.8**	**40.3**	**31.5**	**13.2**	**40.7**	**37.5**	**40.7**	**36.5**
T4 (water stress)	1	27P63	30.3	50.1	44.8	28.4	40.0	31.0	2.8	42.7	36.4	42.7	34.9
	2	DRR Dhan-48	32.3	44.1	45.2	30.5	39.7	30.9	9.8	42.4	38.7	42.4	35.6
	3	HRI-174	36.4	48.8	46.7	48.8	40.4	35.6	4.8	42.5	38.3	42.5	38.5
	4	IIRRH-143	40.4	50.5	47.1	48.1	38.2	34.3	9.4	38.7	39.3	38.7	38.5
	5	IIRRH-148	32.3	48.8	48.3	52.8	37.9	32.1	10.1	42.6	36.8	42.6	38.4
	6	Sahabhagidhan	32.3	51.6	46.8	47.8	45.2	28.2	19.5	42.0	35.9	42.0	39.1
	7	US-312	36.4	49.7	49.7	23.8	35.8	29.2	8.4	34.1	39.1	34.1	34.0
	8	US-314	45.5	51.7	50.3	29.5	41.5	25.1	12.3	37.3	33.0	37.3	36.3
		T4 Mean	**35.7**	**49.4**	**47.4**	**38.7**	**39.8**	**30.8**	**9.6**	**40.3**	**37.2**	**40.3**	**36.9**
		Grand Mean	**35.7**	**50.1**	**46.0**	**35.0**	**40.4**	**33.0**	**20.8**	**40.8**	**39.2**	**40.8**	**38.2**
		LSD (Silicon)			ns			LSD (Silicon x Variety)				ns	
		LSD (Location x Silicon)			5.68**			LSD (Location x Silicon x Variety)				11.0**	
		LSD (Variety)			ns			CV(Silicon) %				19.3	
		LSD (Location x Variety)			5.5**			CV(Residual) %				13.6	

6.2.1 Screening of elite rice cultures for drought tolerance:

Locations: NRRI, RANCHI, RPR, PTB AND REWA (kharif-2021), TTB (Rabi2021)

Rainfed areas account for nearly 57 per cent of the agricultural land in India. These areas assume special significance in terms of ecology, agricultural productivity and livelihoods for millions. With proper management, rainfed areas have the potential of contributing a larger share to food grain production. In-fact the potential is such that there is more opportunity for faster agricultural growth here than in irrigated areas. About 61 per cent of India's farmers rely on rain-fed agriculture and 55 per cent of the gross cropped area is under rain-fed farming. Drought is becoming an increasing problem because of water scarcity resulting from rising demand for water for competing uses. Drought imposes a serious economic burden on society and has been historically associated with food shortages of varying intensities, including those that have resulted in major famines in different parts of Asia and Africa.

Identification of suitable rice cultures for rainfed conditions is one of the research area of Plant Physiology group under AICRIP. A trial to study the drought tolerance traits of rice cultures with respect to yield and other attributes under dry spells was conducted with 36 introgression lines derived from multi-parent inter-crosses in the background of Krishna Hamsa (S.No 1 to 14) and WGL14 (S.No 15 to 34) . These ILs were developed as part of DBT funded project on "Marker assisted introgression of different traits to develop new generation rice varieties". The seeds were obtained from Dr.Jyothi Badri, Plant Breeder & PI of the project (Appendix-II).

The treatments consisted of two irrigation regimes (a) Irrigated as per the recommended schedule and (b) totally rain fed condition without any supplementary irrigation. The data was analyzed as Factorial RCBD with irrigation regimes as first factor and genotypes as second factor. At TTB centre the trial was conducted during Rabi (dry) season with 26 advanced breeding lines taken from AVT-1E-DS set of 2020. Analysis of rainfall data indicated that at PTB centre the crop received total of 515 mm rainfall from sowing to physiological maturity with 31 rainy days. During vegetative period the crop received 363.1 mm rain with 21 rainy days (Fig.6.2.1.1) and during the period from flowering to maturity the crop received 152 mm rain with 6 rainy days. The crop was exposed to dry spell during late grain filling stage.

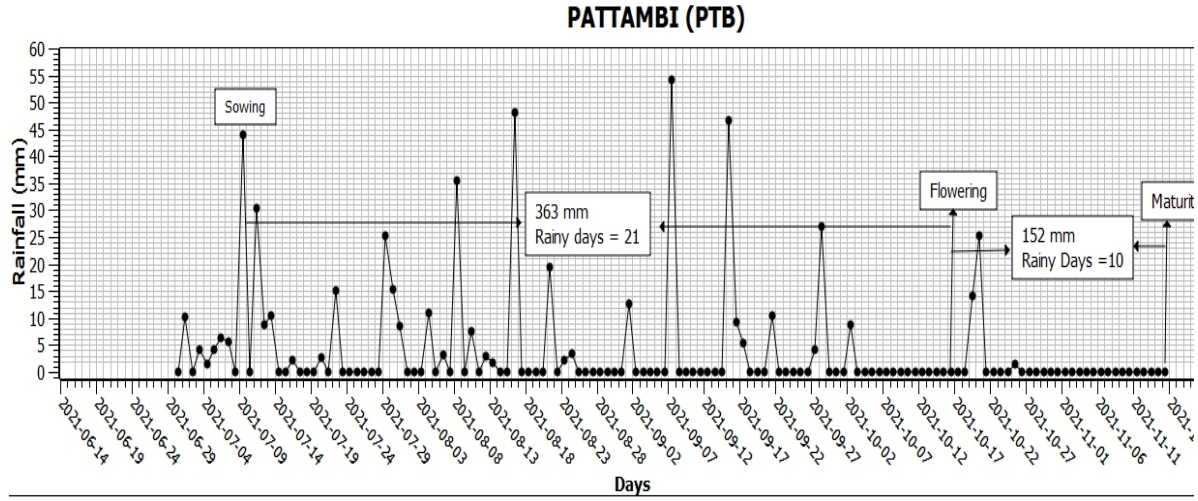


Fig.6.2.1.1: Distribution of rain during crop season (sowing to maturity) at PTB centre during kharif-2019

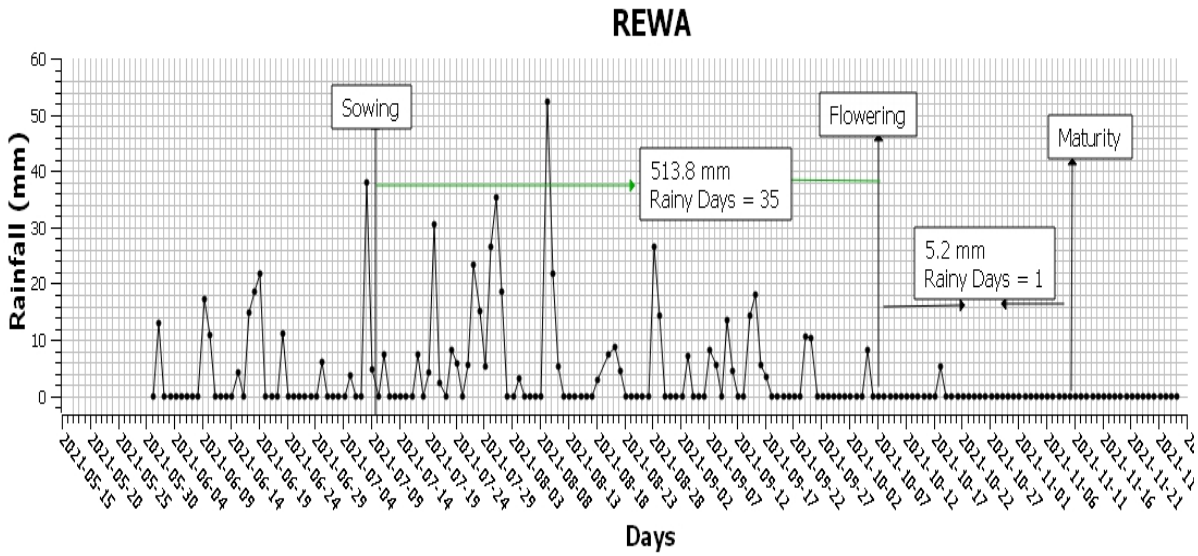


Fig.6.2.1.2: Distribution of rain during crop season (sowing to maturity) at REWA centre during kharif-2021

At REWA centre the crop received 519 mm rain during the whole copping season with 36 rainy days out of which 513.8 mm was received from sowing to 50% flowering stage with 35 rainy days and only 5.2 mm rain was received from flowering to physiological maturity with one rainy day (Fig. 2

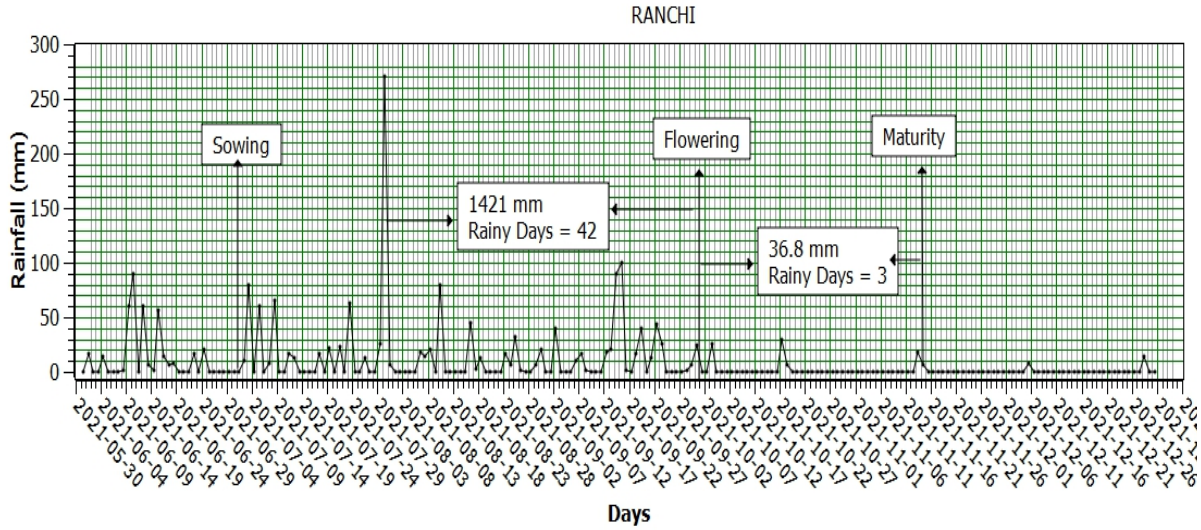


Fig.6.2.1.3: Distribution of rain during crop season (sowing to maturity) at Ranchi centre during kharif-2021

At Ranchi centre the crop received 1457 mm rain with 45 rainy days out of which 1421 cm rain was received in 42 rainy days between sowing to 50% flowering whereas only 52 mm rain in 3 days between flowering to physiological maturity.

At Raipur (RPR) centre the crop received a total of 805 mm with 54 rainy days. From sowing to 50% flowering crop received 789 mm rain with 50 rainy days and between the period flowering and maturity the crop received only 16 mm rain with 4 rainy days.

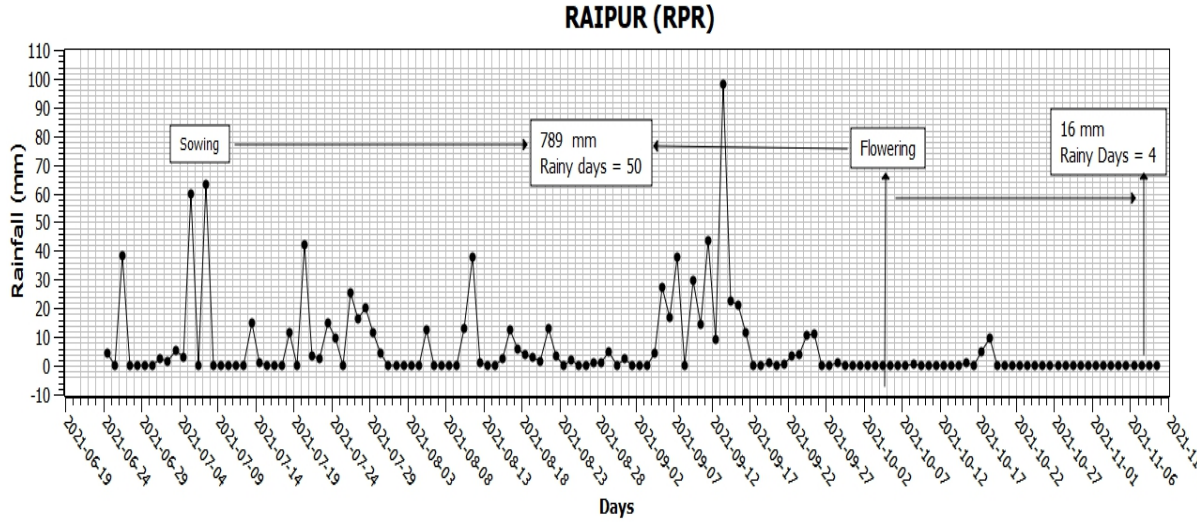


Fig. 6.2.1.4: Distribution of rain during crop season at Raipur (RPR) centre during kharif-2021 season

The mean Tiller number per plant was reduced by 23% under rain fed condition (Fig. 6.2.5). The effect was not uniform across locations. Maximum reduction was observed at Raipur (>38%) followed by PTB (33%) and minimum reduction was observed at Ranchi centre 3.4% reduction in comparison with irrigated treatment. The interaction between treatment and

genotypes was found to be significant ($p<0.01$). However, the differences in the mean Tiller Number (mean of both the treatments) was found to be non-significant *(Table 6.2.1)*.

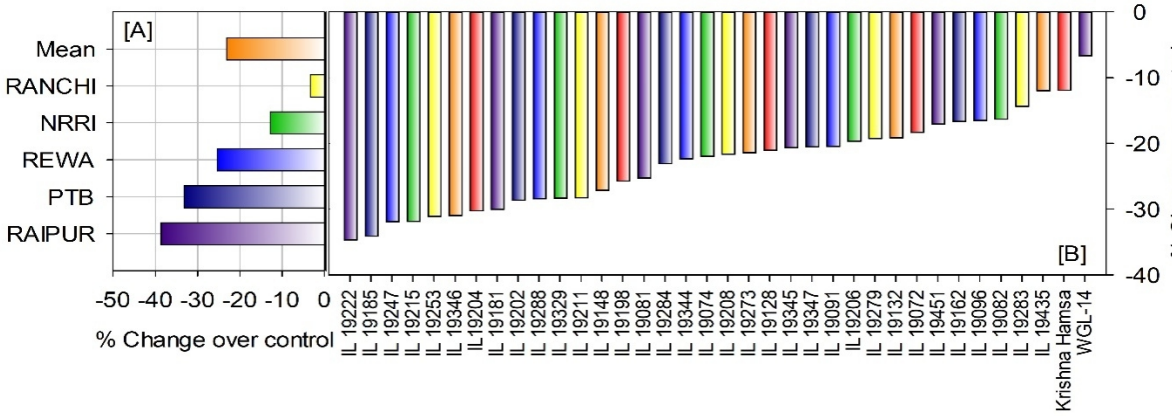


Fig. 6.2.1.5: Influence of irrigation regimes on Tiller No/Plant recorded at flowering stage in different rice genotypes at different AICRIP centres during kharif-2021 season. [A] Mean of all genotypes [B] Mean of all locations.

Minimum reduction in mean tiller No. was observed in WGL-14 followed by Krishna Hamsa, IL-19435 and IL-19283. Maximum reduction mean tiller No. was observed in IL-19222, IL-19185 and IL-19247.

The mean (mean of all genotypes and treatments) Panicle weight (g/m2) recorded at both irrigated and rain fed condition revealed that under rainfed treatment the panicle weight was reduced by >7.0% over irrigated control (Table 6.2.2). Although the treatment effect was statistically non-significant, a significant interaction was observed between location x treatment. The reduction in mean panicle weight under rainfed treatment was maximum at NRRI centre (>15% reduction) followed by PTB and REWA recorded minimum reduction (<10%) in panicle weight (Fig. 6.2.5)

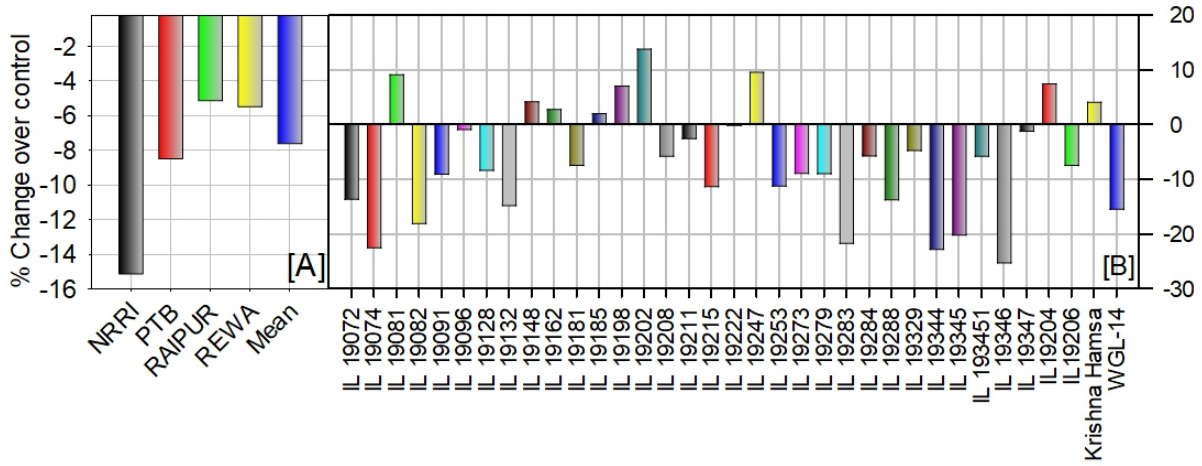


Fig. 6.2.1.6*: Influence of irrigation regimes on panicle weight/m2 recorded at flowering stage in different rice genotypes at different AICRIP centres during kharif-2021 season. [A] Mean of all genotypes [B] Mean of all locations.*

The differences between the genotypes for mean panicle weight was statistically non-significant. Maximum reduction in panicle weight was observed in IL-19346 followed by IL-19344, IL-19074 and IL-19345. Minimum reduction was observed in IL-19222, IL-19096 and IL-19347 (<2% reduction over control). In the remaining genotypes the reduction in panicle weight under rainfed condition is between 5 to 20% in comparison with irrigated control treatment. Genotypes like IL-19202, IL 19247, IL 19204 IL-19161 and IL-19185 *(Fig. 6.2.6)*

Number of grains per panicle (GrNoPan) is one of the important yield attribute which was reduced by <15% in comparison with irrigated control. The interaction between Treatment x location as found to be highly significant indicating that the treatment effect varied amongst the locations. Maximum reduction in mean GrNoPan was observed at PTB (62.4%) followed by REWA and NRRI. No change in GrNoPan was observed at Raipur centre where as an increase of 9% was recorded at Ranchi centre *(Fig 6.2.1.7).*

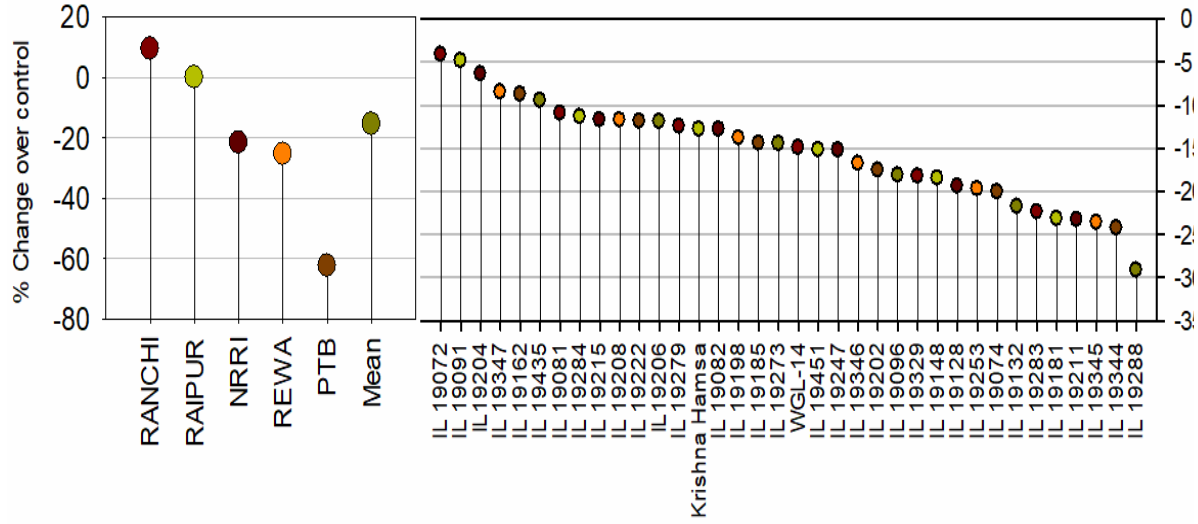


Fig. 6.2.7: Influence of irrigation regimes on No. Grains/Panicle in different rice genotypes at different AICRIP centres during kharif-2021 season. [A] Mean of all genotypes [B] Mean of all locations. Each value represents % change under rainfed treatment in comparison with irrigated control.

Although the differences between mean (mean of treatments & locations) GrNoPan amongst the genotypes is statistically non-significant, the interaction between Genotype x Location was found to be highly significant ($p<0.01$) implying that the response of genotypes to drought stress varied with location (*Table 6.2.7).* Maximum reduction in mean GrNoPan (mean of all locations) was observed in IL-19288 followed by IL-19244, IL-19211 and IL-19281. Minimum reduction was observed in IL-19072 and IL-19091 in which the reduction in GrNoPan is <5%. The reduction varied between 6% to 22% over irrigated control in the remaining genotypes *(Fig.6.2.7)*. The remaining interactions were statistically non-significant.

The mean Grain Yield (g/m2) (mean of all locations) show >15% reduction under rainfed condition in comparison with irrigated control. The interaction between location x treatment was found to be highly significant ($p<0.01$) implying that the treatment effect varied across locations. Maximum reduction in mean grain yield (mean of all genotypes) was observed at PTB centre(>48%) followed by NRRI (22%) and REWA. However, at Ranchi and Raipur centres the change in grain yield under rainfed condition was negligible. The interaction between Genotype x location was found to be highly significant ($p<0.01$) suggesting that the response of genotypes to the treatments varied with locations (Table 6.2.8). Maximum reduction in mean grain yield was noticed in IL-19346, IL-19222, IL-19345, WGL-14 and IL-19082 in which the reduction in mean grain yield is >20% under rainfed condition in comparison with irrigated control. Minimum reduction in grain yield was observed in IL-19206, Krishna Hamsa, IL-19204, IL-19185, IL-19198, IL-19181 and IL-19347 in which the

reduction in grain yield is <10% under rainfed condition in comparison with irrigated control. The reduction in grain yield in the remaining genotypes varied between 10% to 20% under rainfed condition. The genotypes with minimum reduction could be identified as relatively tolerant to drought and suitable for rainfed cultivation.

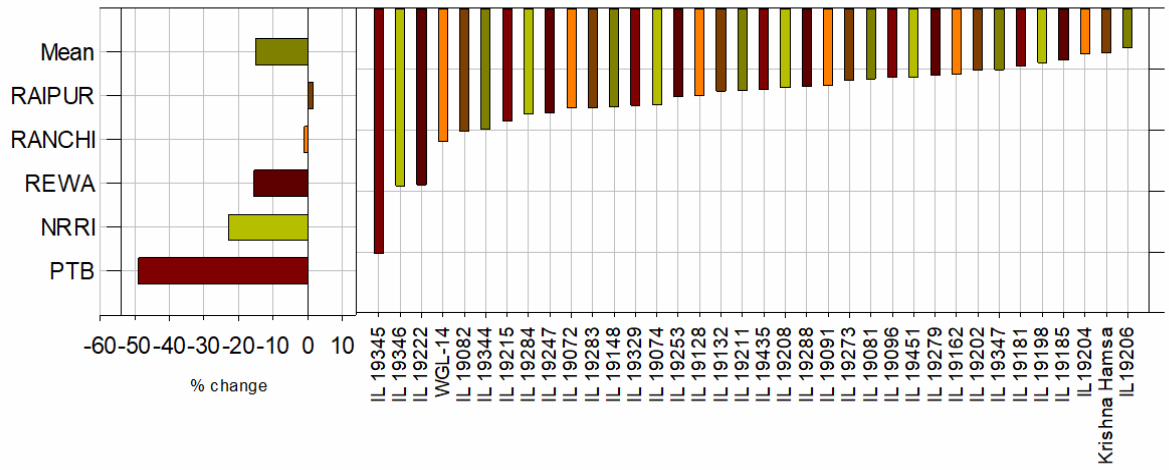


Fig. 6.2.8: Influence of irrigation regimes on Grain Yield (g/m^2) in different rice genotypes at different AICRIP centres during kharif-2021 season. [A] Mean of all genotypes [B] Mean of all locations. Each value represents % change under rainfed treatment in comparison with irrigated control.

The mean TDM(g/m^2) (mean of all locations) show 20% reduction under rainfed condition in comparison with irrigated control treatment. Results of analysis of variance indicated highly significant ($p<0.01$) interaction between location x treatment implying that the treatment effect varied across location. The reduction in TDM was maximum at Raipur (45%) followed by PTB (24%) and NRRI. At REWA centre the reduction in TDM under rainfed condition was <3% over control, whereas at Ranchi the reduction in mean TDM is 6.2% in comparison with irrigated treatment *(Fig. 6.2.9).*

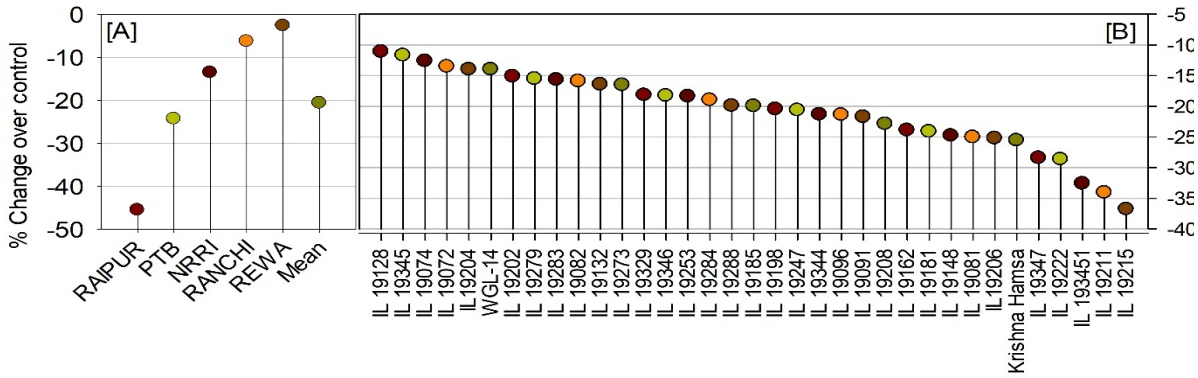


Fig. 6.2.9: Influence of irrigation regimes on No. TDM (g/m^2) in different rice genotypes at different AICRIP centres during kharif-2021 season. [A] Mean of all genotypes [B] Mean of all locations. Each value represents % change under rainfed treatment in comparison with irrigated control.

The interaction between location x treatment was found to be highly significant ($p<0.01$) implying that the treatment effect varied across locations. Maximum reduction in mean TDM (mean of all genotypes) was observed at Raipur centre (>45%) followed by PTB and NRRI. However, at Ranchi and Raipur centres the change in grain yield under rainfed condition was negligible. The interaction between Genotype x location was found to be highly significant ($p<0.01$) suggesting that the response of genotypes to the treatments varied with locations (Table 6.2.9). Minimum reduction in mean TDM was noticed in IL-19128, IL-19345, IL-19074, IL-19072, IL-19204 and WGL-14 (Fig.6.2.9). Maximum reduction (>30%) in mean TDM was observed in IL-19351, IL-19211 and IL-19215. In the remaining genotypes the reduction in TDM under rainfed treatment varied between 30% to 15% in comparison with irrigated control *(Table 6.2.9)*. The remaining interactions were statistically non-significant.

The mean test weight (1000 grain weight) (mean of all locations) was reduced by >15% under rainfed treatment in comparison with irrigated control *(Fig.6.2.10)*. Significant interaction between Location x treatment was observed. Maximum reduction in mean (mean of all genotypes) 1000 grain weight was observed at PTB centre (52%) followed by REWA (15%). The reduction was negligible at Ranchi and NRRI centres (<2% reduction over control). At Raipur centre marginal increase in 1000 grain weight was observed. Significant ($p<0.01$) interaction was observed between Location x Genotype was observed suggesting that the genotypes behaved differently at different locations (*Table 6.2.10).* Significant differences were observed amongst the genotypes in their response to treatments. The test weight was reduced under rainfed treatments in all the tested genotypes. Maximum reduction was observed in IL-19329, WGL-14, IL-19284 and IL-19317 in which the reduction was >25%. Minimum reduction was observed in IL-19206 (<10% reduction) in all other remaining genotypes the reduction in test weight was between 10% to 20% under rainfed treatment in comparison with irrigated control.

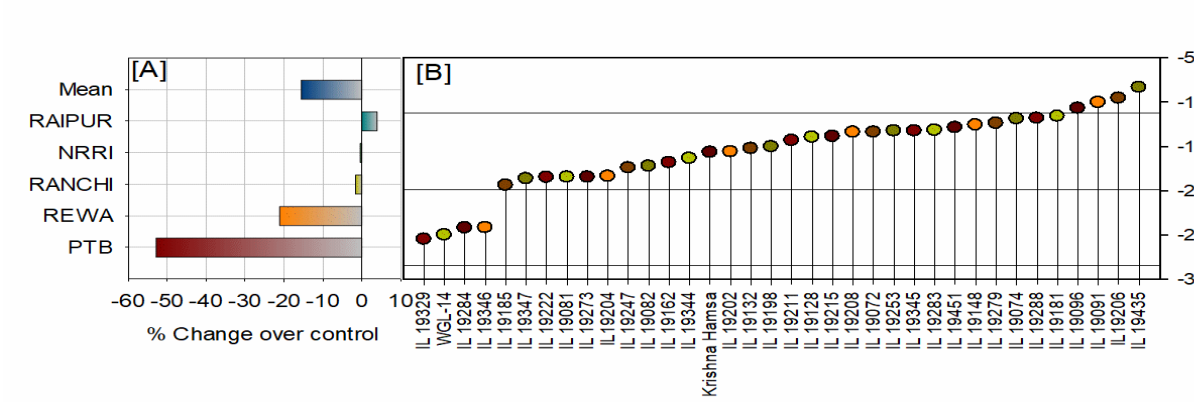


Fig. 6.2.10: Influence of irrigation regimes 1000 grain weight (g) in different rice genotypes at different AICRIP centres during kharif-2021 season. [A] Mean of all genotypes [B] Mean of all locations. Each value represents % change under rainfed treatment in comparison with irrigated control.

Harvest index (HI) is one of the most important yield trait which was affected by irrigation regimes. The mean HI (mean of all locations) show 26% reduction under rainfed treatment in comparison with irrigated control. Perusal of analysis of variance results revealed a significant ($p<0.01$) interaction between location x treatment suggesting that the treatment effect varied amongst the locations. Maximum reduction in HI was observed at PTB centre (60%) followed by Raipur (45% reduction) and REWA (17% reduction) under rainfed treatment in comparison with irrigated control. The reduction in HI was comparatively lower at NRRI(11%) and Ranchi (6% *(Fig.6.2.11)*. Significant interaction was noticed between Location x Genotypes indicating that the response of genotypes varied from one location to another. Minimum reduction in HI was observed in IL-19204 followed by Krishna Hamsa and WGL-14 in which the reduction in HI under rainfed treatment was <20% in comparison with irrigated control (Fig.6.3.11). Maximum reduction was observed in IL-19222, IL-19208 and IL-19346. The reduction in HI varied between 30% to 20% over irrigated control in all the remaining genotypes.

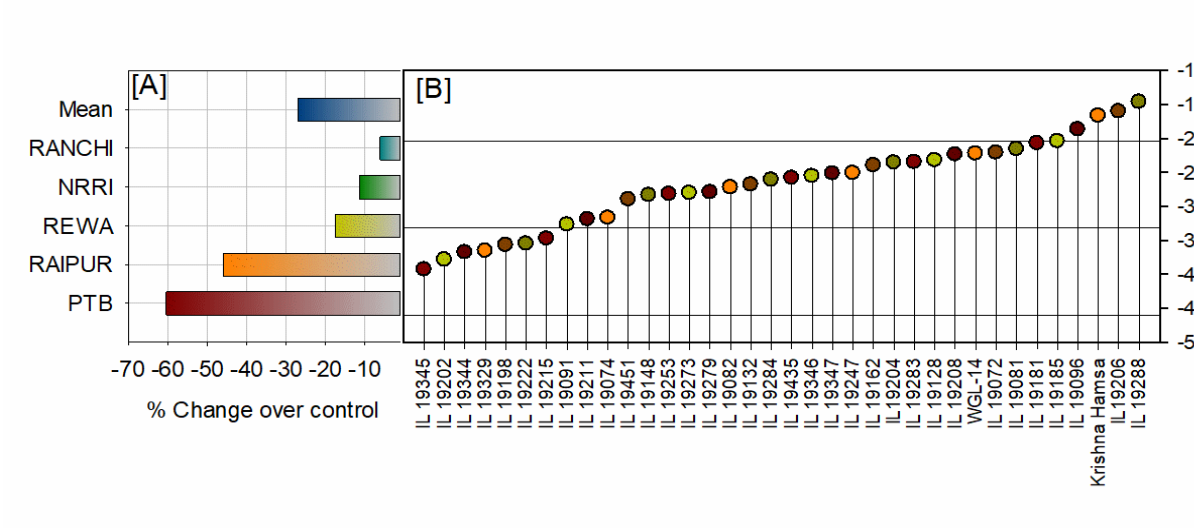


Fig. 6.2.11: Influence of irrigation regimes Harvest Index (%) in different rice genotypes at different AICRIP centres during kharif-2021 season. [A] Mean of all genotypes [B] Mean of all locations. Each value represents % change under rainfed treatment in comparison with irrigated control.

Identification of Drought Tolerant genotypes using yield based drought Indices*:* Loss of yield under water limited condition is the main concern of plant breeders. Hence they emphasize on yield performance under stress conditions. Thus, drought indices which provide a measure of drought based on loss of yield under drought-conditions in comparison to normal conditions have been used for screening drought tolerant genotypes. In order to identify genotypes tolerant to drought, different indices were computed based on the grain yield recorded under irrigated control and rainfed (drought)treatment. Different Drought tolerance indices including Drought susceptibility index (DSI), Relative Drought index (RDI), Drought tolerance index (DTI), Geometric mean productivity (GMP), Tolerance (TOL), Mean production (MP), Yield index (YI), Heat resistance index (HI), Yield stability index (YSI), Modified stress tolerance index (KiSTI), were calculated using the relationships of (Fischer and Maurer, 1978; Fischer et al., 1998; Fernandez, 1992; Rosielle and Hamblin, 1981; Bouslama and Schapaugh, 1984; Blum, 1988; Moosavi et al., 2008; Farshadfar and Sutka, 2002). For calculating different drought indices, the means of all locations were used.

The results of Drought tolerance indices were presented on *Table 6.2.12* The data revealed that significant variation was observed amongst the genotypes for different drought indices. Based on different drought indices individual entries were ranked. The rank sum and mean rank was calculated for each entry and standard error was computed. The genotype having high Mean Rank ±low SEm was considered as most suitable for rain fed conditions as they have relative tolerance to water stressed conditions. The data pertaining to the drought

indices and their ranks were presented in Table. 12. The data revealed that genotypes IL-19206, Krishna Hamsa, IL-19096 and IL-19279, have high Mean Rank with low SEm and they may be considered as relatively drought tolerant and are suitable for rain fed cultivation.

In order to identify most suitable index for drought phenotyping, multiple correlation was performed between yield measured under rain fed condition (Ys) and drought tolerance indices. The correlation analysis between grain yield and tolerance indices can be a good criterion for screening the best cultivars and indices used. A suitable index must have a significant association with yield recorded under stress condition. The results of correlation analysis indicated that the indices like GMP (Geometric Mean Production), DTI (Drought Tolerance Index, Yi (Yield Index), HM (Hormonic Mean), K1STO, K2STI (Modified Stress Tolerance Index), Yield index (YI) showed highly significant positive association with grain yield recorded under stress condition. These indices are useful in selecting suitable genotypes for drought tolerance. These indices show strong association with the yield recorded under control conditions also.

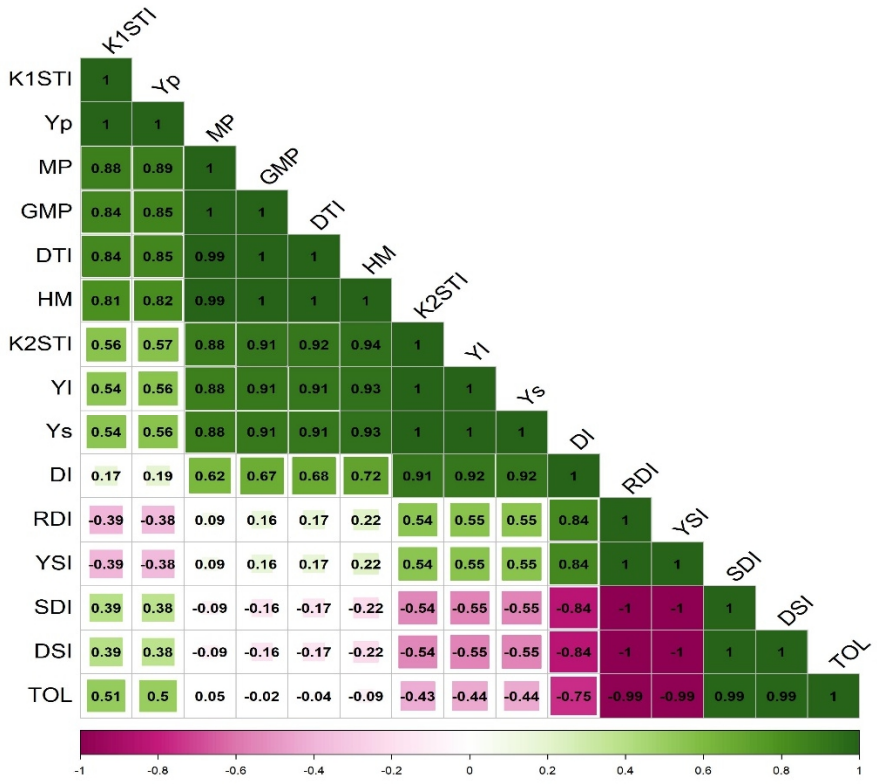


Fig.6.2.13: Relationship between grain yield recorded under irrigated and rain fed condition and drought tolerant indices. For computing indices mean yield values for all the locations were used.

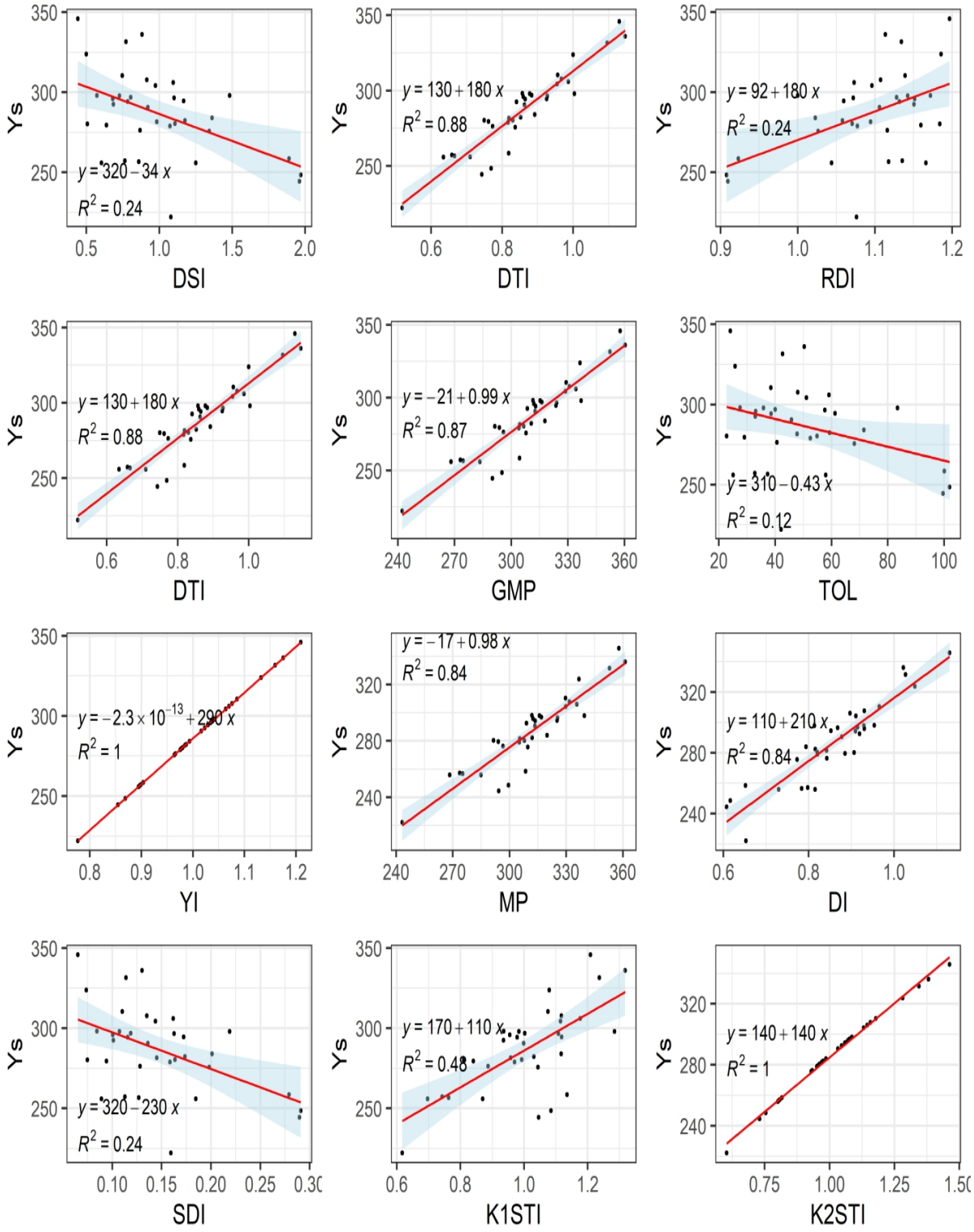


Fig 6.2.13: Relationship between grain yield recorded under rainfed condition (drought) and different drought tolerance indices computed from grain yield recorded under both rainfed and irrigated conditions.

Table 6.2.1 Screening of elite rice cultures for drought tolerance on tiller number/hill at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	5.4	10.3	13.0	19.7	8.9	11.5	6.5	5.9	16.7	20.0	11.2	12.1
2	IL 19074	6.9	12.9	14.3	17.7	9.5	12.2	9.5	6.9	17.7	19.3	11.3	13.0
3	IL 19081	7.3	8.4	11.0	16.0	5.7	9.7	9.2	6.8	16.7	19.0	9.3	12.2
4	IL 19082	7.7	10.4	14.7	17.3	9.1	11.8	9.8	7.8	19.0	16.3	12.0	13.0
5	IL 19091	7.9	10.9	13.7	17.0	8.6	11.6	10.8	8.4	20.7	16.3	11.2	13.5
6	IL 19096	8.0	11.3	14.7	19.3	8.4	12.3	9.6	7.4	19.0	17.3	12.0	13.1
7	IL 19128	6.5	11.6	11.7	17.0	5.3	10.4	6.7	8.2	20.7	16.0	6.7	11.6
8	IL 19132	6.3	10.3	11.7	16.0	5.6	10.0	6.1	7.9	16.3	18.0	7.9	11.2
9	IL 19148	6.8	10.7	10.7	18.7	8.3	11.0	8.3	7.8	20.3	20.0	12.4	13.8
10	IL 19162	7.7	8.1	12.3	19.7	9.4	11.4	7.8	6.1	19.7	19.0	11.6	12.8
11	IL 19181	8.1	11.3	12.7	16.7	6.8	11.1	8.1	5.7	22.7	18.7	10.5	13.1
12	IL 19185	7.8	11.8	14.0	16.3	7.1	11.4	9.7	6.8	28.3	18.3	10.8	14.8
13	IL 19198	7.6	8.3	16.0	16.3	5.6	10.8	8.8	5.5	22.3	20.3	9.0	13.2
14	IL 19202	8.7	9.7	15.0	17.0	6.3	11.3	11.3	6.2	25.7	18.0	10.0	14.2
15	IL 19208	7.7	11.0	11.7	17.3	7.3	11.0	7.7	6.7	16.7	20.0	9.3	12.1
16	IL 19211	7.5	10.6	12.3	16.3	7.4	10.8	10.9	7.7	20.7	18.3	11.0	13.7
17	IL 19215	7.7	9.7	11.3	15.3	9.4	10.7	8.9	7.3	27.7	17.0	11.7	14.5
18	IL 19222	8.1	9.6	12.3	16.3	7.5	10.8	10.1	5.2	27.3	17.0	11.8	14.3
19	IL 19247	7.8	11.1	12.7	15.3	9.2	11.2	10.6	6.3	21.7	18.7	13.3	14.1
20	IL 19253	7.3	12.4	11.7	17.3	8.7	11.5	7.3	5.3	24.7	18.7	10.0	13.2
21	IL 19273	7.7	7.2	14.0	17.0	8.4	10.9	7.7	6.0	23.0	18.7	10.9	13.3
22	IL 19279	7.3	9.4	12.3	19.0	9.1	11.4	9.4	7.1	19.0	17.7	12.5	13.1
23	IL 19283	11.1	11.3	13.0	19.3	8.5	12.7	11.1	9.3	21.3	17.0	10.8	13.9
24	IL 19284	10.6	13.1	12.7	17.0	6.0	11.9	10.9	10.0	23.3	16.7	9.1	14.0
25	IL 19288	5.3	10.0	12.0	17.7	8.2	10.6	9.3	5.2	19.3	19.3	9.7	12.6
26	IL 19329	6.8	10.7	13.3	16.3	7.7	11.0	7.6	6.8	22.3	18.3	12.1	13.4
27	IL 19344	8.5	11.7	14.7	16.7	6.4	11.6	8.7	7.2	18.7	18.7	11.0	12.9
28	IL 19345	8.7	12.1	13.3	16.7	7.5	11.7	8.6	9.2	21.0	18.0	10.1	13.4
29	IL 19346	8.5	10.8	9.7	18.7	9.0	11.3	8.1	7.0	27.3	19.7	10.7	14.6
30	IL 19347	7.4	10.6	12.0	18.0	12.3	12.1	8.3	5.6	17.3	18.3	15.0	12.9
31	IL 19435	6.2	10.1	13.0	18.7	11.3	11.9	6.1	6.1	17.3	16.7	12.7	11.8
32	IL 19451	9.2	9.1	12.6	19.7	10.3	12.2	10.5	5.9	20.3	18.0	11.6	13.3
33	IL19204	8.5	8.8	13.7	18.3	4.9	10.8	8.7	6.1	30.0	17.7	8.7	14.2
34	IL19206	7.6	11.7	10.3	17.7	7.4	10.9	8.1	8.4	16.3	19.3	8.7	12.2
35	K. Hamsa	9.1	8.3	12.7	21.0	8.8	12.0	10.6	4.9	17.0	17.0	11.2	12.1
36	WGL-14	7.7	13.0	12.0	18.0	10.4	12.2	9.1	11.1	11.7	17.7	12.0	12.3
	Mean	**7.7**	**10.5**	**12.7**	**17.6**	**8.1**	**11.3**	**8.9**	**7.0**	**20.8**	**18.2**	**10.8**	**13.1**
	LSD (Treat)				ns			LSD (Treat x Genotype)					ns
	LSD (Location x Treat)				0.74**			LSD (Location x Treat x Genotype)					ns
	LSD (Genotype)				ns			CV (%)					17.2
	LSD (Location x Genotype)				3.13**								

Table 6.2.2 Screening of elite rice cultures for drought tolerance on shoot weight (g/m2) at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	370	831	824	818	684	705	415	774	224	748	567	546
2	IL 19074	419	1143	821	824	525	746	480	851	233	746	400	542
3	IL 19081	424	1013	811	821	591	732	466	594	163	741	510	495
4	IL 19082	401	1247	828	811	647	787	497	926	159	769	554	581
5	IL 19091	346	701	839	828	537	650	425	418	105	751	411	422
6	IL 19096	376	828	818	839	769	726	461	688	181	749	664	549
7	IL 19128	428	909	797	818	753	741	475	874	200	760	630	588
8	IL 19132	380	1128	818	797	589	742	485	866	223	741	486	560
9	IL 19148	433	1260	833	818	664	802	467	821	198	736	560	556
10	IL 19162	455	1204	809	833	557	771	503	611	272	740	462	518
11	IL 19181	458	856	755	762	569	680	497	486	253	741	452	486
12	IL 19185	456	906	755	755	706	716	486	567	220	764	603	528
13	IL 19198	431	594	751	755	528	612	457	503	228	732	399	464
14	IL 19202	410	470	760	751	689	616	439	702	193	740	575	530
15	IL 19208	475	751	736	736	701	680	502	462	157	760	591	494
16	IL 19211	405	2268	774	736	726	982	463	632	143	753	607	519
17	IL 19215	341	1764	824	774	603	861	405	403	181	746	512	449
18	IL 19222	371	849	822	824	717	717	497	569	173	748	606	519
19	IL 19247	431	650	809	822	703	683	474	513	268	748	617	524
20	IL 19253	448	851	795	809	718	724	552	611	258	740	604	553
21	IL 19273	506	1021	810	795	671	760	543	670	183	760	580	547
22	IL 19279	391	715	818	810	732	693	436	439	193	779	592	488
23	IL 19283	373	1007	809	809	674	734	420	618	208	758	546	510
24	IL 19284	405	1078	814	809	583	738	430	794	124	737	471	511
25	IL 19288	406	1038	823	814	604	737	463	600	152	745	479	488
26	IL 19329	450	988	826	823	487	715	560	1047	230	757	363	591
27	IL 19344	438	1447	821	826	670	840	487	940	141	755	570	579
28	IL 19345	449	904	815	821	522	702	483	1232	173	736	435	612
29	IL 19346	403	1271	812	815	467	753	455	723	182	752	590	540
30	IL 19347	412	1353	795	812	529	780	443	469	188	763	651	503
31	IL 19435	425	1224	822	795	466	746	460	654	164	738	640	531
32	IL 19451	366	1019	817	822	438	692	441	429	134	750	451	441
33	IL19204	472	260	758	760	424	535	539	562	208	750	349	482
34	IL19206	379	857	736	758	735	693	456	444	161	761	631	491
35	K. Hamsa	388	1331	833	817	532	780	446	474	123	787	661	498
36	WGL-14	388	1012	791	833	548	714	501	561	244	764	664	547
	Mean	**414**	**1021**	**802**	**801**	**613**	**730**	**473**	**654**	**190**	**751**	**541**	**522**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			38.6**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				17.5	
	LSD (Location x Genotype)			163.6**									

Table 6.2.3 Screening of elite rice cultures for drought tolerance on panicle weight (g/m2) at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	245	382	646	0	683	391	333	643	644	0	640	452
2	IL 19074	389	257	777	0	533	391	425	450	742	0	825	489
3	IL 19081	407	320	610	0	660	399	398	266	606	0	553	365
4	IL 19082	335	306	697	0	680	404	457	519	715	0	812	501
5	IL 19091	313	232	769	0	513	365	289	197	747	0	730	393
6	IL 19096	315	318	674	0	855	432	408	324	648	0	749	426
7	IL 19128	270	459	577	0	807	423	250	739	567	0	729	457
8	IL 19132	288	351	669	0	665	395	381	537	668	0	727	462
9	IL 19148	248	610	665	0	752	455	349	342	663	0	827	436
10	IL 19162	316	464	662	0	656	420	311	301	651	0	756	404
11	IL 19181	295	333	471	0	631	346	462	311	450	0	601	365
12	IL 19185	348	324	438	0	760	374	394	259	450	0	755	372
13	IL 19198	337	422	454	0	592	361	391	286	457	0	559	338
14	IL 19202	379	337	271	0	757	349	369	170	243	0	697	296
15	IL 19208	421	296	784	0	738	448	420	249	563	0	689	384
16	IL 19211	365	358	547	0	760	406	354	501	533	0	668	411
17	IL 19215	283	340	313	0	655	318	388	328	295	0	745	351
18	IL 19222	254	522	361	0	631	354	432	297	350	0	670	350
19	IL 19247	290	431	581	0	811	423	350	312	593	0	697	390
20	IL 19253	223	351	452	0	762	358	294	567	429	0	676	393
21	IL 19273	412	348	435	0	746	388	379	431	404	0	851	413
22	IL 19279	281	221	779	0	752	406	237	337	767	0	867	442
23	IL 19283	332	297	393	0	728	350	376	619	373	0	822	438
24	IL 19284	364	483	767	0	657	454	361	652	719	0	579	462
25	IL 19288	250	362	664	0	612	378	262	500	645	0	741	430
26	IL 19329	172	418	498	0	521	322	295	239	507	0	667	342
27	IL 19344	170	360	567	0	684	356	342	551	523	0	790	441
28	IL 19345	193	296	510	0	581	316	281	899	516	0	545	448
29	IL 19346	190	232	547	0	479	290	298	411	511	0	633	371
30	IL 19347	185	532	901	0	617	447	232	308	777	0	695	402
31	IL 19435	243	395	784	0	544	393	274	307	654	0	687	384
32	IL 19451	275	408	682	0	394	352	395	179	572	0	494	328
33	IL19204	432	236	481	0	555	341	471	188	466	0	432	311
34	IL19206	368	221	871	0	785	449	408	249	677	0	687	404
35	K. Hamsa	356	315	839	0	598	421	304	161	823	0	705	399
36	WGL-14	315	229	866	0	490	380	422	320	927	0	714	476
	Mean	**302**	**355**	**611**	**0**	**657**	**385**	**355**	**387**	**580**	**0**	**695**	**403**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			30.9**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				22.3	
	LSD (Location x Genotype)			130.9**									

Table 6.2.4 Screening of elite rice cultures for drought tolerance on panicle number/m2 at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	188	583	367	244	146	306	243	294	392	244	165	268
2	IL 19074	204	511	367	245	160	297	231	311	347	243	181	263
3	IL 19081	245	461	425	244	66	288	284	286	392	244	93	260
4	IL 19082	212	383	347	234	183	272	314	367	383	244	211	304
5	IL 19091	260	622	375	243	137	327	284	433	300	250	169	287
6	IL 19096	226	394	350	247	119	267	261	361	364	242	157	277
7	IL 19128	169	456	300	240	56	244	232	400	481	248	69	286
8	IL 19132	195	567	325	248	57	278	235	356	422	248	84	269
9	IL 19148	232	572	396	256	157	322	255	350	389	244	189	286
10	IL 19162	224	433	383	254	152	289	259	278	386	256	185	273
11	IL 19181	194	844	525	248	77	378	246	244	250	257	112	222
12	IL 19185	230	461	350	245	166	290	314	322	525	245	208	323
13	IL 19198	243	489	433	245	34	289	271	261	433	245	69	256
14	IL 19202	265	872	575	247	162	424	223	300	375	240	204	268
15	IL 19208	240	606	350	249	107	310	224	311	319	247	131	246
16	IL 19211	236	628	528	245	125	352	269	433	317	255	152	285
17	IL 19215	249	561	642	247	177	375	260	378	258	250	200	269
18	IL 19222	194	489	483	247	167	316	289	217	408	247	197	271
19	IL 19247	259	928	408	245	143	397	265	294	383	244	176	273
20	IL 19253	234	506	558	250	141	338	234	256	292	244	178	241
21	IL 19273	236	511	558	242	124	334	226	294	292	243	152	241
22	IL 19279	195	383	417	246	151	278	239	356	331	241	179	269
23	IL 19283	316	578	558	251	136	368	280	411	365	252	182	298
24	IL 19284	320	822	375	248	57	364	297	500	308	256	79	288
25	IL 19288	181	539	358	248	119	289	199	244	399	257	191	258
26	IL 19329	185	489	424	252	78	286	226	294	417	253	213	281
27	IL 19344	210	444	492	248	82	295	285	339	322	251	146	269
28	IL 19345	236	422	536	248	106	310	223	450	317	251	138	276
29	IL 19346	211	878	500	239	202	406	250	256	367	250	218	268
30	IL 19347	215	528	300	247	303	318	203	267	325	256	318	274
31	IL 19435	185	489	358	241	310	317	182	272	311	250	333	270
32	IL 19451	261	539	400	251	276	345	346	206	419	246	269	297
33	IL19204	253	439	517	242	39	298	300	239	356	246	55	239
34	IL19206	251	489	333	245	57	275	270	300	315	254	76	243
35	K. Hamsa	287	700	319	246	222	355	355	228	308	254	264	282
36	WGL-14	222	383	264	240	271	276	264	456	292	243	282	307
	Mean	**230**	**556**	**422**	**246**	**141**	**319**	**259**	**321**	**357**	**248**	**173**	**272**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			32.3**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				31.2	
	LSD (Location x Genotype)			137.2**									

Table 6.2.5 Screening of elite rice culture for drought tolerance on grain number/per panicle at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	112	50	154	131	87	107	122	64	154	113	105	112
2	IL 19074	102	16	214	122	82	107	144	100	214	111	101	134
3	IL 19081	64	33	133	133	105	94	79	63	133	120	131	105
4	IL 19082	68	39	203	132	77	104	82	80	203	127	103	119
5	IL 19091	65	31	188	127	112	105	73	38	188	110	142	110
6	IL 19096	107	37	188	126	59	103	135	88	188	125	95	126
7	IL 19128	106	23	131	129	100	98	137	112	131	113	114	122
8	IL 19132	98	29	202	130	104	113	146	128	202	114	130	144
9	IL 19148	73	41	172	120	102	102	111	91	172	116	134	125
10	IL 19162	145	66	155	117	84	113	157	86	155	108	116	124
11	IL 19181	79	13	204	126	37	92	98	87	204	115	94	120
12	IL 19185	66	13	202	130	106	103	85	61	202	117	139	121
13	IL 19198	48	18	209	126	56	91	65	49	209	122	84	106
14	IL 19202	58	21	102	127	84	79	86	50	102	116	121	95
15	IL 19208	74	9	233	126	109	110	87	62	233	111	132	125
16	IL 19211	63	11	134	127	81	83	83	103	134	114	106	108
17	IL 19215	68	20	115	123	95	84	83	51	115	111	117	95
18	IL 19222	82	29	134	128	75	90	89	64	134	119	103	102
19	IL 19247	67	25	155	120	96	93	72	74	155	117	128	109
20	IL 19253	65	25	204	121	82	100	72	111	204	114	118	124
21	IL 19273	69	28	182	133	117	106	96	81	182	116	143	124
22	IL 19279	74	19	231	128	115	113	92	64	231	119	143	130
23	IL 19283	73	31	138	127	69	88	93	108	138	112	114	113
24	IL 19284	95	42	221	118	101	115	106	90	221	112	122	130
25	IL 19288	108	29	134	127	72	94	149	126	134	112	142	133
26	IL 19329	98	39	124	125	41	85	114	38	124	113	132	104
27	IL 19344	76	28	138	126	72	88	82	112	138	119	129	116
28	IL 19345	72	43	91	123	102	86	77	146	91	117	132	113
29	IL 19346	91	34	205	137	112	116	127	113	205	118	132	139
30	IL 19347	69	77	221	124	115	121	119	83	221	109	130	132
31	IL 19435	84	37	223	124	108	115	95	72	223	124	122	127
32	IL 19451	81	31	149	128	83	94	115	72	149	119	101	111
33	IL19204	81	29	212	125	92	108	93	51	212	112	107	115
34	IL19206	77	15	227	124	83	105	87	71	227	111	101	119
35	K. Hamsa	66	24	199	132	119	108	105	57	199	116	142	124
36	WGL-14	94	38	222	139	99	119	166	58	222	122	129	139
	Mean	**81**	**30**	**176**	**127**	**90**	**101**	**103**	**81**	**176**	**116**	**120**	**119**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			5.68**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				14.7	
	LSD (Location x Genotype)			24.1**									

Table 6.2.6 Screening of elite rice culture for drought tolerance on spikelet number/per panicle at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	169	79	286	127	109	154	118	195	286	118	161	176
2	IL 19074	155	42	286	117	111	142	174	141	319	116	166	183
3	IL 19081	105	55	286	128	151	145	105	101	253	125	180	153
4	IL 19082	127	61	275	126	125	143	116	108	308	131	142	161
5	IL 19091	85	49	308	122	152	143	92	50	275	114	186	143
6	IL 19096	153	56	275	121	89	139	160	112	264	130	122	158
7	IL 19128	159	63	286	125	128	152	180	132	275	118	131	167
8	IL 19132	156	63	319	126	137	160	187	151	330	119	137	185
9	IL 19148	115	81	253	115	140	141	145	139	231	121	209	169
10	IL 19162	207	117	242	112	119	160	157	114	319	112	150	170
11	IL 19181	132	42	242	121	78	123	116	111	220	120	114	136
12	IL 19185	141	46	220	125	148	136	93	98	231	121	146	138
13	IL 19198	104	50	209	122	110	119	86	65	198	127	120	119
14	IL 19202	108	36	209	123	123	120	104	80	286	121	163	151
15	IL 19208	113	39	330	121	169	155	106	71	297	115	159	150
16	IL 19211	104	44	253	122	124	129	106	111	209	119	133	135
17	IL 19215	92	38	209	117	193	130	101	72	242	115	165	139
18	IL 19222	120	64	231	124	120	132	93	91	242	124	142	138
19	IL 19247	132	58	308	115	130	149	92	105	264	121	187	154
20	IL 19253	106	50	198	117	115	117	76	165	264	119	175	160
21	IL 19273	149	57	220	129	156	142	122	104	220	121	187	151
22	IL 19279	112	40	297	123	158	146	98	78	286	123	197	156
23	IL 19283	145	57	253	122	97	135	130	115	264	117	122	150
24	IL 19284	145	74	297	113	124	151	142	124	242	116	138	153
25	IL 19288	190	54	253	123	93	142	173	151	286	116	179	181
26	IL 19329	164	91	242	121	81	140	139	90	253	117	165	153
27	IL 19344	140	95	242	121	108	141	107	156	286	124	156	166
28	IL 19345	143	81	220	118	134	139	97	177	253	122	142	158
29	IL 19346	160	69	220	132	135	143	172	153	231	122	140	164
30	IL 19347	132	109	363	119	160	177	138	139	363	113	155	182
31	IL 19435	178	76	308	119	166	169	124	138	231	128	159	156
32	IL 19451	148	55	286	124	125	148	131	100	264	124	126	149
33	IL19204	120	56	286	120	155	147	106	61	275	116	135	139
34	IL19206	113	44	385	119	147	162	108	86	297	116	141	150
35	K. Hamsa	113	48	286	127	169	149	115	95	286	121	173	158
36	WGL-14	158	56	264	133	136	150	213	82	429	126	152	200
	Mean	**136**	**61**	**268**	**122**	**131**	**144**	**126**	**113**	**272**	**120**	**154**	**157**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			10.3**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				19.4	
	LSD (Location x Genotype)			43.5**									

Table 6.2.7 Screening of elite rice culture for drought tolerance on grain number/m2 at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	23379	26922	55750	30900	13090	30008	28731	19337	60075	27567	17034	30549
2	IL 19074	20955	9537	78383	28600	13358	30167	33085	30044	74211	26867	17916	36425
3	IL 19081	15738	15287	56850	31100	7281	25251	22415	18235	51725	29400	11566	26668
4	IL 19082	14314	14120	70381	29533	14470	28564	25679	29211	77425	30967	21197	36896
5	IL 19091	16937	16152	70275	29600	15908	29774	21217	16376	56217	27367	23388	28913
6	IL 19096	23642	12907	65100	29833	7547	27806	35247	31022	69653	30200	14103	36045
7	IL 19128	17871	11809	39358	29933	5778	20950	31649	47983	63192	27800	7719	35669
8	IL 19132	19179	14850	65992	31100	6144	27453	34187	50133	85322	28267	10628	41707
9	IL 19148	17379	22115	68950	29400	16729	30914	28119	34363	67175	28400	24467	36505
10	IL 19162	32488	32543	59525	28467	13113	33227	33777	23828	59339	27567	21063	33115
11	IL 19181	15334	8791	107142	30067	3061	32879	21590	22344	50950	29567	10113	26913
12	IL 19185	14928	6287	71783	30500	18342	28368	23735	19208	105858	28600	27926	41065
13	IL 19198	11742	8559	90800	29800	1968	28574	16577	12845	90167	29967	6668	31245
14	IL 19202	15408	18352	59200	30333	14092	27477	20559	16063	38067	27867	24157	25343
15	IL 19208	17589	5719	81617	30133	11944	29400	19322	19257	74711	27333	16875	31500
16	IL 19211	14865	6541	70675	29967	10570	26523	22015	46465	41767	29067	15574	30977
17	IL 19215	17100	12565	73883	28933	17342	29965	21275	19643	29792	27800	22738	24249
18	IL 19222	16017	15457	65633	30400	13085	28118	22854	14659	53467	29400	19731	28022
19	IL 19247	17196	17006	62650	28267	14438	27911	18479	20263	59825	28467	21645	29736
20	IL 19253	15683	12348	114283	29300	11803	36683	17526	29506	59725	27867	20763	31077
21	IL 19273	16290	14893	101533	31200	14915	35766	22451	24883	53250	28200	21249	30007
22	IL 19279	14600	7272	96508	30233	18106	33344	18814	23361	76342	28600	24779	34379
23	IL 19283	23094	20322	76833	30667	9672	32118	26049	43809	49072	28333	20354	33524
24	IL 19284	30203	33504	82542	27900	6146	36059	33731	44785	67725	28667	9178	36817
25	IL 19288	19610	18469	47658	30367	8849	24991	28162	30935	54204	28767	26762	33766
26	IL 19329	18200	18031	52582	30400	3362	24515	25978	10689	50767	28600	27486	28704
27	IL 19344	16031	11444	67733	30100	6269	26316	22737	39341	43456	29767	17911	30642
28	IL 19345	16731	17480	47089	29367	11105	24354	18425	69006	31233	29433	17972	33214
29	IL 19346	19081	20707	102200	31667	23118	39355	31826	31431	75900	29400	28192	39350
30	IL 19347	15501	43150	66842	29433	35825	38150	24615	26122	71825	27800	40219	38116
31	IL 19435	15261	20233	79383	28700	34138	35543	17095	19291	69817	30833	40043	35416
32	IL 19451	21092	17394	59683	30933	23325	30486	38626	14744	61772	29367	26520	34206
33	IL19204	20404	12839	109483	29000	3952	35136	25797	14493	74506	27467	5466	29546
34	IL19206	19738	7043	75467	29233	4921	27280	25110	21459	71344	28333	7428	30735
35	K. Hamsa	18957	17654	63619	31200	27183	31723	31998	13087	60875	29367	36388	34343
36	WGL-14	20968	14807	58886	32033	27549	30849	44178	25422	64792	29433	35680	39901
	Mean	**18431**	**16197**	**72674**	**29961**	**13569**	**30167**	**25934**	**27046**	**62376**	**28686**	**20580**	**32925**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			3371.1**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				30.4	
	LSD (Location x Genotype)			14302.2**									

Table 6.2.8 Screening of elite rice culture for drought tolerance on spikelet number/m2 at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	31674	41381	102850	32000	16373	44856	28947	57811	112475	28713	26137	50817
2	IL 19074	31535	21450	105050	29790	18038	41173	40186	42891	110642	28070	29687	50295
3	IL 19081	25702	25507	122925	32314	10393	43368	29822	29020	96525	30533	16069	40394
4	IL 19082	26929	22872	96525	30792	23357	40095	36324	39559	121550	32073	29487	51799
5	IL 19091	22163	28322	115500	30823	21492	43660	26215	22222	86350	28409	30597	38759
6	IL 19096	34050	20859	100100	31213	11213	39487	42016	40770	95700	31249	18291	45605
7	IL 19128	26800	29704	88000	31077	7286	36573	41639	56124	131908	29080	8886	53528
8	IL 19132	30252	37759	101200	32160	8083	41891	43968	59815	139883	29415	11237	56864
9	IL 19148	27034	49215	99275	30639	22790	45791	36913	50646	90200	29619	38577	49191
10	IL 19162	46424	55846	94050	29652	18494	48893	40398	31796	124117	28640	27239	50438
11	IL 19181	25735	35370	126500	31285	6308	45040	28489	27415	55000	30812	12330	30809
12	IL 19185	32295	20998	75900	31791	25392	37275	29506	31440	120725	29693	29290	48131
13	IL 19198	25217	24767	94600	30816	3842	35848	23156	16972	85800	31170	8062	33032
14	IL 19202	28566	32172	121000	31396	20413	46710	23868	25474	111650	29074	32648	44543
15	IL 19208	26894	24330	116050	31249	18407	43386	23702	22054	92675	28515	20386	37466
16	IL 19211	24503	28481	133558	31067	16056	46733	28195	49881	66550	30259	19527	38882
17	IL 19215	22956	22972	134475	30242	34841	49097	26006	27245	62975	28803	32326	35471
18	IL 19222	23496	31774	110000	31476	20706	43490	26730	21191	102300	30630	27321	41634
19	IL 19247	33851	52378	123750	29353	19383	51743	24466	28602	102850	29540	31839	43459
20	IL 19253	25171	24465	110550	30325	16475	41397	17756	42956	77550	28916	30878	39611
21	IL 19273	35116	28778	123200	32245	19813	47830	27507	31331	65450	29461	27790	36308
22	IL 19279	22095	15080	121825	31516	24722	43048	23164	28481	96158	29777	34406	42397
23	IL 19283	45451	36193	141350	31797	13541	53666	36506	46904	95608	29532	21756	46061
24	IL 19284	46433	60691	111925	29147	7514	51142	42440	62063	72600	29725	10392	43444
25	IL 19288	34321	30417	93775	31528	11462	40301	34180	36565	111100	29743	33530	49024
26	IL 19329	30408	45557	106242	31524	6609	44068	31540	24863	103950	29669	34552	44915
27	IL 19344	29382	39935	118525	31292	9327	45692	30711	52956	100742	31095	21808	47462
28	IL 19345	33461	34081	118433	30563	14542	46216	21548	84615	78375	30562	19291	46878
29	IL 19346	33709	62167	109450	32883	27778	53197	43015	41069	80300	30559	29997	44988
30	IL 19347	29110	60735	113300	30542	49524	56642	28615	39033	117975	28986	48050	52532
31	IL 19435	32587	35500	110275	29835	52131	52066	22503	37411	72142	32059	52175	43258
32	IL 19451	38928	29670	116600	32033	35072	50461	46047	20385	107250	30396	33450	47506
33	IL19204	30184	24687	147400	30104	6605	47796	31534	16861	100833	28617	6902	36950
34	IL19206	28679	21719	127325	30296	8657	43335	28984	25813	93821	29469	10459	37709
35	K. Hamsa	32486	32543	90658	32406	38344	45287	41312	22826	93775	30568	44843	46665
36	WGL-14	35134	21433	68383	33481	37519	39190	56653	37756	125675	30518	42036	58528
	Mean	**30798**	**33606**	**110848**	**31129**	**19514**	**45179**	**32349**	**37023**	**97311**	**29832**	**26451**	**44593**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			5697.0**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				36.1	
	LSD (Location x Genotype)			10809.4**									

Table 6.2.9 Screening of elite rice culture for drought tolerance on grain yield (g/m2) at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	151	125	375	293	458	280	190	267	375	277	567	335
2	IL 19074	271	87	432	292	313	279	336	239	411	272	400	331
3	IL 19081	259	150	374	278	410	294	330	157	377	290	510	333
4	IL 19082	214	127	373	271	435	284	303	183	416	323	554	356
5	IL 19091	204	103	390	285	301	257	241	127	368	323	411	294
6	IL 19096	226	111	399	292	630	332	305	177	391	334	664	374
7	IL 19128	149	149	346	290	587	304	188	329	347	283	630	355
8	IL 19132	197	168	406	266	415	291	266	243	409	277	486	336
9	IL 19148	157	159	407	288	519	306	224	362	404	276	560	365
10	IL 19162	271	132	384	290	413	298	276	269	385	276	462	334
11	IL 19181	223	119	349	297	410	280	316	167	310	298	452	309
12	IL 19185	274	115	296	275	531	298	287	133	308	298	603	326
13	IL 19198	248	88	325	260	358	256	252	127	310	316	399	281
14	IL 19202	259	91	315	273	525	292	314	175	284	279	575	325
15	IL 19208	335	95	447	290	513	336	376	251	436	278	591	386
16	IL 19211	221	165	311	302	540	308	277	267	337	291	607	356
17	IL 19215	206	123	274	272	405	256	303	211	229	315	512	314
18	IL 19222	192	94	252	287	398	244	338	217	253	307	606	344
19	IL 19247	159	105	352	288	568	295	221	289	363	289	617	356
20	IL 19253	117	104	329	317	541	282	147	281	308	307	604	329
21	IL 19273	287	109	304	283	501	297	336	239	276	253	580	337
22	IL 19279	152	111	432	317	540	310	194	269	412	278	592	349
23	IL 19283	231	188	274	283	507	297	280	395	252	299	546	354
24	IL 19284	221	210	300	268	412	282	268	288	396	285	471	342
25	IL 19288	144	158	395	285	400	276	159	262	387	297	479	317
26	IL 19329	83	101	322	308	296	222	153	181	343	281	363	264
27	IL 19344	77	159	364	315	464	276	193	329	325	301	570	344
28	IL 19345	82	96	317	333	331	232	143	707	328	328	435	388
29	IL 19346	105	144	284	270	439	248	169	429	253	311	590	350
30	IL 19347	90	84	452	285	568	296	164	92	457	281	651	329
31	IL 19435	118	86	443	277	503	285	173	139	426	267	640	329
32	IL 19451	176	110	361	292	347	257	265	112	357	264	451	290
33	IL19204	320	96	363	312	310	280	400	169	322	276	349	303
34	IL19206	279	96	474	308	573	346	328	143	441	306	631	370
35	K. Hamsa	246	87	449	288	549	324	270	111	430	276	661	350
36	WGL-14	217	91	437	295	449	298	304	144	482	313	664	381
	Mean	**199**	**120**	**364**	**290**	**457**	**286**	**258**	**236**	**359**	**292**	**541**	**337**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			15.6**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				14.2	
	LSD (Location x Genotype)			66.2**									

Table 6.2.10 Screening of elite rice culture for drought tolerance on 1000 grain weight (g) at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	15.6	5.3	20.0	21.3	23.9	17.2	16.2	16.0	16.3	20.7	30.2	19.9
2	IL 19074	16.8	10.7	23.3	20.7	24.5	19.2	17.8	21.3	18.3	21.7	29.9	21.8
3	IL 19081	22.4	3.7	19.3	19.7	24.3	17.9	22.8	14.5	17.7	22.0	32.6	21.9
4	IL 19082	22.6	13.0	18.7	19.7	18.5	18.5	22.5	23.7	20.0	20.0	25.5	22.3
5	IL 19091	22.2	11.0	21.0	22.7	26.8	20.7	23.5	21.7	16.7	20.0	33.4	23.1
6	IL 19096	15.9	5.3	23.0	22.3	15.4	16.4	16.8	16.0	17.0	20.3	21.7	18.4
7	IL 19128	18.0	7.3	19.3	21.0	27.0	18.5	18.4	18.0	20.0	20.3	30.9	21.5
8	IL 19132	16.4	7.0	21.3	21.0	23.0	17.7	16.8	17.7	20.3	22.0	27.9	20.9
9	IL 19148	18.6	5.5	22.7	19.7	24.7	18.2	17.8	16.2	17.0	21.7	31.7	20.9
10	IL 19162	12.9	7.7	20.7	20.0	25.4	17.3	14.5	18.3	19.3	22.7	29.3	20.8
11	IL 19181	25.5	19.2	10.0	21.7	23.3	19.9	24.8	29.8	8.7	20.7	28.7	22.5
12	IL 19185	22.2	12.1	10.0	21.0	24.9	18.0	23.2	22.7	11.7	21.0	33.2	22.4
13	IL 19198	23.4	11.3	10.3	20.3	24.7	18.0	23.3	22.0	10.7	21.7	28.3	21.2
14	IL 19202	22.6	8.8	11.3	20.3	23.7	17.4	23.3	19.5	9.7	21.3	29.0	20.6
15	IL 19208	21.0	12.0	21.7	20.7	24.4	19.9	22.4	22.7	17.3	21.7	31.1	23.0
16	IL 19211	24.6	16.1	15.3	19.7	25.9	20.3	24.2	26.8	11.0	22.7	33.9	23.7
17	IL 19215	21.0	11.8	14.0	20.7	25.6	18.6	21.4	22.5	11.0	22.3	30.9	21.6
18	IL 19222	21.0	11.5	12.7	21.0	19.5	17.1	21.8	22.2	13.7	20.3	27.2	21.0
19	IL 19247	20.1	11.3	19.7	20.0	18.9	18.0	21.5	22.0	16.0	22.0	27.5	21.8
20	IL 19253	20.5	13.5	12.7	20.7	25.2	18.5	20.4	24.2	12.3	21.0	28.7	21.3
21	IL 19273	24.7	19.5	10.7	19.7	32.5	21.4	24.9	30.2	18.3	19.0	38.7	26.2
22	IL 19279	21.2	10.8	23.3	21.0	23.8	20.0	20.8	21.5	21.3	20.0	30.6	22.9
23	IL 19283	19.4	10.4	12.0	20.0	16.2	15.6	16.0	21.1	13.0	20.7	19.1	18.0
24	IL 19284	14.5	7.0	11.3	21.7	25.9	16.1	15.8	17.7	18.3	21.3	32.9	21.2
25	IL 19288	20.0	8.7	21.3	20.7	23.9	18.9	18.9	19.3	18.3	21.0	29.6	21.4
26	IL 19329	15.7	7.7	11.0	20.3	19.3	14.8	15.0	18.3	18.3	21.0	26.6	19.8
27	IL 19344	12.8	3.7	18.0	20.3	17.1	14.4	13.1	14.3	13.0	20.0	25.4	17.2
28	IL 19345	15.1	8.0	15.7	22.3	18.5	15.9	13.5	18.7	16.7	20.3	22.5	18.3
29	IL 19346	11.9	7.0	11.0	21.0	21.9	14.6	11.8	17.7	21.7	20.0	25.0	19.2
30	IL 19347	13.9	6.0	21.0	20.3	15.1	15.3	13.3	16.7	21.3	21.0	21.5	18.8
31	IL 19435	18.1	10.1	23.3	20.0	16.9	17.7	17.0	20.8	19.0	19.7	20.0	19.3
32	IL 19451	17.7	5.7	21.0	20.7	17.8	16.6	16.5	17.0	18.3	21.7	21.5	19.0
33	IL19204	23.3	6.3	17.3	20.7	17.7	17.1	24.2	17.0	14.7	22.0	26.7	20.9
34	IL19206	23.3	10.7	26.0	21.3	18.4	19.9	22.1	21.4	21.0	22.3	23.4	22.0
35	K. Hamsa	20.1	11.3	20.0	20.3	17.7	17.9	20.2	22.0	19.0	21.3	23.5	21.2
36	WGL-14	13.3	6.2	15.0	21.3	16.9	14.5	14.1	16.8	24.3	20.3	21.3	19.4
	Mean	**19.1**	**9.5**	**17.4**	**20.7**	**21.9**	**17.7**	**19.2**	**20.2**	**16.7**	**21.0**	**27.8**	**21.0**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			0.79**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				11.6	
	LSD (Location x Genotype)			3.35**									

Table 2.2.11 Screening of elite rice culture for drought tolerance on harvest index (%) at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	24.6	10.3	25.5	35.9	33.5	26.0	25.2	18.5	43.2	37.2	47.1	34.2
2	IL 19074	33.5	6.3	27.2	35.9	29.5	26.5	37.1	18.2	42.2	36.4	32.6	33.3
3	IL 19081	30.9	11.8	26.5	34.6	32.7	27.3	37.8	19.6	49.1	39.1	48.0	38.7
4	IL 19082	29.1	8.1	24.6	33.8	32.7	25.7	31.7	12.2	47.6	42.1	40.5	34.8
5	IL 19091	31.1	11.1	24.3	34.7	28.7	26.0	33.4	20.6	43.2	43.0	36.0	35.3
6	IL 19096	32.6	9.4	26.9	34.8	38.8	28.5	35.0	19.1	47.1	44.7	47.0	38.6
7	IL 19128	21.4	10.9	25.2	36.3	37.6	26.3	25.8	20.3	45.4	37.2	46.3	35.0
8	IL 19132	29.6	10.9	27.4	34.0	33.0	27.0	30.5	16.8	46.0	37.5	40.2	34.2
9	IL 19148	22.9	8.7	27.2	35.8	36.6	26.2	27.2	31.9	47.3	37.6	40.3	36.9
10	IL 19162	35.2	7.9	26.2	35.2	34.0	27.7	34.1	31.8	41.8	37.3	38.0	36.6
11	IL 19181	29.6	10.1	28.5	39.0	34.2	28.3	33.0	21.8	44.3	40.1	42.9	36.4
12	IL 19185	34.2	9.2	24.8	36.4	36.2	28.2	32.6	16.0	46.0	39.1	44.4	35.6
13	IL 19198	32.3	8.8	26.9	34.5	31.9	26.9	29.8	17.0	45.3	43.2	41.6	35.4
14	IL 19202	33.1	11.3	30.5	36.4	36.3	29.5	38.8	21.6	65.6	37.8	45.2	41.8
15	IL 19208	37.2	9.0	29.4	39.4	35.6	30.1	40.6	35.9	78.2	36.7	46.1	47.5
16	IL 19211	29.1	6.4	23.6	41.0	36.3	27.3	33.8	23.9	49.9	38.7	47.6	38.8
17	IL 19215	32.8	6.4	24.3	35.1	32.1	26.1	38.3	30.5	48.4	42.2	40.7	40.0
18	IL 19222	30.7	6.8	21.5	35.0	29.5	24.7	36.3	26.5	48.6	41.1	47.6	40.0
19	IL 19247	22.0	10.4	25.5	35.6	37.5	26.2	26.7	36.9	42.2	38.6	47.0	38.3
20	IL 19253	17.3	8.6	26.8	39.8	36.6	25.8	17.4	24.1	44.7	41.5	47.3	35.0
21	IL 19273	31.2	8.0	24.5	36.3	35.3	27.1	36.4	22.4	47.0	33.3	40.5	35.9
22	IL 19279	22.7	11.4	27.1	39.8	36.4	27.5	28.6	40.4	42.9	35.7	40.5	37.6
23	IL 19283	32.8	15.5	22.9	35.1	36.2	28.5	34.8	32.6	43.7	39.5	39.9	38.1
24	IL 19284	28.9	13.9	18.9	33.8	33.2	25.7	33.8	22.0	47.0	38.5	44.7	37.2
25	IL 19288	21.9	11.9	26.6	35.5	32.9	25.8	22.0	24.0	48.7	39.9	39.3	34.8
26	IL 19329	13.4	7.3	24.6	38.0	29.4	22.5	17.7	14.1	46.6	37.2	35.1	30.2
27	IL 19344	12.6	8.9	26.3	38.7	34.2	24.1	23.1	23.5	49.0	39.9	41.9	35.5
28	IL 19345	12.7	8.1	24.5	41.1	30.0	23.3	18.7	35.2	47.9	44.5	44.5	38.2
29	IL 19346	17.6	9.5	21.0	33.4	46.4	25.6	22.4	42.8	36.6	41.5	48.2	38.3
30	IL 19347	15.3	4.5	26.7	35.7	49.6	26.3	24.6	11.7	50.1	36.9	48.4	34.3
31	IL 19435	17.7	5.6	27.8	35.3	49.8	27.2	23.6	14.8	53.2	36.1	48.2	35.2
32	IL 19451	27.4	7.7	24.4	36.2	41.7	27.5	31.2	18.7	50.6	35.2	47.7	36.7
33	IL19204	35.5	19.8	29.3	41.1	31.7	31.5	39.5	24.4	47.9	36.8	44.6	38.7
34	IL19206	38.0	9.0	29.5	40.7	37.6	31.0	38.2	21.4	58.0	40.2	47.9	41.1
35	K. Hamsa	33.1	5.2	26.9	36.0	48.7	30.0	36.0	19.3	45.5	35.1	48.4	36.9
36	WGL-14	31.0	7.4	26.4	35.9	43.2	28.8	32.8	16.6	41.2	41.0	48.2	35.9
	Mean	**27.2**	**9.3**	**25.8**	**36.5**	**36.1**	**27.0**	**30.8**	**23.5**	**47.8**	**39.0**	**43.7**	**37.0**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			1.86**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				16.5	
	LSD (Location x Genotype)			7.88**									

Table 6.2.12 Screening of elite rice culture for drought tolerance on total dry matter (g/m2) maturity at different centers in Kharif 2021

S.No.	Genotypes	Drought					Grand Mean	Irrigated					Grand Mean
		NRRI	PTB	RAIPUR	RANCHI	REWA		NRRI	PTB	RAIPUR	RANCHI	REWA	
1	IL 19072	615	1213	1469	818	1367	1096	748	1418	868	748	1207	998
2	IL 19074	807	1400	1599	824	1058	1138	905	1301	975	746	1225	1030
3	IL 19081	832	1333	1420	821	1251	1131	865	859	769	741	1063	859
4	IL 19082	736	1552	1526	811	1327	1190	954	1444	874	769	1365	1081
5	IL 19091	659	933	1608	828	1050	1015	715	615	852	751	1141	815
6	IL 19096	690	1147	1492	839	1623	1158	869	1012	829	749	1413	974
7	IL 19128	698	1368	1374	818	1560	1163	725	1613	767	760	1358	1044
8	IL 19132	668	1479	1488	797	1254	1137	866	1403	890	741	1214	1023
9	IL 19148	681	1871	1498	818	1415	1257	816	1163	860	736	1387	992
10	IL 19162	771	1668	1470	833	1212	1191	815	912	922	740	1219	921
11	IL 19181	753	1188	1226	762	1199	1026	959	797	703	741	1054	851
12	IL 19185	804	1231	1193	755	1466	1090	880	826	670	764	1358	900
13	IL 19198	768	1017	1205	755	1120	973	849	789	685	732	958	802
14	IL 19202	789	807	1031	751	1446	965	808	872	436	740	1272	826
15	IL 19208	896	1047	1520	736	1438	1128	922	711	720	760	1280	879
16	IL 19211	770	2627	1320	736	1486	1388	817	1133	675	753	1275	930
17	IL 19215	624	2104	1138	774	1258	1180	793	732	476	746	1257	801
18	IL 19222	625	1371	1183	824	1348	1070	929	866	523	748	1275	868
19	IL 19247	722	1081	1390	822	1514	1106	824	826	860	748	1313	914
20	IL 19253	671	1201	1246	809	1480	1082	846	1178	687	740	1280	946
21	IL 19273	918	1369	1244	795	1417	1148	923	1101	587	760	1432	960
22	IL 19279	672	935	1597	810	1484	1100	673	776	960	779	1459	929
23	IL 19283	705	1303	1202	809	1401	1084	796	1237	581	758	1367	948
24	IL 19284	769	1561	1581	809	1240	1192	790	1446	844	737	1050	973
25	IL 19288	656	1399	1487	814	1216	1114	725	1100	797	745	1220	917
26	IL 19329	622	1406	1324	823	1008	1037	854	1285	737	757	1030	933
27	IL 19344	607	1807	1388	826	1354	1197	829	1491	664	755	1361	1020
28	IL 19345	642	1200	1325	821	1103	1018	764	2131	689	736	981	1060
29	IL 19346	593	1503	1359	815	946	1043	753	1134	693	752	1222	911
30	IL 19347	597	1885	1696	812	1146	1227	675	777	966	763	1346	905
31	IL 19435	668	1619	1606	795	1010	1140	734	961	819	738	1327	916
32	IL 19451	640	1426	1498	822	832	1044	836	608	706	750	945	769
33	IL19204	904	496	1240	760	979	876	1011	750	675	750	781	793
34	IL19206	747	1078	1607	758	1519	1142	864	693	838	761	1319	895
35	K. Hamsa	744	1646	1672	817	1130	1202	750	636	946	787	1366	897
36	WGL-14	703	1241	1657	833	1039	1094	923	881	1171	764	1378	1023
	Mean	**716**	**1375**	**1413**	**801**	**1269**	**1115**	**828**	**1041**	**770**	**751**	**1236**	**925**
	LSD (Treat)			ns				LSD (Treat x Genotype)				ns	
	LSD (Location x Treat)			55.5**				LSD (Location x Treat x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				15.5	
	LSD (Location x Genotype)			235.4**									

Table 6.2.13 Drought tolerance indices computed for different rice genotypes based on grain yield recorded under both irrigated and drought condition. Mean of all locations was used to compute the indices

Genotype	DSI	RDI	DTI	GMP	TOL	MP	YI	YSI	DI	SDI	HM	K1STI	K2STI
IL 19072	1.11	1.07	0.83	306.6	54.9	307.8	0.98	0.84	0.82	0.16	305.4	0.99	0.96
IL 19074	1.07	1.08	0.82	304.1	52.5	305.2	0.98	0.84	0.82	0.16	302.9	0.97	0.95
IL 19081	0.78	1.13	0.86	312.9	38.5	313.5	1.03	0.88	0.91	0.12	312.3	0.98	1.06
IL 19082	1.36	1.02	0.89	317.8	71.5	319.8	0.99	0.80	0.79	0.20	315.8	1.12	0.99
IL 19091	0.86	1.12	0.67	274.6	37.3	275.2	0.90	0.87	0.78	0.13	274.0	0.76	0.80
IL 19096	0.77	1.13	1.10	352.3	42.6	352.9	1.16	0.89	1.03	0.11	351.6	1.24	1.34
IL 19128	0.97	1.10	0.95	328.8	51.1	329.8	1.06	0.86	0.91	0.14	327.8	1.12	1.13
IL 19132	0.92	1.11	0.86	312.6	45.8	313.5	1.02	0.86	0.88	0.14	311.8	1.00	1.03
IL 19148	1.10	1.07	0.99	334.3	59.1	335.6	1.07	0.84	0.90	0.16	333.0	1.18	1.14
IL 19162	0.73	1.14	0.88	315.3	35.9	315.8	1.04	0.89	0.93	0.11	314.8	0.98	1.08
IL 19181	0.64	1.16	0.76	293.7	29.0	294.0	0.98	0.91	0.89	0.09	293.3	0.84	0.96
IL 19185	0.57	1.17	0.86	311.5	27.5	311.8	1.04	0.92	0.95	0.08	311.2	0.94	1.09
IL 19198	0.60	1.17	0.63	268.1	25.0	268.4	0.89	0.91	0.82	0.09	267.8	0.70	0.80
IL 19202	0.69	1.15	0.84	308.5	32.9	308.9	1.02	0.90	0.92	0.10	308.1	0.94	1.05
IL 19208	0.88	1.11	1.15	360.4	50.3	361.2	1.18	0.87	1.02	0.13	359.5	1.32	1.38
IL 19211	0.91	1.11	0.97	330.9	48.0	331.7	1.08	0.87	0.93	0.13	330.0	1.12	1.16
IL 19215	1.25	1.04	0.71	283.4	58.0	284.9	0.89	0.82	0.73	0.18	282.0	0.87	0.80
IL 19222	1.96	0.91	0.74	290.0	99.7	294.3	0.85	0.71	0.61	0.29	285.8	1.05	0.73
IL 19247	1.17	1.06	0.93	323.7	61.3	325.2	1.03	0.83	0.85	0.17	322.3	1.12	1.06
IL 19253	0.98	1.09	0.82	304.5	47.8	305.5	0.98	0.85	0.84	0.15	303.6	0.96	0.97
IL 19273	0.80	1.13	0.88	316.2	40.0	316.9	1.04	0.88	0.91	0.12	315.6	1.00	1.08
IL 19279	0.75	1.14	0.96	329.1	38.5	329.7	1.09	0.89	0.97	0.11	328.5	1.08	1.18
IL 19283	1.10	1.07	0.93	324.1	57.6	325.3	1.04	0.84	0.87	0.16	322.8	1.11	1.07
IL 19284	1.18	1.06	0.85	310.6	59.3	312.0	0.99	0.83	0.82	0.17	309.2	1.03	0.97
IL 19288	0.87	1.12	0.77	295.9	40.6	296.6	0.97	0.87	0.84	0.13	295.2	0.89	0.93
IL 19329	1.08	1.08	0.52	242.3	42.1	243.2	0.78	0.84	0.65	0.16	241.4	0.62	0.60
IL 19344	1.34	1.03	0.84	307.8	68.1	309.7	0.96	0.80	0.77	0.20	306.0	1.04	0.93
IL 19345	1.89	0.92	0.82	304.4	100.1	308.5	0.90	0.72	0.65	0.28	300.4	1.14	0.82
IL 193451	0.76	1.14	0.66	273.1	32.7	273.6	0.90	0.89	0.80	0.11	272.6	0.74	0.81
IL 19346	1.97	0.91	0.77	295.1	102.0	299.5	0.87	0.71	0.62	0.29	290.8	1.08	0.75
IL 19347	0.68	1.15	0.86	312.0	33.1	312.4	1.03	0.90	0.93	0.10	311.5	0.96	1.07
IL19204	0.51	1.18	0.75	291.4	22.7	291.6	0.98	0.93	0.91	0.07	291.1	0.81	0.96
IL19206	0.44	1.20	1.13	357.7	24.1	357.9	1.21	0.93	1.13	0.07	357.5	1.21	1.46
Krishna Hamsa	0.50	1.19	1.00	336.5	25.8	336.7	1.13	0.93	1.05	0.07	336.2	1.08	1.28
WGL-14	1.48	1.00	1.00	337.1	83.5	339.6	1.04	0.78	0.81	0.22	334.5	1.28	1.09
Mean	**0.99**	**1.09**	**0.86**	**310.49**	**49.69**	**311.67**	**1.00**	**0.85**	**0.86**	**0.15**	**309.33**	**1.01**	**1.01**

Ranking of drought tolerant indices and identification of relatively tolerant rice genotypes based on mean high mean rank and low SEm±

Genotypes	DSI	RDI	DTI	GMP	TOL	MP	YSI	DI	SDI	HM	K1STI	K2STI	Mean Rank	SEM
IL 19072	10	10	15	15	12	14	10	13	10	14	19	14	13	0.8
IL 19074	14	14	12	12	13	11	14	14	14	12	14	11	13	0.4
IL 19081	25	24	22	22	24	22	24	24	24	22	15	21	22	0.8
IL 19082	5	5	25	25	5	25	5	8	5	25	28	17	15	3.0
IL 19091	23	22	4	4	26	4	22	7	22	4	4	7	12	2.9
IL 19096	26	25	34	34	20	34	25	34	25	34	33	34	30	1.6
IL 19128	16	16	28	28	14	29	16	25	16	28	27	29	23	1.9
IL 19132	17	17	21	21	18	21	17	20	17	21	17	19	19	0.6
IL 19148	12	12	31	31	9	31	12	22	12	31	31	30	22	2.9
IL 19162	29	28	23	23	27	23	28	28	28	23	16	26	25	1.1
IL 19181	33	31	8	8	31	7	31	21	31	10	6	12	19	3.5
IL 19185	33	33	19	19	32	18	33	31	33	19	10	28	26	2.5
IL 19198	32	32	2	2	34	2	32	11	32	2	2	5	16	4.5
IL 19202	30	29	17	17	29	15	29	27	29	17	9	20	22	2.2
IL 19208	20	20	36	36	15	36	20	33	20	36	35	35	29	2.6
IL 19211	18	18	30	30	16	30	18	30	18	30	29	31	25	1.9
IL 19215	7	7	5	5	10	5	7	5	7	5	7	6	6	0.5
IL 19222	3	3	6	6	3	8	3	2	3	6	22	3	6	1.6
IL 19247	9	9	26	26	7	26	9	17	9	26	30	22	18	2.7
IL 19253	15	15	13	13	17	12	15	15	15	13	13	15	14	0.4
IL 19273	24	23	24	24	23	24	23	26	23	24	18	25	23	0.6
IL 19279	28	27	29	29	25	28	27	32	27	29	23	32	28	0.8
IL 19283	11	11	27	27	11	27	11	19	11	27	26	24	19	2.3
IL 19284	8	8	18	18	8	19	8	12	8	18	20	16	13	1.6
IL 19288	21	21	10	10	22	9	21	16	21	11	8	10	15	1.7
IL 19329	13	13	1	1	21	1	13	4	13	1	1	1	7	2.2
IL 19344	6	6	16	16	6	16	6	6	6	16	21	9	11	1.7
IL 19345	1	1	11	11	1	17	1	1	1	7	36	2	8	3.2
IL 19346	2	2	9	9	2	10	2	3	2	8	25	4	7	2.0
IL 19347	31	30	20	20	28	20	30	29	30	20	12	23	24	1.8
IL 19435	19	19	14	14	19	13	19	18	19	15	11	18	17	0.9
IL 19451	27	26	3	3	30	3	26	9	26	3	3	8	14	3.5
IL19204	34	34	7	7	36	6	34	23	34	9	5	13	20	4.0
IL19206	36	36	35	35	35	35	36	36	36	35	32	36	35	0.3
Krishna Hamsa	35	35	32	32	33	32	35	35	35	33	24	33	33	0.9
WGL-14	4	4	33	33	4	33	4	10	4	32	34	27	19	4.3

Selection for high yield and stability of performance under rainfed conditions

Genotypes	Mean Yield (g/m^2)	Yield Rank (Y^n)	Adj.rank	Adjustment to Yield rank (Y^n)	Stability Variance (σ_i^2)	Stability Rating (S)	YSi = (Y+S)	
IL 19072	280.4	14	-1	13	1519^{ns}	0	13	+
IL 19074	278.9	11	-1	10	24610**	-8	2	
IL 19081	294.3	21	1	22	4980^{ns}	-4	18	+
IL 19082	284.1	17	-1	16	617^{ns}	0	16	+
IL 19091	256.6	7	-2	5	16369**	-8	-3	
IL 19096	331.6	34	2	36	16728**	-8	28	+
IL 19128	304.3	29	1	30	14703**	-8	22	+
IL 19132	290.6	19	1	20	4718 ^{ns}	0	20	+
IL 19148	306.0	30	1	31	5216**	-4	27	+
IL 19162	297.9	26	1	27	5230**	-4	23	+
IL 19181	279.5	12	-1	11	2007 ^{ns}	0	11	
IL 19185	298.1	28	1	29	11770**	-8	21	+
IL 19198	255.9	5	-2	3	8493**	-8	-5	
IL 19202	292.5	20	1	21	8884**	-8	13	+
IL 19208	336.1	35	2	37	12949**	-8	29	+
IL 19211	307.7	31	1	32	7549**	-8	24	+
IL 19215	255.9	6	-2	4	4911*	-4	0	
IL 19222	244.5	3	-2	1	6259*	-4	-3	
IL 19247	294.5	22	1	23	10731**	-8	15	+
IL 19253	281.6	15	-1	14	12284**	-8	6	
IL 19273	296.8	25	1	26	9798**	-8	18	+
IL 19279	310.4	32	1	33	8871**	-8	25	+
IL 19283	296.5	24	1	25	12177**	-8	17	+
IL 19284	282.3	16	-1	15	11573**	-8	7	
IL 19288	276.3	10	-1	9	6187*	-4	5	
IL 19329	222.1	1	-3	-2	16616**	-8	-10	
IL 19344	275.7	9	-1	8	12799**	-8	0	
IL 19345	231.7	2	-3	-1	15371**	-8	-9	
IL 19346	248.5	4	-2	2	7142**	-8	-6	
IL 19347	295.9	23	1	24	25635**	-8	16	+
IL 19435	285.3	18	-1	17	12518**	-8	9	
IL 19451	257.2	8	-2	6	6540*	-4	2	
IL19204	280.2	13	-1	12	29248**	-8	4	
IL19206	345.9	36	3	39	11408**	-8	31	+
Krishna Hamsa	323.8	33	2	35	9119**	-8	27	+
WGL-14	297.9	27	1	28	4391 ^{ns}	0	28	+
Yield Mean	286.1			+ Selected Genotypes				
YS Mean	12.3	LSD (0.05): 26.7		Kong, M.S. 1993. Agronomy Journal. 85:754-757				

Selection for high yield and stability of performance under rainfed conditions

In order to simultaneously select genotypes with higher yield and stability of performance across locations under elevated temperature conditions, a parametric model for simultaneous selection in yield and stability "Shukla's stability variance and Kang's" statistic was performed and the results were presented in *(Table 6.2.15).*Based on their performance across locations and YSi values IL-19072, IL-19081, IL-18085, IL-19092, IL-190208, IL-19211, IL-19247, IL-19273, IL-19279, IL-19283, IL-19347, IL-19206, Krishna Hamsa and WGL-14 could be identified as stable genotypes under rainfed condition. Amongst the selected genotypes IL-19072, IL-19081, IL-19082, IL-19132 and WGL-14 show non-significant stability variance (σ_i^2). These genotypes have a higher yield and a lower variation and could be identified as relatively drought tolerant genotypes suitable for rainfed cultivation.

6.2.2 Screening of elite rice genotypes for drought tolerance during Rabi 2018-19 season at TTB

At Titabar centre (TTB) the trial was conducted during Rabi season of 2020-21. In this trial 26 rice genotypes from AVT-1E-DS trial of 2020 was included. The treatments consisted of rainfed (drought) and recommended irrigation. The mean tiller No./plant is an important trait which was significantly ($p<0.01$) affected by irrigation regime. The mean Tiller No./plant was reduced by >50% under rainfed treatment in comparison with irrigated control *(Table 6.2.2.1)*. The differences amongst the tested genotypes for mean tiller number was also found to significant($p<0.01$). Maximum reduction in tiller number was observed in RP 63389-24, IET-28258, IET-28825 and IR-64. Minimum reduction in tiller number was observed in KMR-3R followed by IET-28242. The interaction between genotype x treatment was also found to be significant *(Table 6.2.2.1).*

The mean Shoot weight (g/m2) was also reduced under rainfed treatment. The reduction in shoot weight under rainfed treatment was 63% in relation to control irrigated treatment *(Table 6.2.2.1).* The differences amongst the genotypes was also found to be significant ($p<0.01$). Maximum reduction in shoot weight was observed in IET 28248, RP63389-24, IET 28241, IET28242 and Anjali and minimum reduction was observed in KMR-3R, followed by N-22. In all the remaining entries the reduction varied between 40% to 70% reduction under rainfed treatment (*Table 6.2.2.1 & Fig.6.2.2.1[C])*

The panicle weight/m2 is another important yield attribute which was affected adversely under rainfed condition. The mean panicle weight was reduced by >27% in relation to irrigated control. Maximum reduction in panicle weight was observed in KMR-3R followed by IET 26753 and RP-633389-9. Minimum reduction was observed in IET28836, IET28834, IET28825, IET28258 and IR-64 in which the reduction is <10%. In the remaining entries the reduction varied between 14% to 45% under rainfed condition in relation to irrigated control (*Table 6.2.2.1 & Fig.6.2.2.2).*

No. of grains/ panicle was significantly ($p<0.01$) reduced (16% reduction) under rainfed condition. The differences in the mean number of grains was also found to be highly significant ($p<0.01$). The interaction between treatment x genotype was also found to statistically significant. Maximum reduction in grain number per panicle was observed in Anjali, IEt-28253 and IR-64. Minimum reduction was observed in GNV Ageti, IET28258, IET28836 and Vandana. In IET 288825 higher grain number per panicle was recorded. The increase in grain number was negligible in Vandana and N-22 *(Table 6.2.2.2 & Fig.6.2.2.2).*

Grain Yield (g/m2) was adversely affected under rainfed condition. Significant ($p<0.01$) reduction mean grain yield (37.9%) in comparison with irrigated control was observed. The interaction between treatment x genotype was also found to be significant ($p<0.01$). Maximum reduction in grain yield under rainfed condition was observed in IET-26753, RP 63389-9, IET29024 and IET28243. Minimum reduction in grain yield was observed in IET28836, IET28825 and IET28834 in which the reduction in grain yield is <20% in comparison with irrigated control. These genotypes can be identified as relatively drought tolerant genotypes (*Table 6.2.2.2 & Fig 6.2.2.1)*

Harvest Index (%) is an important yield attribute which was adversely affected under rainfed treatment. The mean HI was significantly ($p<0.01$) reduced by 19% in comparison with irrigated control. The interaction between treatment x genotype was found to be highly significant($p<0.01$). With the exception of GNV Agent all other tested entries recorded significant reduction HI under rainfed condition. Maximum reduction was noticed in IET28248, RP-63389-9, IR-64, IET28241 and Anjali in which the reduction is >30%. Minimum reduction in HI was observed in GNV Agent, IET28250, IET 28834 and IET 28241 (Table 6.2.2.4 & Fig No.6.6.2.2).

The mean 1000 grain weight was significantly reduced under rainfed treatment. The mean test weight was reduced by 3.6% under rainfed condition in comparison with irrigated control. The interaction between treatment x genotype was found to be significant. In IR-64, N-22, IET28248, IET26753, Vandana and Anjali the 1000 grain weight was not affected. However, in IET228241, IET28259 the reduction in test weight is >10%. In all the remaining entries only marginal reduction in 1000 grain weight was noticed (Table 6.2.2.2 & Fig.6.2.2.2).

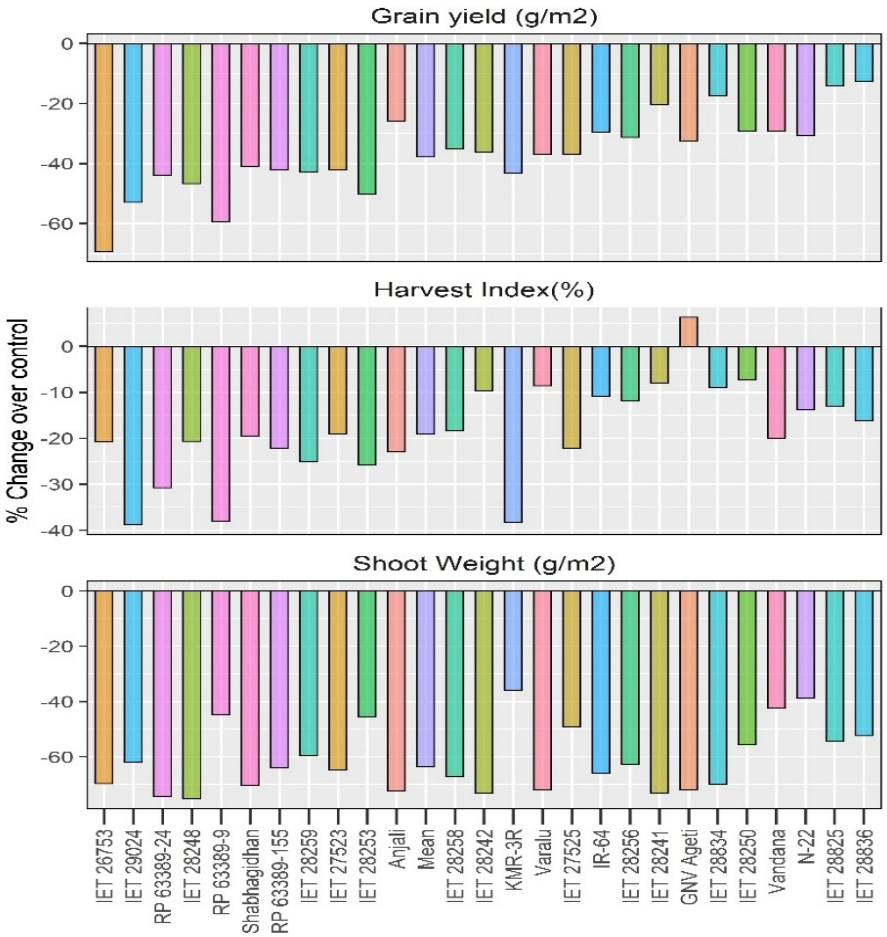


Fig.6.2.2.1: Influence of irrigation regimes on important physiological traits in selected rice genotypes at TTB centre during Rabi season. Each bar represents % change under rainfed condition in relation to irrigated control treatment.

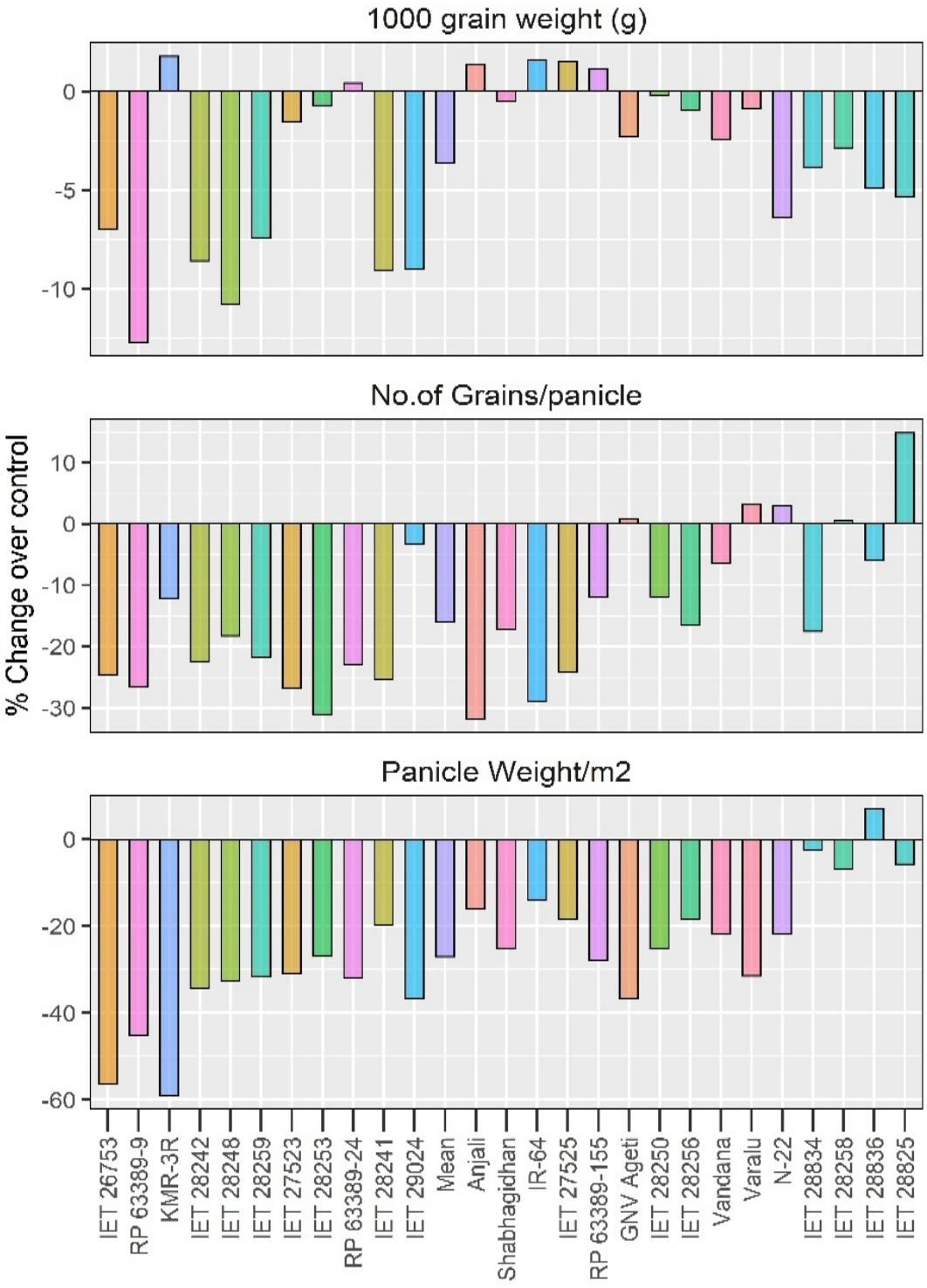


Fig.6.2.2.2: Influence of irrigation regimes on important physiological traits in selected rice genotypes at TTB centre during Rabi season. Each bar represents % change under rainfed condition in relation to irrigated control treatment.

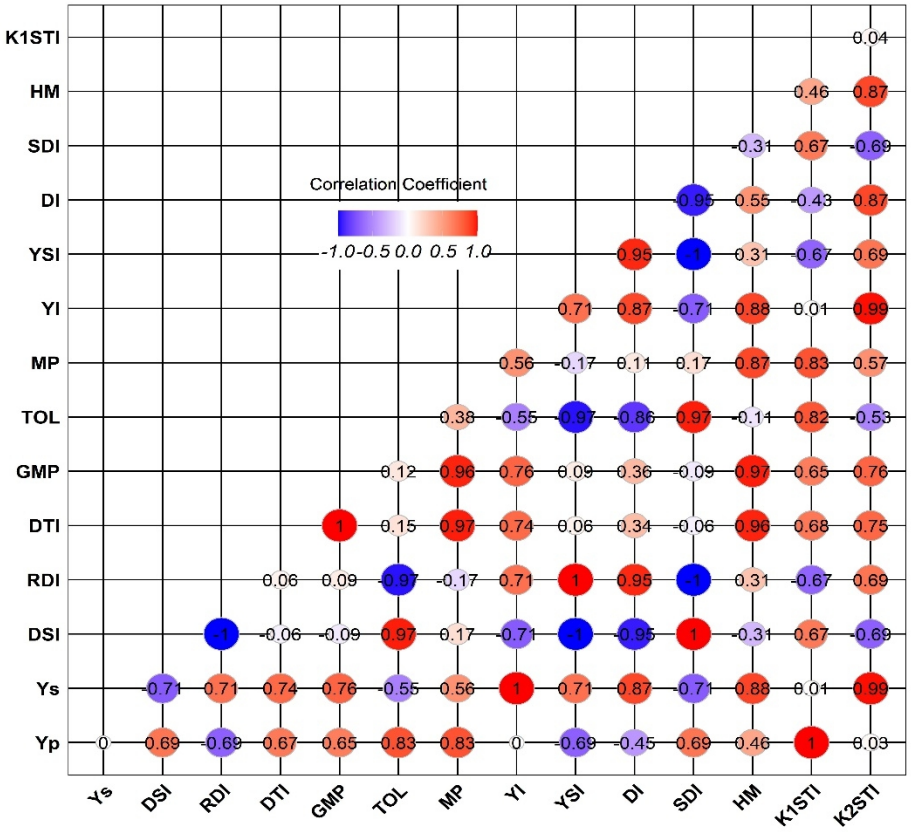


Fig.6.2.2.3: Relationship between different drought tolerance indices and grain yield recorded under Rainfed (Ys) and Irrigated control (Yp)

Different Drought tolerance indices including Drought susceptibility index(DSI), Relative Drought index (RDI), Drought tolerance index (DTI), Geometric mean productivity (GMP), Tolerance (TOL), Mean production (MP), Yield index (YI), Heat resistance index (HI), Yield stability index (YSI), Modified stress tolerance index (K1STI), were calculated. The data on the indices was presented in table 6.2.2.5 Genotypes were ranked for each index and the rank sum and mean rank and SEm was computed. Drought tolerant genotypes were identified based on the high mean rank and low SEm. The entries IET27523, IET28241, IET28242 could be identified as drought tolerant and are suitable for cultivation and rainfed conditions. Multiple correlation analysis between yield obtained under rainfed condition and the computed yield indices revealed a strong positive association between yield for BMP, MP, YSI, YI and strong negative relation was observed for DSI, TOL and, SDI these indices are useful for identification drought tolerant genotype.

Summary & Conclusions

A trial to study the drought tolerance traits of rice cultures with respect to yield and other attributes under dry spells was conducted with 36 introgression lines derived from multi-parent inter-crosses in the background of Krishna Hamsa during kharif-2021 season. The treatments consisted of two irrigation regimes (a) Irrigated as per the recommended schedule and (b) totally rain fed condition without any supplementary irrigation. At TTB centre the trial was conducted during Rabi (dry) season with 26 advanced breeding lines taken from AVT-1E-DS set of 2020. Results of Analysis of variance revealed that the mean Grain Yield (g/m2) (mean of all locations) show >15% reduction under rainfed condition in comparison with irrigated control. Maximum reduction in mean grain yield (mean of all genotypes) was observed at PTB centre(>48%) followed by NRRI (22%) and REWA. Minimum reduction in grain yield was observed in IL-19206, Krishna Hamsa, IL-19204, IL-19185, IL-19198, IL-19181 and IL-19347 in which the reduction in grain yield is <10% under rainfed condition. These genotypes could be identified as relatively tolerant to drought and suitable for rainfed cultivation. Based on drought indices computed from grain yield recorded under both irrigated as well as rainfed. The results revealed that IL-19206, Krishna Hamsa, IL-19096 and IL-19279, have high mean rank with low SEm± and may be considered as relatively drought tolerant. In order to simultaneously select genotypes with higher yield and stability of performance across locations under rain fed condition, a parametric model for simultaneous selection in yield and stability "Shukla's stability variance and Kang's" statistic was performed. Based on their performance across locations and YSi values IL-19072, IL-19081, IL-18085, IL-19092, IL-190208, IL-19211, IL-19247, IL-19273, IL-19279, IL-19283, IL-19347, IL-19206, Krishna Hamsa and WGL-14 could be identified as stable. Amongst the selected genotypes IL-19072, IL-19081, IL-19082, IL-19132 and WGL-14 show non-significant stability variance (σ_i^2). These genotypes have a higher yield and a lower variation and could be identified as relatively drought tolerant genotypes suitable for rainfed cultivation. At TTB centre, based on yield under rainfed condition the genotypes IET28836, IET28825 and IET28834 in which the reduction in grain yield is <20% in comparison with irrigated control. Based on drought tolerance indices the genotypes. The entries IET27523, IET28241, IET28242 could be identified as drought tolerant and are suitable for cultivation and rainfed conditions. Multiple correlation analysis between yield obtained under ranfed condition and the computed yield indices revealed a strong positive association between yield for BMP, MP, YSI, YI and strong negative relation was observed for DSI, TOL and, SDI these indices are useful for identification drought tolerant genotype.

Table 6.2.2.1 Influence of irrigation regimes on important physiological traits of rice genotypes at TTB centre during Rabi(dry) season 2020-21

Genotype	Tiller No./Plant			Shoot Weight (g/m2)			Panicle Weight/m2		
	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean
Anjali	10.0	5.0	7.5	1408.0	388.0	898.0	344.0	288.5	316.3
GNV Ageti	14.0	6.3	10.2	1016.0	286.5	651.3	357.0	226.5	291.8
IET 26753	12.0	4.7	8.3	843.0	255.0	549.0	419.5	182.5	301.0
IET 27523	15.0	8.3	11.7	1041.2	368.0	704.6	459.0	316.5	387.8
IET 27525	14.0	6.3	10.2	767.5	391.5	579.5	361.0	295.0	328.0
IET 28241	13.3	7.7	10.5	1611.5	430.0	1020.8	392.0	314.5	353.3
IET 28242	13.0	8.3	10.7	1393.0	374.5	883.8	467.0	306.5	386.8
IET 28248	18.0	10.0	14.0	1288.5	320.0	804.3	394.5	266.0	330.3
IET 28250	11.3	6.3	8.8	937.5	415.0	676.3	415.0	310.0	362.5
IET 28253	14.3	5.3	9.8	604.5	330.0	467.3	378.0	276.0	327.0
IET 28256	11.0	5.0	8.0	977.5	362.5	670.0	391.5	320.0	355.8
IET 28258	14.0	4.7	9.3	1104.0	362.5	733.3	356.0	331.5	343.8
IET 28259	13.0	5.0	9.0	1011.0	409.0	710.0	411.0	280.5	345.8
IET 28825	14.0	4.7	9.3	937.5	426.5	682.0	340.0	320.5	330.3
IET 28834	10.7	6.7	8.7	1295.0	388.0	841.5	312.5	304.5	308.5
IET 28836	11.7	7.3	9.5	878.5	420.0	649.3	320.0	342.0	331.0
IET 29024	13.0	6.7	9.8	956.0	362.5	659.3	452.0	286.5	369.3
IR-64	12.3	4.3	8.3	1003.0	342.5	672.8	352.5	303.0	327.8
KMR-3R	10.7	8.3	9.5	727.5	467.0	597.3	404.0	166.0	285.0
N-22	16.0	8.7	12.3	595.5	365.0	480.3	319.5	250.0	284.8
RP 63389-155	12.7	6.0	9.3	934.0	338.0	636.0	378.0	272.5	325.3
RP 63389-24	15.0	4.7	9.8	1567.0	399.5	983.3	417.5	283.5	350.5
RP 63389-9	13.0	4.7	8.8	856.0	471.5	663.8	498.5	274.0	386.3
Shabhagidhan	18.0	8.7	13.3	1070.0	315.5	692.8	364.0	272.5	318.3
Vandana	9.0	4.7	6.8	566.5	327.0	446.8	340.5	266.0	303.3
Varalu	11.7	4.3	8.0	1215.0	340.0	777.5	423.0	290.0	356.5
Mean	**13.1**	**6.3**	**9.7**	**1023.3**	**371.4**	**697.3**	**387.2**	**282.5**	**334.9**
LSD(Treat)		0.49**			10.8**			3.73**	
LSD(Genotype)		1.79**			39.1**			13.48**	
LSD(Treat x genotype)		2.52**			55.15**			19.4**	
CV(%)		12.14			3.69			4.1	

Table 6.2.2.2 Influence of irrigation regimes on important physiological traits of rice genotypes at TTB centre during Rabi(dry) season 2020-21

Genotype	No. of grains/Panicle			No. of spikelets/panicle			No. grains/m2		
	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean
Anjali	94.5	64.5	79.5	109	94	101	25107	12358	18732
GNV Ageti	57.0	57.5	57.3	73	79	76	15400	12834	14117
IET 26753	85.5	64.5	75.0	107	102	104	22459	11293	16876
IET 27523	108.5	79.5	94.0	124	107	115	25751	14297	20024
IET 27525	112.0	85.0	98.5	123	115	119	25915	14715	20315
IET 28241	90.5	67.5	79.0	104	94	99	16836	10808	13822
IET 28242	98.0	76.0	87.0	111	99	105	19393	13927	16660
IET 28248	82.0	67.0	74.5	105	96	100	21373	13736	17555
IET 28250	84.5	74.5	79.5	101	103	102	22159	16316	19237
IET 28253	116.0	80.0	98.0	131	109	120	27649	15613	21631
IET 28256	87.5	73.0	80.3	106	111	108	24883	14051	19467
IET 28258	94.5	95.0	94.8	105	123	114	24062	19360	21711
IET 28259	90.0	70.5	80.3	110	100	105	19571	13536	16553
IET 28825	77.5	89.0	83.3	90	105	97	18006	17353	17679
IET 28834	74.0	61.0	67.5	90	80	85	17862	12152	15007
IET 28836	83.0	78.0	80.5	99	93	96	19871	16046	17959
IET 29024	73.5	71.0	72.3	90	99	94	20159	13700	16930
IR-64	83.0	59.0	71.0	99	88	93	21132	13057	17094
KMR-3R	73.5	64.5	69.0	91	98	94	19904	11331	15617
N-22	52.0	53.5	52.8	62	78	70	14159	11486	12823
RP 63389-155	93.0	82.0	87.5	116	137	127	18728	13440	16084
RP 63389-24	118.0	91.0	104.5	144	130	137	23607	15801	19704
RP 63389-9	127.5	93.5	110.5	148	137	142	25491	14348	19920
Shabhagidhan	87.5	72.5	80.0	107	108	107	17969	13610	15789
Vandana	110.5	103.5	107.0	122	141	131	30797	20275	25536
Varalu	95.5	98.5	97.0	126	139	133	21559	19979	20769
Mean	**90.3**	**75.8**	**83.1**	**107**	**106**	**107**	**21531**	**14439**	**17985**
LSD(Treat)		1.26**			1.82**			369**	
LSD(Genotype)		4.55**			6.56**			1330**	
LSD(Treat x Genotype)		6.44**			9.32**			1882**	
CV(%)		3.61			4.07			4.88	

Table 6.2.2.3 Influence of irrigation regimes on important physiological traits of rice genotypes at TTB centre during Rabi (dry) season 2020-21

Genotype	No.Spikelets/m2			Grain yield (g/m2)		
	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean
Anjali	28851	17994	23423	288.0	213.5	250.8
GNV Ageti	19598	17639	18619	261.0	176.5	218.8
IET 26753	27971	17770	22870	353.0	108.5	230.8
IET 27523	29425	19141	24283	429.0	248.5	338.8
IET 27525	28602	19820	24211	350.5	221.0	285.8
IET 28241	19283	14971	17127	323.3	257.5	290.4
IET 28242	21970	18131	20051	423.3	269.5	346.4
IET 28248	27215	19679	23447	361.3	192.5	276.9
IET 28250	26369	22448	24408	334.0	236.0	285.0
IET 28253	31235	21176	26205	365.0	181.5	273.3
IET 28256	29995	21367	25681	341.0	234.5	287.8
IET 28258	26743	25007	25875	344.0	223.5	283.8
IET 28259	23934	19200	21567	378.5	216.0	297.3
IET 28825	20918	20375	20646	288.5	247.5	268.0
IET 28834	21740	15915	18827	266.0	220.0	243.0
IET 28836	23700	19107	21403	272.0	237.5	254.8
IET 29024	24548	19013	21780	380.5	179.0	279.8
IR-64	25101	19317	22209	319.5	225.5	272.5
KMR-3R	24666	17122	20894	314.0	178.0	246.0
N-22	16864	16725	16795	281.5	195.5	238.5
RP 63389-155	23339	22474	22907	365.5	211.0	288.3
RP 63389-24	28880	22473	25676	368.5	207.0	287.8
RP 63389-9	29519	21018	25269	446.5	181.5	314.0
Shabhagidhan	21878	20272	21075	355.0	209.0	282.0
Vandana	33878	27646	30762	305.0	216.0	260.5
Varalu	28444	28203	28324	345.0	218.0	281.5
Mean	**25564**	**20154**	**22859**	**340.8**	**211.7**	**276.2**
LSD(Treat)		522**			2.62**	
LSD(Genotype)		1882**			9.45**	
LSD(Treat x Genotype)		2662**			13.38**	
CV(%)		5.54			2.6	

Table 6.2.2.4 Influence of irrigation regimes on important physiological traits of rice genotypes at TTB centre during Rabi(dry) season 2020-21

Genotype	1000 grain weight (g)			HI(%)		
	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean
Anjali	22.0	22.3	22.2	37.6	29.0	33.3
GNV Ageti	17.6	17.2	17.4	32.4	34.5	33.4
IET 26753	18.6	17.3	17.9	36.0	28.5	32.2
IET 27523	22.8	22.4	22.6	43.6	35.3	39.5
IET 27525	22.8	23.1	22.9	43.5	33.9	38.7
IET 28241	24.3	22.1	23.2	38.0	34.9	36.4
IET 28242	25.1	22.9	24.0	40.9	37.0	38.9
IET 28248	23.2	20.7	22.0	40.1	31.8	35.9
IET 28250	23.0	23.0	23.0	36.5	33.9	35.2
IET 28253	20.4	20.2	20.3	42.9	31.8	37.3
IET 28256	20.5	20.3	20.4	39.6	34.9	37.2
IET 28258	22.8	22.2	22.5	42.1	34.4	38.2
IET 28259	23.6	21.8	22.7	41.5	31.1	36.3
IET 28825	23.4	22.1	22.7	35.4	30.9	33.1
IET 28834	23.3	22.4	22.9	36.6	33.3	34.9
IET 28836	22.4	21.3	21.8	35.6	29.9	32.8
IET 29024	22.2	20.2	21.2	42.4	26.0	34.2
IR-64	21.9	22.3	22.1	40.1	35.7	37.9
KMR-3R	19.8	20.1	19.9	34.4	21.2	27.8
N-22	19.5	18.3	18.9	34.9	30.1	32.5
RP 63389-155	18.0	18.2	18.1	39.5	30.7	35.1
RP 63389-24	23.4	23.5	23.4	41.6	28.8	35.2
RP 63389-9	25.6	22.4	24.0	43.4	26.9	35.1
Shabhagidhan	20.5	20.4	20.5	43.4	35.0	39.2
Vandana	20.5	20.0	20.3	41.0	32.9	36.9
Varalu	17.6	17.5	17.5	36.1	33.0	34.6
Mean	**21.7**	**20.9**	**21.3**	**39.2**	**31.7**	**35.5**
LSD(Treat)		0.15**			0.65**	
LSD(Genotype)		0.55**			2.35**	
LSD(Treat x Genotype)		13.4**			3.33**	
CV(%)		11.69			14.23	

Table 6.2.2.5 Drought tolerant indices of different rice genotypes. The indices were computed from grain yield recorded under rainfed and normal irrigated conditions at TTB centre during Rabi 2020-21 season

Genotypes	DSI	RDI	DTI	GMP	TOL	MP	YI	YSI	DI	SDI	HM	K1STI	K2STI
Anjali	0.68	1.19	0.53	248	75	251	1.01	0.74	0.75	0.26	245	0.71	1.02
GNV Ageti	0.85	1.09	0.40	215	85	219	0.83	0.68	0.57	0.32	211	0.59	0.70
IET 26753	1.83	0.49	0.33	196	245	231	0.51	0.31	0.16	0.69	166	1.07	0.26
IET 27523	1.11	0.93	0.92	327	181	339	1.17	0.58	0.68	0.42	315	1.59	1.38
IET 27525	0.98	1.01	0.67	278	130	286	1.04	0.63	0.66	0.37	271	1.06	1.09
IET 28241	0.54	1.28	0.72	289	66	290	1.22	0.80	0.97	0.20	287	0.90	1.48
IET 28242	0.96	1.02	0.98	338	154	346	1.27	0.64	0.81	0.36	329	1.54	1.62
IET 28248	1.23	0.86	0.60	264	169	277	0.91	0.53	0.49	0.47	251	1.12	0.83
IET 28250	0.77	1.14	0.68	281	98	285	1.11	0.71	0.79	0.29	277	0.96	1.24
IET 28253	1.33	0.80	0.57	257	184	273	0.86	0.50	0.43	0.50	242	1.15	0.74
IET 28256	0.82	1.11	0.69	283	107	288	1.11	0.69	0.76	0.31	278	1.00	1.23
IET 28258	0.93	1.05	0.66	277	121	284	1.06	0.65	0.69	0.35	271	1.02	1.11
IET 28259	1.13	0.92	0.70	286	163	297	1.02	0.57	0.58	0.43	275	1.23	1.04
IET 28825	0.38	1.38	0.61	267	41	268	1.17	0.86	1.01	0.14	266	0.72	1.37
IET 28834	0.46	1.33	0.50	242	46	243	1.04	0.83	0.86	0.17	241	0.61	1.08
IET 28836	0.33	1.41	0.56	254	35	255	1.12	0.87	0.98	0.13	254	0.64	1.26
IET 29024	1.40	0.76	0.59	261	202	280	0.85	0.47	0.40	0.53	243	1.25	0.71
IR-64	0.78	1.14	0.62	268	94	273	1.07	0.71	0.75	0.29	264	0.88	1.13
KMR-3R	1.14	0.91	0.48	236	136	246	0.84	0.57	0.48	0.43	227	0.85	0.71
N-22	0.81	1.12	0.47	235	86	239	0.92	0.69	0.64	0.31	231	0.68	0.85
RP 63389-155	1.12	0.93	0.66	278	155	288	1.00	0.58	0.58	0.42	268	1.15	0.99
RP 63389-24	1.16	0.90	0.66	276	162	288	0.98	0.56	0.55	0.44	265	1.17	0.96
RP 63389-9	1.57	0.65	0.70	285	265	314	0.86	0.41	0.35	0.59	258	1.72	0.74
Shabhagidhan	1.09	0.95	0.64	272	146	282	0.99	0.59	0.58	0.41	263	1.09	0.97
Vandana	0.77	1.14	0.57	257	89	261	1.02	0.71	0.72	0.29	253	0.80	1.04
Varalu	0.97	1.02	0.65	274	127	282	1.03	0.63	0.65	0.37	267	1.03	1.06
Mean	**0.97**	**1.02**	**0.62**	**267**	**129**	**276**	**1.00**	**0.63**	**0.65**	**0.37**	**258**	**1.02**	**1.02**

Table 6.2.2.6 Ranking of different drought tolerance indices and identification of tolerant rice genotypes at TTB centre during Rabi season of 2020-21

Genotypes	DSI	RDI	DTI	GMP	TOL	MP	YI	YSI	DI	SDI	HM	K1STI	K2STI	Mean Rank	Sem
Anjali	5	5	6	6	22	6	12	5	18	22	8	5	12	10	1.8
GNV Ageti	11	11	2	2	21	1	2	11	8	16	2	1	2	7	1.8
IET 26753	26	26	1	1	2	2	1	26	1	1	1	16	1	8	3.0
IET 27523	17	17	25	25	5	25	24	17	15	10	25	25	24	20	1.8
IET 27525	15	15	19	19	13	18	17	15	14	12	20	15	17	16	0.7
IET 28241	4	4	24	24	23	22	25	4	24	23	24	10	25	18	2.5
IET 28242	13	13	26	26	10	26	26	13	22	14	26	24	26	20	1.8
IET 28248	22	22	11	11	6	12	7	22	6	5	9	18	7	12	1.8
IET 28250	7	7	20	20	17	17	21	7	21	20	22	11	21	16	1.7
IET 28253	23	23	9	9	4	11	5	23	4	4	6	19	5	11	2.2
IET 28256	10	10	21	21	16	19	20	10	20	17	23	12	20	17	1.3
IET 28258	12	12	17	17	15	16	18	12	16	15	19	13	18	15	0.7
IET 28259	19	19	23	23	7	23	13	19	11	8	21	22	13	17	1.6
IET 28825	2	2	12	12	25	9	23	2	26	25	16	6	23	14	2.6
IET 28834	3	3	5	5	24	4	16	3	23	24	5	2	16	10	2.5
IET 28836	1	1	7	7	26	7	22	1	25	26	11	3	22	12	2.9
IET 29024	24	24	10	10	3	13	4	24	3	3	7	23	4	12	2.5
IR-64	8	8	13	13	18	10	19	8	19	19	14	9	19	14	1.3
KMR-3R	20	20	4	4	12	5	3	20	5	7	3	8	3	9	1.9
N-22	9	9	3	3	20	3	8	9	12	18	4	4	8	8	1.5
RP 63389-155	18	18	18	18	9	21	11	18	9	9	18	20	11	15	1.3
RP 63389-24	21	21	16	16	8	20	9	21	7	6	15	21	9	15	1.7
RP 63389-9	25	25	22	22	1	24	6	25	2	2	12	26	6	15	2.9
Shabhagidhan	16	16	14	14	11	15	10	16	10	11	13	17	10	13	0.7
Vandana	6	6	8	8	19	8	14	6	17	21	10	7	14	11	1.5
Varalu	14	14	14	15	14	14		14	13	13	17	14	15	14	0.3

6.3 Screening for high temperature tolerance in rice genotypes

Locations: CHN, IIRR, MTU, PNR, PTB, REWA, TTB

Heat stress (HS) caused by rapidly warming climate has become a serious threat to global food security. Rice (*Oryzasativa* L.) is a staple food crop for over half of the world's population, and its yield and quality are often reduced by HS. There is an urgent need for breeding heat-tolerant rice cultivars. Rice plants show various morphological and physiological symptoms under HS. Precise analysis of the symptoms (phenotyping) is essential for the selection of elite germplasm and the identification of thermo-tolerance genes. The objectives of this work is to screen rice cultivars for high temperature tolerance and to understand the impact of high temperature stress on rice .The trial was conducted in 7 AICRIP centres with 25 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.

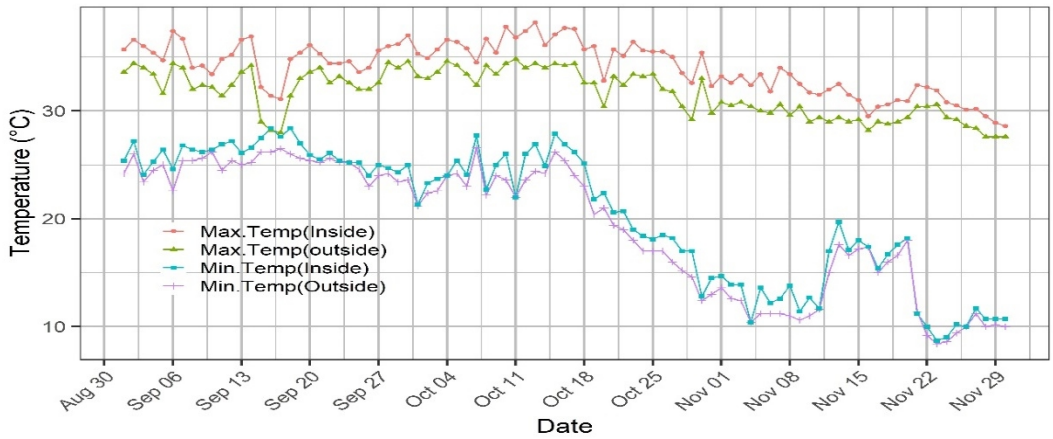


Fig. 6.3.1 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at Rewa centre during Kharif-2021.

The mean maximum temperature recorded at Rewa centre during reproductive stage is >4.5°C higher inside the polythene tunnel than ambient temperature recorded during the same period. Similarly, the mean minimum temperature was >1.4°C higher inside the polythene tunnel than ambient temperature at Rewa (Fig.6.3.1). The mean maximum temperature recorded during reproductive stage is > 4.7°C higher inside the polythene tunnel than ambient temperature

recorded during the same period. Similarly, the mean minimum temperature was >0.91°C higher inside the polythene tunnel than ambient temperature at TTB centre *(Fig.6.3.2).* At PNR centre, mean maximum temperature recorded during reproductive period is >9.8°C higher inside polythene tunnel than ambient temperature recorded. Similarly, the mean minimum temperature is >1.1°C higher inside the polythene tunnel (*Fig.6.3.3).* At MTU centre mean maximum temperature recorded during reproductive phase of the crop is 5.9°C higher and mean minimum temperature is 2.0°C higher inside the polythene tunnel than ambient temperature outside the polythene tunnel (Fig.6.3.4). Similarly, at IIRR Hyderabad, the mean maximum temperature recorded during the reproductive stage is 10.2°C higher inside the polythene tunnel than the mean temperature recorded during corresponding period. The mean minimum temperature inside the polythene tunnel is 0.67°C higher than minimum temperature recorded outside the polythene tunnel (Fig.6.3.5).

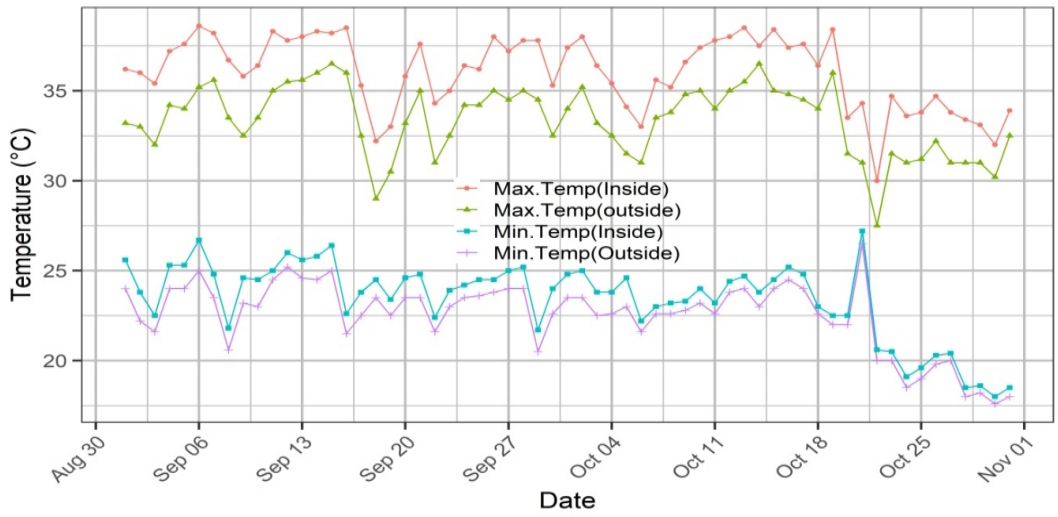


Fig. 6.3.2 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at Titabar (TTB) centre during Kharif-2021.

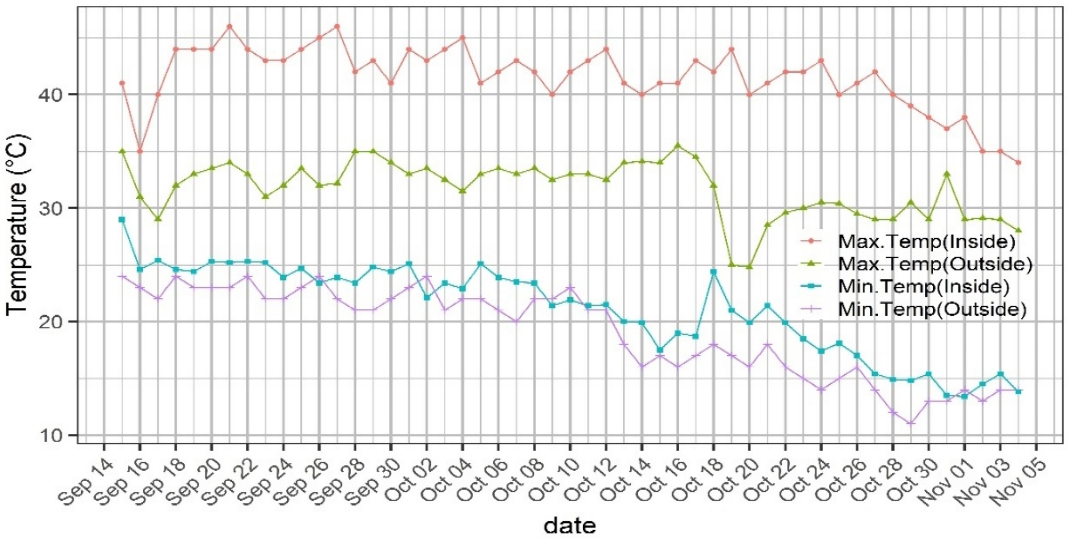


Fig. 6.3.3 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at GBPUA & T, Pantnagar (PNR) centre during Kharif-2021.

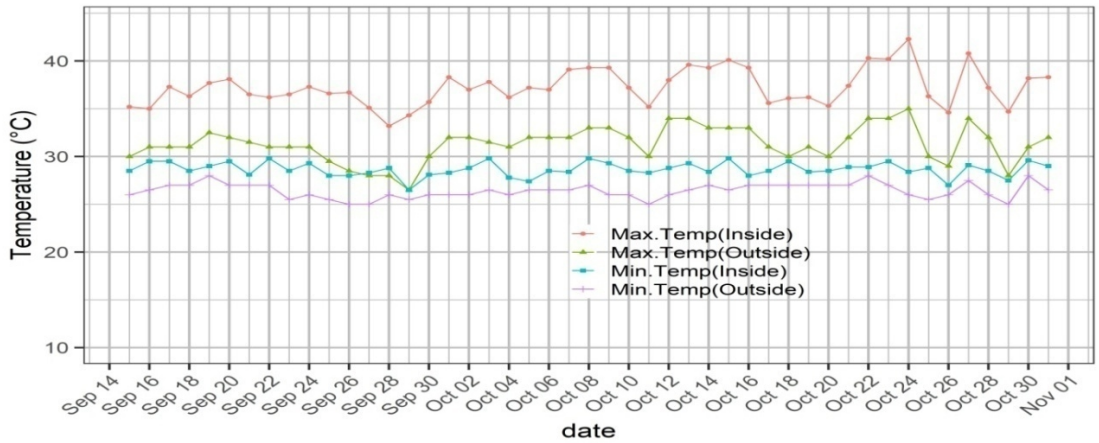


Fig. 6.3.4 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at IIRR, Hyderabad (IIRR) centre during Kharif-2021.

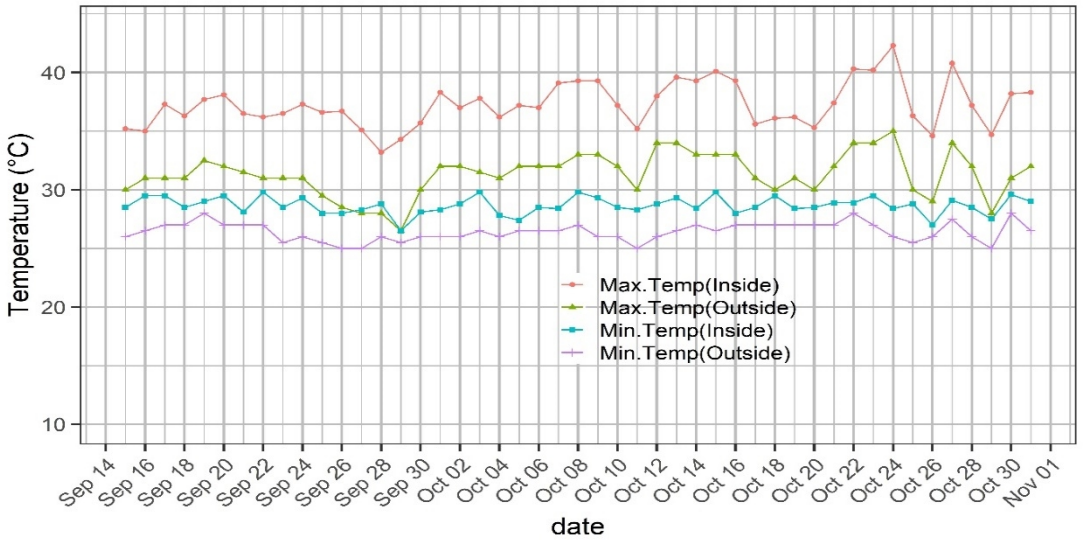


*Fig. 6.3.5 Maximum and minimum temperatures recorded between **PI and maturity stages** of rice crop inside and outside (ambient) the polythene tunnel **at MARUTERU (MTU)** centre during Kharif-2021.*

Exposure to elevated temperature during reproductive stage did not affected the mean days to flowering (mean of all entries and locations). However, the interaction between location and treatment was found to be significant ($p<0.01$). The differences between the genotypes was found to be significant ($p<0.01$). The interaction between genotype x location was also significant implying that the genotypes behaved differently at different locations. The interaction between Genotype x Treatment was also found to be significant indicating that the genotypes behaved differently under different temperature regimes *(Table 6.3.1).* The three-way interaction between Treatment x Genotype x Location was also found to be significant.

The mean days for physiological maturity (DM) (mean of all genotypes and locations) was found to be statistically non-significant between the temperature regimes, when pooled analysis for all the centres was performed. The mean DM under ambient control condition for all the tested genotypes was 126 days where as under elevated temperature inside the polythene tunnel, it was 120 days indicating that exposure to elevated temperature shortened the maturity period. Amongst the tested entries IET29950, IET29952, CO-51 and IET299549 matured early (>20 days) under elevated temperatures. For all other entries the difference in DM between the treatments was <5 days (*Table 6.3.2)*.

The mean shoot weight (g/m^2) recorded at maturity was reduced by elevated temperature by <14% in comparison with control temperature *(Table 6.3.3).* The interaction between Treatment x Location was found to be significant *($p<0.01$).* The differences between the tested entries were also found to be significant(*$p<0.05$).* The data also revealed significant Treat x Genotype interaction (*$p<0.05$).* The three-way interaction between Treatment x Genotype x Location was also found to be highly significant ($p<-0.01$) implying that the genotypes behaved differently at different locations and temperature regimes. The reduction in shoot weight under elevated temperature is maximum at TTB (30%) followed by PNR (<20%), MTU, PTB and IIRR. However, REWA the differences between the treatments is only 3% and at CHN no effect was observed. Maximum reduction in shoot weight was noticed in IET29957 (32%) followed by IET29953, IET29960, IET29951. In all other genotypes the mean shoot weight reduction under elevated temperature was between 5 to 20%. However, in genotypes like IET29948, IET29946 and 29173(R) the reduction is <5% in comparison with control temperature *(Fig 6.3.6).*

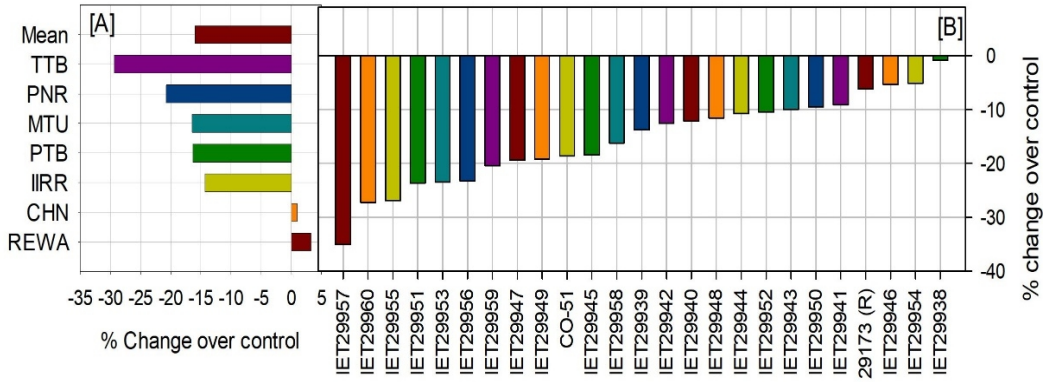


Fig. 6.3.6 : Influence of elevated temperature on shoot weight (g/m^2) recorded at maturity. Each bar represents % change in shoot weight under elevated temperature in comparison with control. [A] Mean of all genotypes [B] Mean of all locations.

Number of Panicles/m^2 (PanNo) is an important yield attribute which was recorded. Combined analysis of variance for all the centres indicate that exposure to elevated temperature during reproductive stage has no significant influence on PanNo. However, it was noticed that the mean PanNo for all genotypes and locations show >8% reduction in PanNo. It was also observed that the interaction between location x treatment and location x genotype was found to be significant ($p<0.01$) implying that the tested entries behaved differently at different locations(*Table 6.3.4).* However, the interaction between Treatment x Genotype was found non-significant. Maximum reduction in PanNo was observed at PNR centre (16%) followed by MTU (11%). Minimum effect was observed at PTB centre(<3% reduction). Maximum reduction in mean PanNo was observed in IET29941 followed by IET29959. Minimum effect was observed in CO-51, IET29950 and IET29956 *(Fig.6.3.7)*

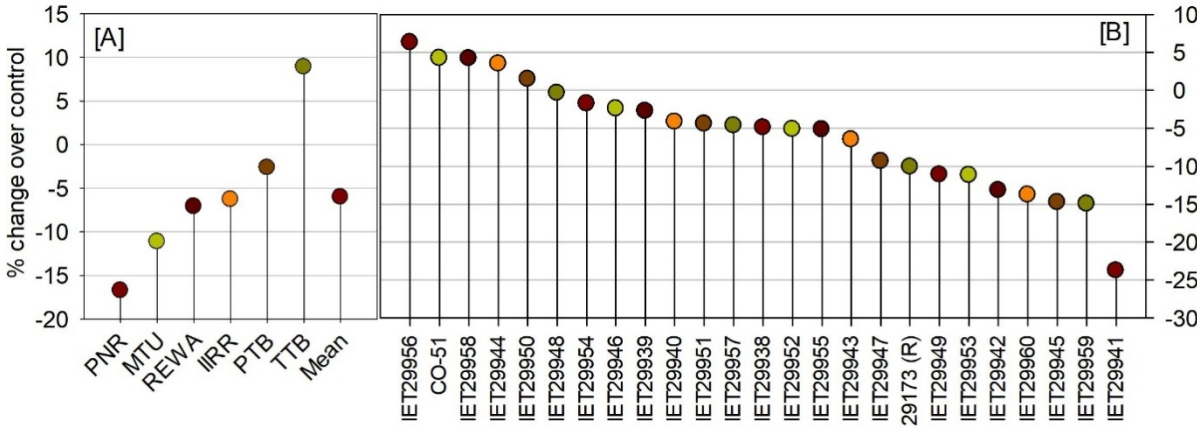


Fig. 6.3.6 : Influence of elevated temperature on Number of Panicles/m^2*recorded at maturity. Each bar represents % change in shoot weight under elevated temperature in comparison with control. [A] Mean of all genotypes [B] Mean of all locations.*

Number of filled grains per panicle (GNoPan) was measured after harvesting the crop. The GNoPan was reduced by >20% under elevated temperature inside the polythene tunnel in

comparison with plants grown outside the polythene tunnel (Control). Maximum reduction in mean GNoPan for all genotypes was observed at REWA centre (80%) followed by IIRR (17%) and MTU. At PTB and PNR centre the reduction is negligible. Similarly, the reduction caused by exposure to elevated temperature ranged from 32% (IET2994) followed by IET29955 to 1.48% (IET29940)*(Table 6.3.8& Fig.6.37).*

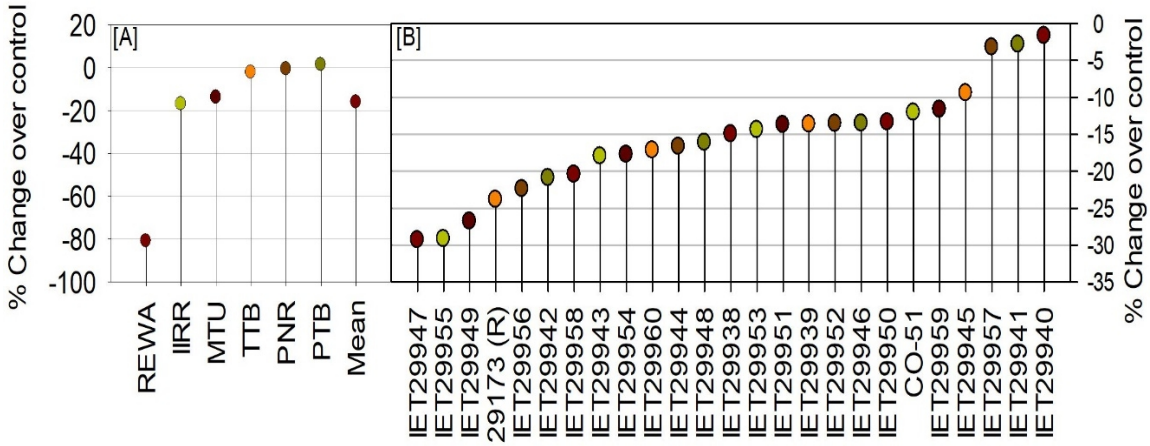


Fig. 6.3.7: Influence of elevated temperature on No. of filled grains/Panicle recorded at maturity. Each bar represents % change in shoot weight under elevated temperature in comparison with control. [A] Mean of all genotypes [B] Mean of all locations

Exposure to high temperature after anthesis results in spikelet sterility in rice which is the main reason for yield loss. Number of unfilled grains per panicle was measured for each genotype. The mean number of unfilled grains (mean of all genotypes and locations) increased from 25 under control condition to 88 under elevated temperature treatment. Significant differences were noticed amongst the location mean for number of unfilled grains. Maximum increase was observed at REWA and minimum increase was observed at PTB centre. The entry IET29949 show maximum number of unfilled grains under elevated temperature followed by IET29960 and IET29938.

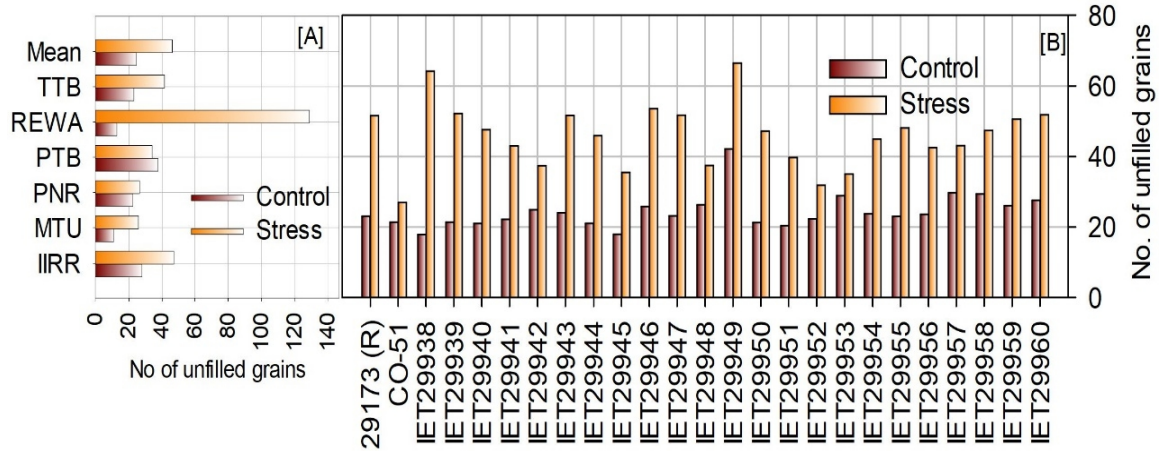


Fig. 6.3.8 : Influence of elevated temperature on No. of Unfilled grains/Panicle recorded at maturity. [A] Mean of all genotypes [B] Mean of all locations

The mean Grain yield (mean of all genotypes and locations) was reduced by >35% under elevated temperature *(Table 6.3.9)*. The interaction between location x treatment was found to be highly significant ($p<0.01$). The mean grain yield (mean of all genotypes) was reduced amongst the locations also. Maximum reduction was observed at REWA (86% reduction) followed by MTU and IIRR. Minimum reduction was observed at PNR and PTB(>10% reduction).

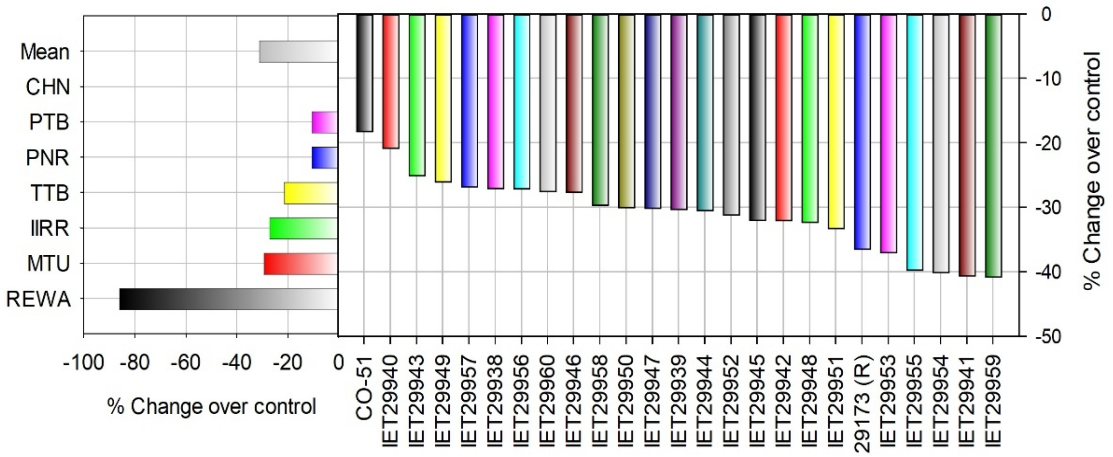


Fig. 6.3.9: Influence of elevated temperature on grain yield (g/m^2) recorded at maturity. Each bar represents % change in shoot weight under elevated temperature in comparison with control. [A] Mean of all genotypes [B] Mean of all locations

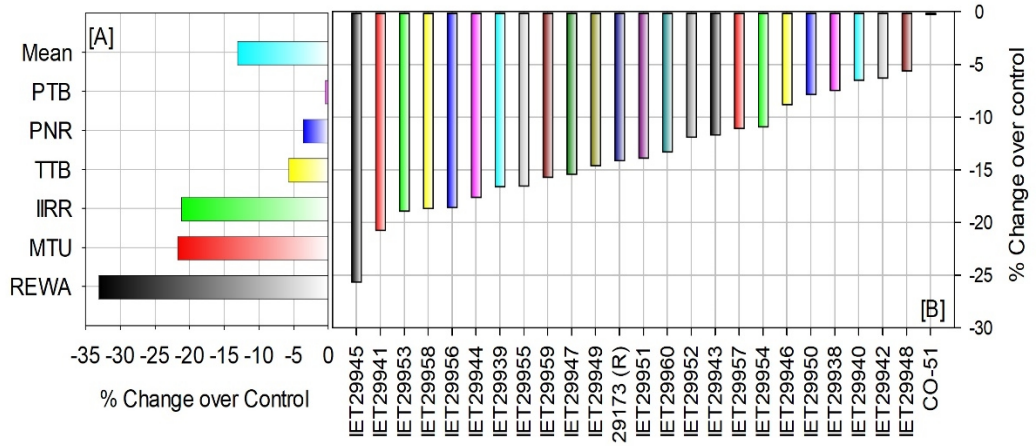


Fig. 6.3.10: Influence of elevated temperature on TDM (g/m^2) recorded at maturity. Each bar represents % change in shoot weight under elevated temperature in comparison with control. [A] Mean of all genotypes [B] Mean of all locations

The reduction in mean grain yield (mean of all locations) varied amongst the tested genotypes. Maximum reduction was noticed in case of IET29941 followed by IET29959 and IET29954 and minim reduction in mean grain yield was noticed in case of CO-51 (22% reduction) followed by IET29940. In all other entries the reduction in grain yield is >25% under elevated temperature treatment inside polythene tunnel in comparison with ambient condition *(Fig. 6.3.9)*.

Similarly, the mean above ground total dry matter (TDM) recorded after harvest was reduced by >14% (mean of all genotypes and locations). The interaction between treatment x location was found to be significant ($p<0.01$). The differences between the genotypes in the mean TDM (mean of all locations) was also found to be significant ($p<0.05$). The interaction between location x genotype and genotype x treatment was found to be highly significant ($p<0.01$).

Maximum reduction in TDM was observed under elevated temperature treatment at REWA centre (<33%) followed by MTU and IIRR. Least reduction was noticed at TTB (6%), PTB (0.84%) and PNR (3.6%). The reduction in TDM amongst the genotypes was also found to be significant. Maximum reduction was observed in IET29945, IET29953 and IET 29958 in which the reduction in TDM under elevated temperature was <20% in comparison to control treatment. The reduction in TDM was lowest in case of CO-1 followed by IET29948, IET29946 and IET29942 *(Fig.6.3.10)*.

The mean test weight (mean of all genotypes and locations) was significantly ($p<0.05$) reduced by elevated temperature (5.9% reduction in comparison with control). The interactions between

location x treatment and location x genotype was also found to highly significant ($p<0.01$). The differences between the tested genotypes was also found to be significant ($p<0.05$). The genotype IET29939 followed by IET29958 recorded highest 1000 grain weight. Low test weight was recorded by IET29954 followed by IET29939 and IET29949 (*Table 6.3.11)*

The mean Harvest Index (HI) (mean of all genotypes and locations) was reduced by 20% under elevated temperature in comparison with control treatment. Combined analysis for all locations revealed a significant interaction between location x treatment, indicating that the treatment effect varied from location to location. Maximum reduction in HI was observed in REWA centre where in the HI was reduced by <80% under elevated temperature in comparison with ambient control followed by TTB (16%), MTU (10.3%) and 11% at PTB. Least reduction was observed at IIRR centre (8%) (Fig.6.3.11). The interaction between treatment x genotype was found to be significant ($p<0.01$) indicating that the tested genotypes differ in their response to elevated temperature. Maximum reduction (>28%) in HI was observed in 29173(R) followed by IET29949,IET29960 and IET29954. Minimum reduction in HI was observed in case of IET29958, CO-1, IET29950 and IET29957. In all other entries the reduction varied between 10 to 20% in comparison with ambient control (Table 6.3.12).

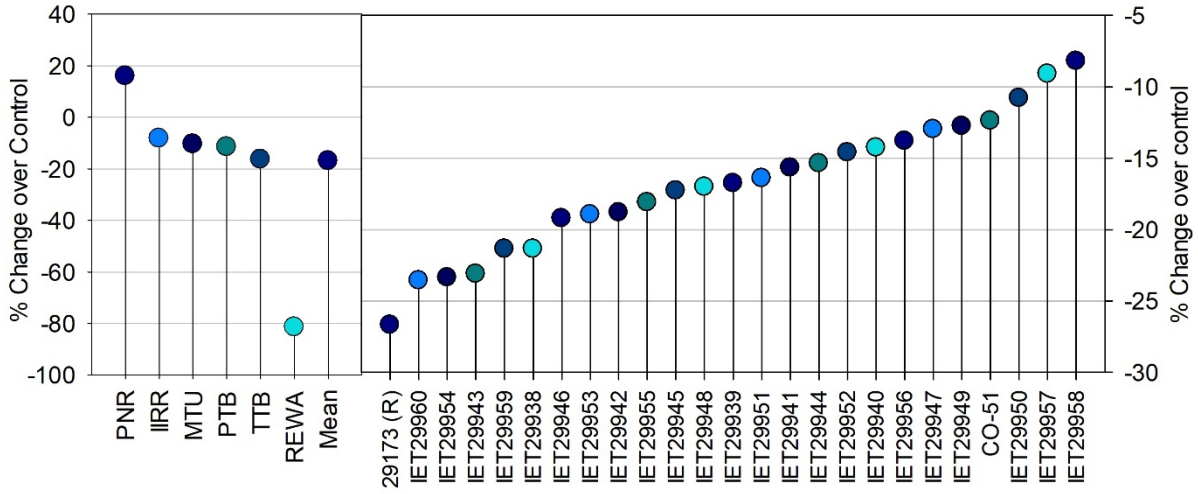


Fig. 6.3.10: Influence of elevated temperature on HI recorded at maturity. Each bar represents % change in HI under elevated temperature in comparison with control. [A] Mean of all genotypes [B] Mean of all locations

Identification of high temperature tolerant genotypes using yield based indices

In order to identify genotypes tolerant to high temperature, different indices were computed based on the grain yield recorded under ambient (control) and high temperature conditions.

Different heat indices including Heat susceptibility index (HSI), Relative Heat index (RHI), Heat tolerance index (HTI), Geometric mean productivity (GMP), Tolerance (TOL), Mean production (MP), Yield index (YI), Heat resistance index (HI), Yield stability index (YSI), Modified stress tolerance index (KiSTI), were calculated following the equations published (Fischer and Maurer, 1978; Fischer et al., 1998; Fernandez, 1992; Rosielle and Hamblin, 1981; Bouslama and Schapaugh, 1984; Blum, 1988; Moosavi et al., 2008; Farshadfar and Sutka, 2002). The results are presented in Table (6.3.13). Significant Variation was observed amongst the genotypes for mostof the indices. The genotypes were ranked for each index and rank-sum and mean rank for each genotype was calculated. The genotype with high mean rank and low SEm± was considered as heat tolerant genotype. Based on the mean rank CO-1, IET29940, IET29949, IET29952 and IET29960 can be identified as relatively heat tolerant genotype (Table 6.3.14).

To determine the most desirable heat stress tolerant criteria, the correlation coefficients between Ys, and other quantitative indices of heat tolerance were calculated. The correlation analysis between grain yield and heat tolerance indices can be a good criterion for screening the best cultivars and indices used. A suitable index must have a significant association with yield recorded under stress condition Fig. *6.3.14*presents the results of correlation analysis which indicate that the indices like HTI, SHI, GMP(Geometric Mean Production), HM (Hormonic Mean), K2STI (Modified Stress Tolerance Index), Yield index (YI) showed highly significant positive association with grain yield recorded under stress condition. These indices are useful in selecting suitable genotypes for heat tolerance.

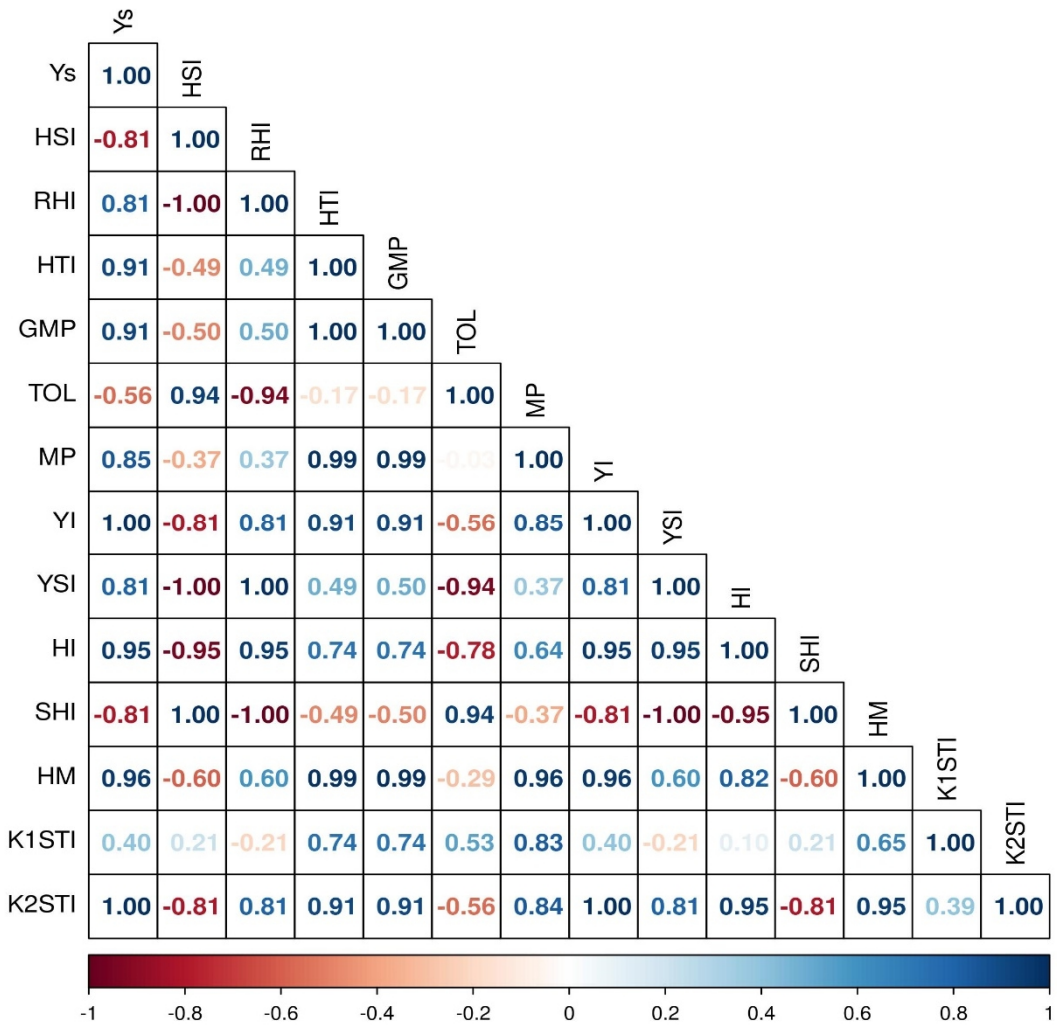


Fig.6.3.1: Correlation between yield recorded under elevated temperature condition and heat indices computed from yield recorded under both stressed and non-stressed condition. Mean yield data from all locations was used for computing the correlation coefficients. Statistically significant coefficients were shown in dark colours, light coloured and blank numbers represents non-significance.

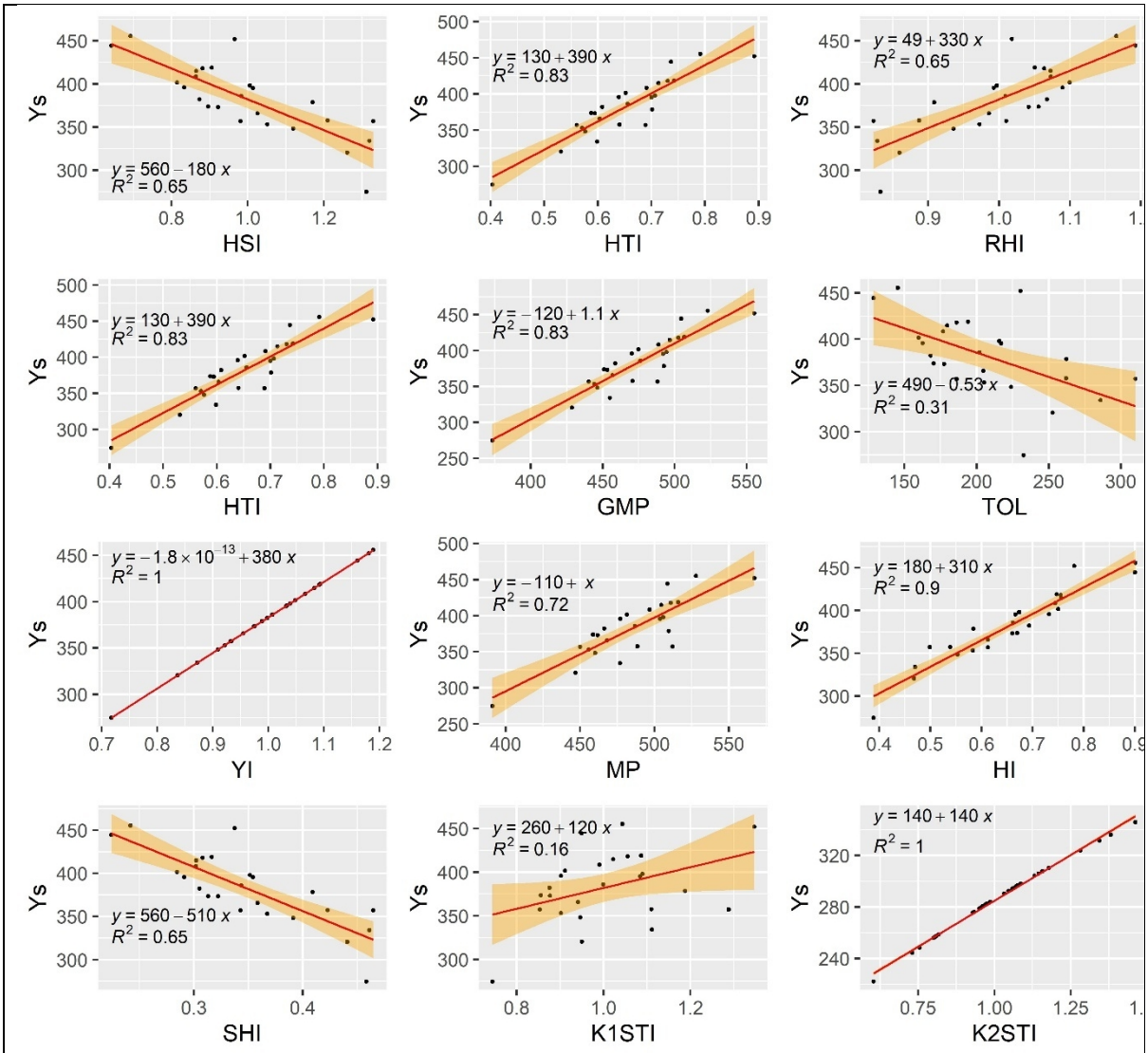


Fig.6.3.15 : Relationship between Heat Stress Indices and grain yield recorded under stressed condition (Ys). Mean of grain yield recorded at different locations was used for regression analysis.

Selection for high yield and stability of performance under elevated temperature:

In order to simultaneously select genotypes with higher yield and stability of performance across locations under elevated temperature conditions, a parametric model for simultaneous selection in yield and stability "Shukla's stability variance and Kang's" statistic was performed and the results were presented in *(Table 6.3.15).*Based on their performance across locations and YSi values under elevated temperature conditions genotypes IET29943, IET29946, IET22946, 29947, 29948, IET29949, IET29952, IET29956 and 29958 can be selected as they produced relatively higher yield under heat stress condition and also they show non-significant stability variance (σ_i^2). These genotypes have a higher yield and a lower variation. According to the ANOVA, the interaction is significant.

Influence of elevated temperature on grain chalkiness , grain protein and starch content:

Grain samples were collected from plant grown under elevated temperature (inside polythene tunnel) and from plants grown outside polythene tunnel (Control) condition. The seeds wee carefully de-husked using portal dehusker and brown rice of each sample was cleaned and chalky and normal translucent grains were separated from each treatment using a trans-illuminator and % chalky grains was computed (Fig. 6.3.16). The results indicated that under control conditions only 33% of total grains are chalky whereas under elevated temperature condition the chalky grain % has increased to 68%. Total starch and protein content was measured according to Willards, 1965 method for starch and Lowry, 1951 method for protein estimation.

Results of ANOVA indicated that temperature during reproductive stage significantly ($p<0.01$) influenced the total content and increase in total starch content was observed in both normal and chalky grains under elevated temperature. The differences amongst the genotypes was found to be significant ($p<0.01$). However, the differences between normal and chalky grain under both control and elevated temperature condition was found to be non-significant. All other interaction were found to be non-significant *(Table 6.3.16).* Genotypes like IET 29948, IET29949, IET29942, and IET29944 show minimum increase in % chalkiness under stress conditions (Fig6.3.16).

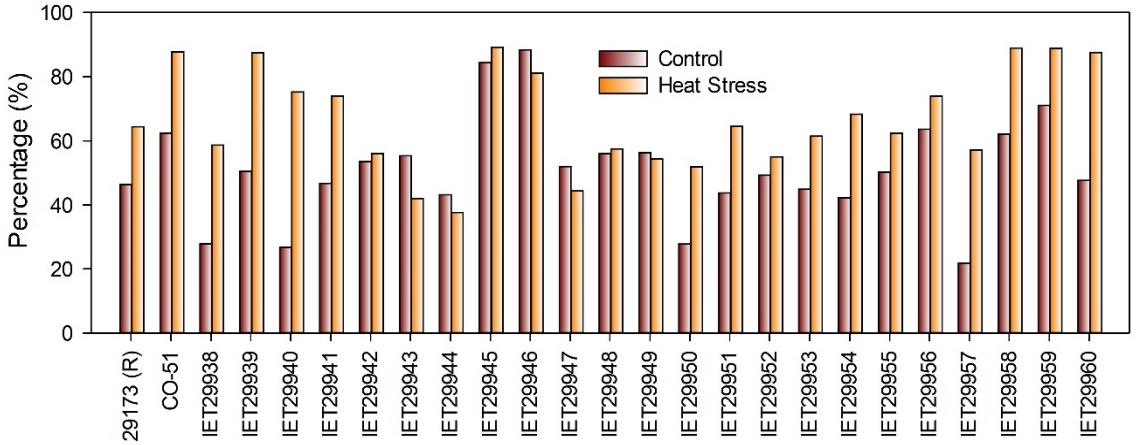


Fig. 6.3.16: Influence of high temperature on % chalkiness of rice grain under normal and elevated temperature condition.

Similarly, total protein content of the seed was estimated in both chalky and normal grain under both control and elevated temperature condition. The results of ANOVA suggest a significant effect of treatment on protein content ($p<0.01$). The mean protein content for all genotypes was not significantly affected in chalky and normal grains under control temperature regime. However, the mean protein content was reduced by >5% in chalky grains under high temperature condition *(Table 6.3.17& Fig.16.3.17)*

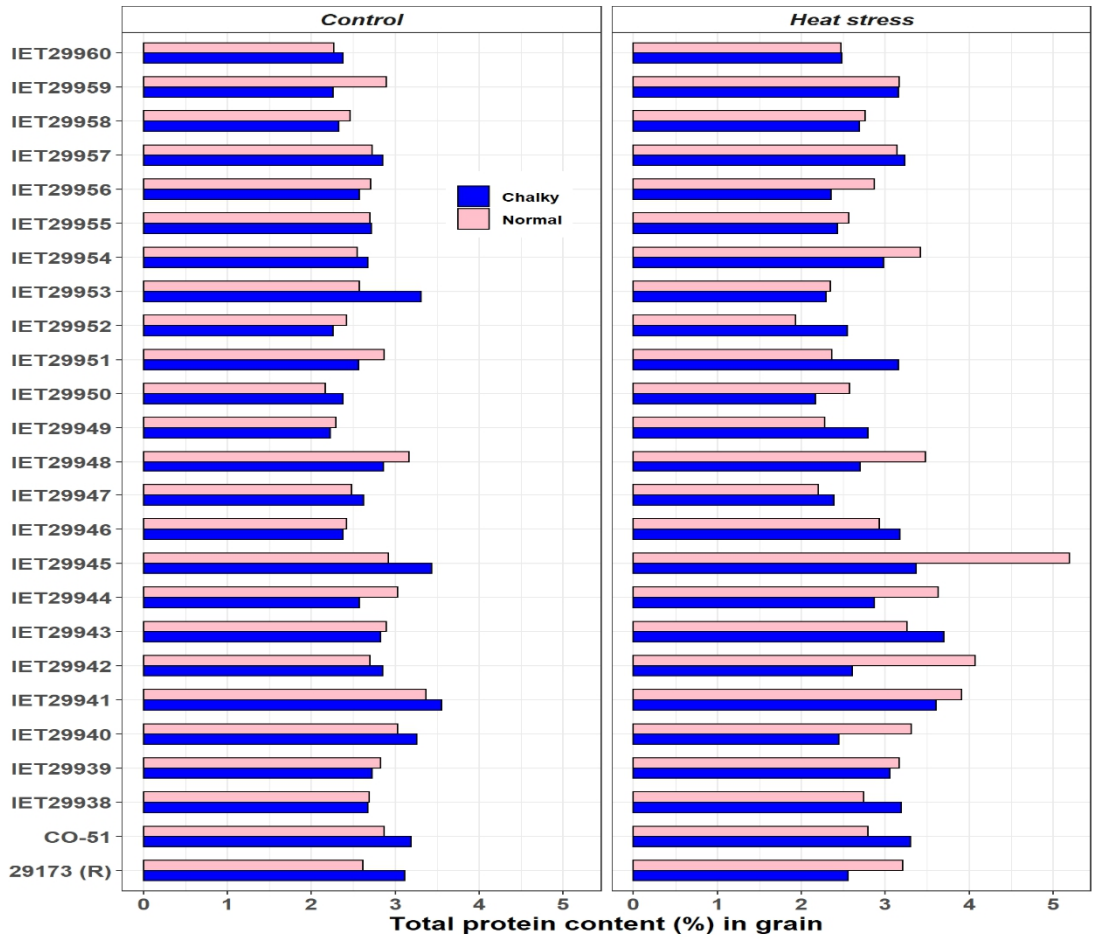


Fig. 6.3.17: Influence of high temperature on seed protein content (%) in chalky and normal rice seeds.

Table 6.3.1 Influence of Heat Stress on Days to flowering at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		CHN	IIRR	MTU	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	78	116	77	91	101	102	91	95	79	116	77	88	97	104	89	93
2	CO-51	82	95	77	78	83	92	77	83	82	98	77	78	80	93	77	83
3	IET29938	81	99	72	77	86	82	79	83	81	96	73	77	80	84	78	81
4	IET29939	81	98	73	79	87	93	81	85	81	97	74	81	81	94	80	84
5	IET29940	78	103	77	79	89	95	79	86	79	103	78	80	86	96	78	86
6	IET29941	76	104	80	87	99	103	91	92	76	105	80	87	93	105	90	91
7	IET29942	79	103	76	77	87	97	80	86	79	104	77	80	82	98	79	85
8	IET29943	82	104	76	78	89	86	89	87	83	104	77	82	87	88	88	87
9	IET29944	83	103	72	79	79	90	77	83	84	103	73	79	78	91	77	83
10	IET29945	83	98	76	78	85	95	89	86	83	97	77	81	81	96	88	86
11	IET29946	80	99	79	79	81	97	79	84	80	97	80	82	79	99	79	84
12	IET29947	79	103	78	79	86	97	89	87	79	103	79	82	86	98	90	88
13	IET29948	79	104	81	85	93	97	80	89	79	104	81	90	87	98	79	88
14	IET29949	80	104	78	76	88	96	89	87	81	103	78	82	85	98	88	87
15	IET29950	81	110	81	77	89	91	91	89	81	111	81	81	84	92	90	88
16	IET29951	80	104	78	82	85	93	79	86	80	104	77	81	79	95	78	84
17	IET29952	80	109	81	86	97	95	91	92	80	111	81	87	93	96	90	91
18	IET29953	78	103	81	82	92	92	89	89	78	104	81	82	92	93	88	89
19	IET29954	78	96	73	75	76	86	70	79	77	98	72	77	75	87	71	79
20	IET29955	80	102	75	79	88	88	89	86	79	103	76	82	89	89	88	87
21	IET29956	82	95	75	75	80	88	72	81	83	98	75	79	78	90	71	82
22	IET29957	80	104	77	77	83	88	80	84	80	104	78	79	83	89	79	84
23	IET29958	81	104	74	70	85	88	82	84	81	104	75	78	83	90	81	84
24	IET29959	82	104	81	84	92	93	89	90	82	104	81	88	92	94	88	90
25	IET29960	84	111	81	85	91	111	91	93	85	110	81	87	90	112	90	93
	Mean	**80**	**103**	**77**	**80**	**88**	**94**	**84**	**87**	**80**	**103**	**78**	**82**	**85**	**95**	**83**	**86**
	LSD (Treat)			ns						LSD(Treat x Genotype)				2.60**			
	LSD (Location x Treat)			1.47**						LSD (Location x Treat x Genotype)				ns			
	LSD (Genotype)			1.84**						CV(%)				4.04			

Table 6.3.2 Influence of Heat Stress on Days to maturity at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		CHN	IIRR	MTU	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	110	146	109	130	132	128	124	126	110	143	107	132	129	125	122	125
2	CO-51	113	130	109	126	181	120	109	134	113	129	107	127	110	117	108	115
3	IET29938	113	132	102	126	121	116	113	118	113	128	101	127	112	113	110	114
4	IET29939	112	132	102	128	122	119	114	119	112	128	101	128	112	118	112	115
5	IET29940	109	135	110	128	123	124	112	120	109	135	110	128	117	122	110	118
6	IET29941	107	133	111	129	132	130	123	125	107	134	113	132	124	128	122	123
7	IET29942	111	134	105	129	122	122	113	120	110	133	106	130	113	121	111	117
8	IET29943	114	135	106	128	126	114	121	121	114	135	107	129	118	111	120	119
9	IET29944	114	132	101	128	120	117	110	118	115	132	101	129	109	114	109	115
10	IET29945	115	129	106	126	124	121	118	120	114	129	105	132	112	118	120	118
11	IET29946	111	133	107	127	122	124	113	120	112	132	106	131	110	123	111	117
12	IET29947	111	135	110	127	125	126	119	122	111	135	110	129	116	124	121	120
13	IET29948	110	135	110	130	124	126	112	121	110	136	109	129	118	124	111	119
14	IET29949	111	135	108	128	186	128	122	138	112	135	108	130	116	125	120	120
15	IET29950	112	141	111	129	187	118	124	139	113	138	110	128	116	117	123	120
16	IET29951	111	135	110	127	182	120	111	135	110	135	109	128	109	117	109	116
17	IET29952	111	137	112	130	129	122	123	124	111	139	111	130	124	121	122	123
18	IET29953	109	135	112	128	125	127	121	123	110	135	110	130	123	126	120	122
19	IET29954	110	131	101	126	116	113	102	114	109	130	100	127	106	110	102	111
20	IET29955	111	132	105	128	127	114	122	121	111	132	105	131	120	111	120	119
21	IET29956	113	131	104	126	119	115	105	116	114	129	103	132	109	113	102	114
22	IET29957	111	133	106	129	121	115	112	119	111	133	104	128	113	113	109	116
23	IET29958	112	133	105	128	123	117	115	119	113	133	104	128	114	115	113	117
24	IET29959	114	135	112	130	127	120	122	123	113	135	110	132	123	118	121	122
25	IET29960	115	139	111	130	128	138	125	127	116	139	110	132	121	136	123	125
	Mean	**112**	**134**	**107**	**128**	**134**	**121**	**116**	**123**	**112**	**134**	**107**	**130**	**116**	**119**	**115**	**118**
	LSD (Treat)			ns						LSD(Treat x Genotype)				ns			
	LSD (Location x Treat)			ns						LSD (Location x Treat x Genotype)				ns			
	LSD (Genotype)			ns						CV(%)				17.5			
	LSD (Location x genotype			ns													

Table 6.3.4 Influence of Heat Stress on panicle weight (g/m2) at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	942	0.0	1365	506	1090	602	716	617	0.0	878	456	238	447	442
2	CO-51	950	0.0	1024	424	821	462	586	761	0.0	758	554	538	434	514
3	IET29938	975	0.0	1558	403	786	466	656	848	0.0	1147	385	180	371	474
4	IET29939	1084	0.0	1706	582	921	726	800	997	0.0	1152	415	309	436	532
5	IET29940	1003	0.0	1604	427	780	577	688	1005	0.0	1222	451	230	521	554
6	IET29941	875	0.0	1391	791	899	630	768	515	0.0	1029	619	245	471	500
7	IET29942	1017	0.0	1301	455	801	455	641	664	0.0	790	868	180	353	532
8	IET29943	1111	0.0	1913	432	577	480	706	740	0.0	1431	433	148	384	510
9	IET29944	699	0.0	1127	470	748	519	576	919	0.0	820	317	152	323	407
10	IET29945	943	0.0	921	501	696	503	581	880	0.0	643	369	165	315	392
11	IET29946	1029	0.0	1032	385	652	516	571	790	0.0	687	635	174	329	464
12	IET29947	900	0.0	1569	589	837	463	707	655	0.0	1271	787	177	376	579
13	IET29948	1032	0.0	1874	534	731	571	754	711	0.0	1450	769	251	386	619
14	IET29949	1040	0.0	2037	564	840	535	797	871	0.0	1494	639	243	460	621
15	IET29950	807	0.0	1006	467	729	456	562	659	0.0	643	529	185	410	422
16	IET29951	962	0.0	1239	560	648	480	636	517	0.0	726	601	281	400	446
17	IET29952	906	0.0	1490	650	1152	603	779	466	0.0	1159	578	666	441	555
18	IET29953	1006	0.0	979	455	742	627	609	529	0.0	754	331	263	485	385
19	IET29954	697	0.0	1066	293	1043	344	534	524	0.0	683	285	264	279	332
20	IET29955	964	0.0	1279	397	888	457	626	589	0.0	822	442	262	329	413
21	IET29956	758	0.0	1137	620	718	624	639	720	0.0	654	507	223	495	444
22	IET29957	881	0.0	1466	440	619	480	618	661	0.0	847	450	318	425	450
23	IET29958	989	0.0	1316	919	740	566	778	590	0.0	1089	651	247	504	533
24	IET29959	942	0.0	1175	532	793	497	639	497	0.0	697	605	204	351	423
25	IET29960	1143	0.0	2030	494	649	679	784	711	0.0	1375	531	122	533	543
	Mean	**946**	**0.0**	**1384**	**516**	**796**	**533**	**670**	**697**	**0.0**	**969**	**528**	**251**	**410**	**483**
	LSD (Treat)				ns				LSD(Treat x Genotype)				ns		
	LSD (Location x Treat)				57.0**				LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)				ns				CV(%)				23.4		
	LSD (Location x genotype				201.4**										

Table 6.3.5 Influence of Heat Stress on panicle number/m2 at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	360	385	317	195	280	192	275	290	352	233	207	265	175	247
2	CO-51	433	473	367	312	197	275	338	483	418	333	338	183	375	353
3	IET29938	463	341	267	260	228	292	301	393	308	217	276	211	325	287
4	IET29939	313	385	250	206	233	250	263	353	341	200	215	218	250	256
5	IET29940	380	495	300	240	235	275	309	363	473	267	235	219	283	296
6	IET29941	433	495	367	478	258	325	405	310	429	317	296	255	258	309
7	IET29942	340	451	283	301	255	375	330	357	418	217	248	241	275	286
8	IET29943	363	418	367	186	176	192	270	280	363	317	210	150	233	252
9	IET29944	370	407	383	270	181	167	293	390	352	333	275	162	333	303
10	IET29945	447	352	233	292	219	217	293	390	286	200	231	226	183	250
11	IET29946	393	407	217	224	164	250	268	380	363	167	273	145	233	262
12	IET29947	403	440	333	334	252	308	344	377	385	283	331	239	233	311
13	IET29948	433	484	333	315	262	292	348	427	407	300	380	247	283	346
14	IET29949	407	484	317	262	247	242	317	343	451	267	238	237	200	282
15	IET29950	423	451	383	337	251	367	364	377	440	333	395	230	417	370
16	IET29951	333	473	333	290	216	225	309	333	363	250	297	192	333	295
17	IET29952	377	484	383	334	257	317	355	360	429	367	316	230	342	337
18	IET29953	340	407	283	294	253	308	311	390	363	250	213	222	283	276
19	IET29954	433	352	417	288	265	392	348	467	330	367	323	249	333	342
20	IET29955	423	407	383	383	252	217	350	390	374	333	322	231	350	332
21	IET29956	373	407	317	311	252	258	318	433	352	217	359	233	417	338
22	IET29957	433	429	317	261	240	225	309	350	363	217	293	225	325	295
23	IET29958	353	506	300	302	178	258	314	320	429	267	349	169	408	327
24	IET29959	407	495	333	404	248	283	368	330	462	250	318	228	283	313
25	IET29960	407	429	383	384	163	325	354	337	396	300	328	146	300	305
	Mean	**394**	**434**	**327**	**298**	**230**	**273**	**322**	**369**	**386**	**272**	**290**	**214**	**297**	**303**
	LSD (Treat)				ns				LSD(Treat x Genotype)				36.3*		
	LSD (Location x Treat)				25.3**				LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)				ns				CV(%)				19.2		
	LSD (Location x genotype				89.4**										

Table 6.3.6 Influence of Heat Stress on Grain number/panicle at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	105	155	145	90	158	120	123	86	135	115	92	9	128	94
2	CO-51	118	112	102	99	164	130	118	92	97	126	91	127	100	103
3	IET29938	145	171	189	162	150	216	171	149	149	166	155	16	224	145
4	IET29939	117	128	143	121	128	137	128	91	108	199	106	24	137	110
5	IET29940	118	133	97	109	110	122	114	134	116	156	128	7	118	112
6	IET29941	86	132	92	92	131	118	106	74	102	135	135	11	131	103
7	IET29942	119	132	160	125	108	131	129	76	114	122	135	8	121	102
8	IET29943	115	138	124	116	137	139	127	99	115	125	114	9	151	104
9	IET29944	92	134	130	121	160	145	129	115	114	150	115	9	134	107
10	IET29945	89	102	157	110	126	113	115	96	87	212	99	7	132	104
11	IET29946	100	118	102	103	159	132	117	82	105	101	132	9	147	101
12	IET29947	88	111	184	124	128	160	131	72	89	104	119	10	137	93
13	IET29948	121	144	140	104	108	127	121	86	125	113	119	12	139	102
14	IET29949	141	171	166	137	109	169	147	157	144	120	105	9	115	108
15	IET29950	77	118	105	92	109	106	100	70	100	123	95	10	110	86
16	IET29951	120	101	135	93	127	118	112	68	88	147	105	47	118	97
17	IET29952	91	125	132	91	158	128	117	52	110	104	110	114	106	101
18	IET29953	112	161	132	98	113	130	121	55	144	137	111	36	129	103
19	IET29954	112	128	112	104	157	147	123	86	112	103	119	26	145	102
20	IET29955	88	124	72	98	127	126	105	63	111	51	90	10	104	74
21	IET29956	91	129	137	105	109	140	116	73	113	106	98	26	118	90
22	IET29957	94	144	95	96	113	141	111	92	125	145	103	55	130	107
23	IET29958	109	115	152	90	134	125	116	74	103	116	109	15	122	93
24	IET29959	89	108	117	116	136	122	115	63	94	132	128	13	153	102
25	IET29960	127	112	178	108	155	144	133	102	96	164	119	11	161	110
	Mean	**107**	**130**	**132**	**108**	**133**	**135**	**122**	**88**	**112**	**131**	**113**	**25**	**132**	**102**
	LSD (Treat)				ns				LSD(Treat x Genotype)				ns		
	LSD (Location x Treat)				8.98**				LSD(Location x Treat x Genotype)				ns		
	LSD (Genotype)				9.11*				CV(%)				18.9		
	LSD (Location x genotype				31.7**										

Table 6.3.7 Influence of Heat Stress on spikelet number/panicle at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	144	167	163	124	166	139	147	138	166	122	126	174	168	146
2	CO-51	134	121	124	135	172	152	139	111	126	142	115	180	125	131
3	IET29938	174	182	171	192	160	251	189	208	181	175	212	168	310	210
4	IET29939	142	140	172	146	134	164	149	137	137	210	157	142	199	163
5	IET29940	138	148	121	139	122	140	135	177	145	167	164	130	173	160
6	IET29941	106	144	117	124	151	134	128	115	140	138	158	160	154	146
7	IET29942	150	141	187	163	127	147	154	125	136	134	151	136	142	139
8	IET29943	139	151	145	156	148	160	151	164	146	140	150	156	185	156
9	IET29944	115	146	144	156	174	162	150	146	142	168	142	181	154	154
10	IET29945	95	114	179	140	141	125	133	110	112	217	118	149	157	140
11	IET29946	141	132	126	139	176	148	143	139	130	120	164	185	183	155
12	IET29947	104	122	202	167	137	184	155	123	118	113	161	149	187	145
13	IET29948	156	154	163	143	124	151	148	130	151	119	142	132	159	139
14	IET29949	230	184	179	197	123	218	190	324	178	124	148	131	169	174
15	IET29950	94	130	149	117	116	126	121	116	128	125	136	124	173	134
16	IET29951	137	109	166	126	135	133	133	106	105	163	138	141	168	137
17	IET29952	127	137	147	125	170	145	139	82	134	122	137	179	141	133
18	IET29953	127	172	173	145	126	160	150	82	171	149	135	138	162	139
19	IET29954	126	139	137	145	173	168	148	110	134	122	152	181	176	147
20	IET29955	100	132	98	137	144	147	128	98	127	65	128	152	159	122
21	IET29956	111	138	157	145	121	165	140	105	135	117	135	130	172	133
22	IET29957	135	156	126	137	129	167	141	148	152	169	136	138	177	151
23	IET29958	133	124	182	138	149	160	146	113	121	131	143	158	173	140
24	IET29959	112	117	139	157	154	151	141	112	113	143	171	161	197	152
25	IET29960	192	120	193	148	162	164	161	169	116	179	160	170	184	162
	Mean	**134**	**141**	**154**	**146**	**145**	**158**	**146**	**135**	**138**	**143**	**147**	**154**	**174**	**148**
	LSD (Treat)			ns					LSD(Treat x Genotype)				ns		
	LSD (Location x Treat)			9.62					LSD(Location x Treat x Genotype)				ns		
	LSD (Genotype)			9.77*					CV(%)				15.5		
	LSD (Location x genotype			34.1											

Table 6.3.8 Influence of Heat Stress on Grain number/m2 at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	37394	59774	50750	16933	43429	21925	35305	25026	47487	30633	17836	1770	22417	23286
2	CO-51	50378	52833	38917	29871	31552	36417	38548	43796	40568	46067	31012	22532	37333	36046
3	IET29938	66831	58234	53550	43370	33430	62242	51575	58057	46057	44317	45876	2926	72042	45021
4	IET29939	36550	49412	45300	25280	28954	33750	34932	32257	36795	59700	23549	4641	33417	30558
5	IET29940	44747	65835	27550	26634	25205	33333	35705	48175	54769	59683	29314	1240	33067	36509
6	IET29941	37183	65175	32083	39221	33142	37775	40543	22624	43615	53950	39681	2089	33133	33539
7	IET29942	40362	59345	45333	38572	26912	50100	42742	27185	47740	30583	32716	1485	32850	29325
8	IET29943	41654	57805	33167	21544	23382	26558	32237	27766	41745	49867	24422	1002	34742	29138
9	IET29944	33851	54593	50017	29594	28036	23467	35593	44193	40150	55083	32843	1069	44467	35807
10	IET29945	39557	35992	44467	31983	26882	24567	33633	37595	24805	52917	20574	1204	22408	25725
11	IET29946	38814	48147	32350	23592	25344	32633	32067	31230	38071	26883	35459	910	34167	28883
12	IET29947	35242	48972	58283	39755	31562	48258	43118	26400	34353	34850	36871	1802	32333	29069
13	IET29948	52146	69817	53683	31942	27520	36800	43407	36742	50776	37717	43200	2445	39217	36185
14	IET29949	57428	82885	47083	34918	26287	40500	46288	53694	65109	34167	24291	1660	22342	32222
15	IET29950	32458	53240	38500	31401	26709	38867	36082	26426	44143	51300	38155	1765	46167	35159
16	IET29951	39879	47685	40417	25207	26443	26667	33072	22585	32230	44183	31443	8802	38575	29894
17	IET29952	34190	60720	52933	29660	39842	40492	41071	18830	47124	38200	34395	25249	35683	33411
18	IET29953	37754	65571	44000	29460	27820	40567	39233	21309	52151	36667	25049	7407	36750	29197
19	IET29954	49090	44968	35400	34227	40894	57167	42282	39943	37103	43067	38717	5945	48675	36024
20	IET29955	36907	50325	22817	32881	31196	27342	33478	24825	41404	20400	29477	1841	36467	26270
21	IET29956	33912	52393	47950	30649	26773	36192	36931	31661	39721	38933	36328	5313	49433	33960
22	IET29957	40525	61776	23733	23307	26364	31617	32947	32195	45375	45783	30949	11633	42200	34155
23	IET29958	38595	58245	45567	25807	23186	32650	35694	23891	44330	40517	38417	2046	48792	33773
24	IET29959	36247	53504	40733	47131	32508	36567	41974	20938	43329	42100	39638	2391	42567	32943
25	IET29960	51375	48180	68083	40100	24581	47692	45730	34295	38071	60200	38005	1242	48983	36972
	Mean	**41723**	**56217**	**42907**	**31322**	**29518**	**36966**	**38568**	**32465**	**43081**	**43111**	**32729**	**4816**	**38729**	**32523**
	LSD (Treat)			ns					LSD(Treat x Genotype)				7214.5**		
	LSD (Location x Treat)			3817.5**					LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)			3877.7*					CV(%)				25.5		
	LSD (Location x genotype			13497.1**											

Table 6.3.9 Influence of Heat Stress on Spikelet number/m2 at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	50901	64405	56933	23488	45544	25333	41442	40186	58278	32600	24578	45398	29325	36420
2	CO-51	57417	57233	47650	41903	33034	42483	45946	52518	52547	52133	39182	31986	46892	44920
3	IET29938	80469	61974	48300	51195	35678	72133	57278	81436	55704	46567	62511	34601	99400	63247
4	IET29939	44525	53735	54517	30882	30474	40975	40856	48462	46783	62900	34382	30113	48042	43581
5	IET29940	52338	73425	34217	33307	27930	38192	41816	63864	68552	64100	38855	27868	48608	50100
6	IET29941	46046	71280	40833	57192	38232	43025	50543	35374	60060	55250	46654	39628	38983	46086
7	IET29942	50827	63547	52917	48428	31676	56475	50328	44725	56672	33500	37103	32018	38950	40010
8	IET29943	50340	63074	38833	28956	25246	30542	37992	45767	52998	56133	32232	22662	42992	40716
9	IET29944	42044	59345	55150	41001	30504	26208	42179	56348	49720	61483	39761	28658	50608	46620
10	IET29945	42148	40084	50683	41983	30014	27333	39175	43072	31922	54333	24607	33067	26642	34036
11	IET29946	55094	53581	39883	31190	28074	36808	39403	52924	47179	31917	44012	26049	42683	41254
12	IET29947	42016	53658	63783	54739	33732	56067	51248	45491	45507	37650	49901	34917	43917	43897
13	IET29948	67490	74657	62617	44525	31625	43975	52773	55613	61479	39567	52598	31925	44950	48390
14	IET29949	93560	89034	50833	50549	29650	51717	59413	111075	80212	34933	33617	30358	31992	50829
15	IET29950	39903	58465	54600	39896	28317	46333	43916	43521	56144	52083	54225	27583	71183	51281
16	IET29951	45302	51370	49600	35999	28304	29992	39509	35075	37972	48850	42051	26820	55717	41220
17	IET29952	48499	66352	58933	41085	42862	45742	49223	29363	57684	44567	42701	40044	47167	43461
18	IET29953	42629	70048	57783	43133	31054	49892	48239	31796	61952	39833	30785	29714	46300	38738
19	IET29954	55000	48829	43283	43810	45035	65150	49274	51242	44198	50733	49545	44322	59042	49804
20	IET29955	42312	53570	31000	50573	35536	31742	42187	38220	47355	26033	42009	34461	55317	40772
21	IET29956	41344	56199	55133	43759	29890	42567	44664	45606	47432	43017	51295	29349	72700	48670
22	IET29957	58555	66781	31350	34870	30208	37617	42036	51643	55297	53600	41470	30085	58475	47434
23	IET29958	47125	62799	54383	40650	25723	41542	44696	36119	51931	45783	51528	25815	69992	47528
24	IET29959	45635	57937	48450	65092	37143	44700	52007	37054	52129	45233	53426	35954	55917	47591
25	IET29960	77752	51414	74033	56616	25635	54400	56638	56527	46145	65700	52112	23965	55750	50330
	Mean	**52771**	**60912**	**50228**	**42993**	**32445**	**43238**	**46511**	**49321**	**53034**	**47140**	**42846**	**31894**	**51262**	**45477**
	LSD (Treat)			ns					LSD(Treat x Genotype)				6837.5*		
	LSD (Location x Treat)			4759.8					LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)			6360.5*					CV(%)				24.5		
	LSD (Location x genotype			16828.5**											

Table 6.3.10 Influence of Heat Stress on total dry matter (g/m2) at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	1777	1544	1133	1112	1920	1188	1398	1258	1132	1067	1414	1061	1062	1201
2	CO-51	1585	1336	1099	1245	1658	934	1300	1344	1026	1097	1640	1420	1413	1369
3	IET29938	1675	1102	1429	981	1682	1127	1283	1518	898	1225	1259	1058	1097	1188
4	IET29939	1809	1381	1190	1587	1707	1402	1524	1838	1177	1060	1332	1114	1049	1272
5	IET29940	1645	1492	1236	953	1586	1083	1278	1677	1195	1119	1139	1027	1077	1196
6	IET29941	1568	1668	1133	1837	1789	1540	1625	1215	1325	1218	1535	1145	1050	1289
7	IET29942	1698	1622	992	1039	1678	1039	1301	1156	1286	823	1588	1073	1026	1220
8	IET29943	1924	1488	1060	1174	1384	1087	1327	1424	1185	1250	1249	961	895	1173
9	IET29944	1310	1514	1030	1352	1630	1140	1332	1542	1096	1129	1022	1028	852	1099
10	IET29945	1695	1292	1282	1529	1630	1161	1445	1502	834	1167	1063	1006	895	1076
11	IET29946	1694	1472	1161	1228	1611	1183	1368	1341	1144	1156	1545	1101	910	1249
12	IET29947	1535	1471	1310	1790	1741	1243	1554	1254	1163	1035	1753	1102	1149	1316
13	IET29948	1774	1570	1374	1400	1581	1254	1479	1585	1341	1264	1716	1095	1063	1397
14	IET29949	1649	1603	1107	1571	1689	1400	1513	1388	1254	1060	1542	1095	1172	1293
15	IET29950	1391	1513	1220	1435	1545	1122	1380	1110	1241	1057	1591	993	1327	1273
16	IET29951	1640	1355	1039	1551	1563	1060	1394	1065	995	1271	1425	1202	1026	1201
17	IET29952	1625	1494	1083	1492	1972	1233	1484	1009	1315	1059	1548	1478	1204	1309
18	IET29953	1703	1693	1107	1159	1586	1188	1371	1081	1245	1010	986	1075	1405	1113
19	IET29954	1224	1127	1090	930	1858	839	1142	1079	778	943	1097	1076	1059	1019
20	IET29955	1715	1467	1129	1288	1721	1139	1392	1048	1150	1122	1350	1094	1027	1163
21	IET29956	1428	1519	1223	1557	1528	1305	1445	1273	1247	1052	1233	1056	1151	1178
22	IET29957	1570	1667	864	1237	1478	1100	1308	1082	1241	1274	1121	1200	1111	1164
23	IET29958	1717	1620	1395	1681	1668	1158	1560	1013	1254	1190	1539	1165	1188	1270
24	IET29959	1820	1469	1254	1728	1579	1251	1547	1173	1234	1504	1515	1021	1173	1305
25	IET29960	2020	1284	2745	1777	1476	1606	1812	1479	1012	2415	1723	963	1692	1572
	Mean	**1648**	**1471**	**1227**	**1385**	**1650**	**1191**	**1422**	**1298**	**1151**	**1183**	**1397**	**1104**	**1123**	**1236**
	LSD (Treat)			ns					LSD(Treat x Genotype)				132.8*		
	LSD (Location x Treat)			92.5					LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)			123.6					CV(%)				16.5		
	LSD (Location x genotype			326.9**											

Table 6.3.11 Influence of Heat Stress on shoot weight (g/m2) at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		CHN	IIRR	MTU	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	189	835	934	462	929	583	1231	762	205	641	749	290	1135	590	969	714
2	CO-51	212	635	797	379	1064	574	957	710	209	584	677	306	855	623	516	578
3	IET29938	205	700	653	622	535	629	573	557	204	671	566	416	737	636	450	552
4	IET29939	198	725	831	446	1056	543	777	704	201	841	737	362	843	561	465	606
5	IET29940	209	642	891	630	685	564	826	641	183	672	732	507	665	574	511	563
6	IET29941	215	693	983	482	1100	642	1016	779	221	699	873	411	1011	667	770	708
7	IET29942	189	681	995	419	686	564	790	626	202	492	784	344	683	589	600	547
8	IET29943	218	813	895	564	935	561	992	739	210	684	748	381	960	581	798	665
9	IET29944	221	611	903	524	935	613	726	683	223	624	684	466	783	631	686	610
10	IET29945	231	752	796	329	1067	600	737	697	240	622	573	269	761	609	714	569
11	IET29946	196	665	891	396	876	601	731	654	187	551	748	384	930	605	620	619
12	IET29947	195	634	896	488	1381	574	1141	836	205	599	777	419	989	599	818	674
13	IET29948	199	742	930	402	1142	577	1234	796	193	875	863	397	981	594	745	704
14	IET29949	222	609	938	407	1153	583	1155	777	234	517	781	320	913	610	734	628
15	IET29950	223	584	888	433	1037	575	803	698	219	451	771	389	963	580	717	631
16	IET29951	172	677	815	450	1088	597	774	708	179	548	669	290	762	607	501	540
17	IET29952	163	718	864	507	988	548	921	712	157	544	781	441	949	561	720	638
18	IET29953	155	697	974	392	820	555	792	651	172	552	733	310	509	568	628	498
19	IET29954	177	527	722	513	801	552	824	615	170	555	544	356	831	562	819	583
20	IET29955	172	751	889	429	1082	579	1065	756	174	459	715	339	815	590	512	552
21	IET29956	169	670	888	459	1110	565	1027	750	155	553	825	450	703	600	611	575
22	IET29957	145	690	959	484	996	593	1018	735	148	420	763	302	556	617	455	477
23	IET29958	217	728	950	374	937	631	942	715	218	423	756	336	873	658	652	599
24	IET29959	209	878	850	521	1167	545	696	754	243	676	784	425	774	575	551	600
25	IET29960	243	877	763	706	1481	591	1323	933	239	767	659	456	978	624	731	679
	Mean	**198**	**701**	**876**	**473**	**1002**	**582**	**923**	**720**	**200**	**601**	**732**	**375**	**838**	**600**	**652**	**604**
	LSD (Treat)			ns						LSD(Treat x Genotype)				ns			
	LSD (Location x Treat)			55.2**						LSD (Location x Treat x Genotype)				ns			
	LSD (Genotype)			52.4*						CV(%)				19.7			
	LSD (Location x genotype			195.1**													

Table 6.3.12 Influence of Heat Stress on Grain yield (g/m2) at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		CHN	IIRR	MTU	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	216	821	610	655	351	879	542	553	217	527	383	543	296	32	410	338
2	CO-51	289	818	539	419	307	649	416	468	301	694	349	551	371	389	398	428
3	IET29938	257	856	450	666	298	685	420	491	248	745	332	636	252	47	340	356
4	IET29939	214	920	551	437	412	645	654	531	222	865	440	493	279	69	400	381
5	IET29940	270	851	601	648	341	538	520	514	252	825	463	673	316	25	478	419
6	IET29941	239	782	685	506	504	675	568	558	246	439	452	690	348	39	432	375
7	IET29942	241	865	627	357	323	601	410	468	252	561	502	376	319	27	324	335
8	IET29943	267	943	593	659	296	465	432	494	269	638	437	510	260	14	352	342
9	IET29944	292	641	611	422	343	595	468	464	282	795	412	563	217	19	296	350
10	IET29945	289	882	497	472	349	525	453	477	280	791	261	463	243	18	289	323
11	IET29946	249	866	580	585	301	529	465	485	258	644	396	516	341	13	302	351
12	IET29947	253	801	575	484	401	642	417	497	249	560	385	521	470	30	345	379
13	IET29948	251	887	640	459	383	525	514	505	263	590	478	627	414	35	354	397
14	IET29949	245	841	666	517	391	576	482	514	242	671	473	498	381	33	422	388
15	IET29950	303	700	625	473	326	522	411	461	293	544	470	679	317	25	376	377
16	IET29951	268	840	540	477	387	500	432	479	270	442	326	593	362	134	367	357
17	IET29952	209	794	630	444	458	986	543	565	203	395	534	544	320	566	405	411
18	IET29953	209	872	719	439	356	591	565	513	209	459	511	560	254	124	445	352
19	IET29954	215	599	405	399	223	805	310	397	207	466	234	504	172	102	256	264
20	IET29955	221	841	578	372	289	697	412	463	207	502	435	460	257	36	302	307
21	IET29956	217	660	630	438	435	584	562	495	211	624	421	442	331	96	454	364
22	IET29957	160	739	708	383	314	455	432	438	168	561	465	504	313	148	390	358
23	IET29958	237	843	669	540	404	523	510	516	234	508	511	629	391	40	462	396
24	IET29959	273	835	618	438	325	658	448	490	273	394	450	663	352	36	322	355
25	IET29960	269	914	521	779	360	542	612	545	278	586	354	728	355	22	489	396
	Mean	**246**	**816**	**595**	**499**	**355**	**616**	**480**	**495**	**245**	**593**	**419**	**559**	**317**	**85**	**376**	**364**
	LSD (Treat)			ns						LSD(Treat x Genotype)				ns			
	LSD (Location x Treat)			35.0**						LSD (Location x Treat x Genotype)				ns			
	LSD (Genotype)			ns						CV(%)				19.3			
	LSD (Location x genotype			123.6**													

Table 6.3.13 Influence of Heat Stress on 1000 grain weight (g) at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		CHN	IIRR	MTU	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	24.1	25.2	21.0	28.2	25.1	22.3	25.5	24.6	24.2	24.6	15.2	24.3	25.2	20.9	24.1	23.0
2	CO-51	28.2	18.9	21.1	23.2	19.9	22.7	19.7	21.7	28.4	17.4	18.5	19.3	20.3	19.4	18.9	20.3
3	IET29938	22.2	14.6	13.0	16.3	19.1	22.6	13.5	17.6	22.3	14.6	11.9	13.2	19.6	19.0	13.0	16.7
4	IET29939	22.3	29.7	22.3	37.5	28.6	24.4	30.5	28.0	22.1	30.9	20.5	35.5	29.0	17.4	29.8	26.8
5	IET29940	30.0	22.4	19.2	23.8	21.7	23.4	18.8	22.6	29.9	20.9	17.5	20.8	22.1	23.2	18.0	21.8
6	IET29941	25.3	23.5	21.7	25.7	21.1	22.5	22.9	23.0	25.5	22.8	19.9	23.2	21.6	22.2	22.1	22.3
7	IET29942	24.9	25.2	23.3	26.8	21.6	24.5	21.3	23.7	24.8	24.3	21.4	25.5	21.5	21.7	19.3	22.5
8	IET29943	23.1	26.7	23.2	23.8	24.4	22.0	27.4	24.4	23.2	26.6	20.3	23.5	24.7	18.4	26.4	23.5
9	IET29944	27.4	20.8	24.6	23.8	21.3	23.4	24.5	23.4	27.4	20.8	20.2	22.7	19.9	21.1	20.2	21.5
10	IET29945	25.7	23.8	22.9	22.8	21.9	21.6	23.1	23.0	25.7	23.4	20.7	21.3	21.3	18.9	20.4	21.6
11	IET29946	23.6	26.5	22.3	30.2	22.0	23.0	20.0	23.7	23.7	25.4	20.3	28.3	22.4	19.1	19.2	22.6
12	IET29947	23.3	25.5	24.1	24.3	24.1	22.5	25.5	24.2	23.4	24.8	22.7	22.2	24.0	19.4	23.8	23.0
13	IET29948	21.9	19.8	20.6	26.8	20.8	21.2	24.3	22.0	22.2	19.3	18.5	25.5	20.4	17.0	21.8	20.6
14	IET29949	22.7	18.2	16.7	18.8	17.3	24.1	18.5	19.2	22.8	16.2	14.9	15.7	17.4	23.4	17.2	18.1
15	IET29950	25.0	24.9	23.3	20.8	23.7	21.7	24.2	23.4	25.0	24.9	21.1	22.0	24.0	16.8	23.0	22.6
16	IET29951	29.7	24.1	23.5	22.3	22.6	21.1	25.2	23.9	29.6	22.9	21.2	21.2	18.1	17.3	14.5	20.3
17	IET29952	26.1	26.5	25.1	23.3	21.7	26.8	22.1	24.2	26.1	24.7	24.3	22.2	21.6	24.6	20.2	23.2
18	IET29953	23.4	26.7	23.2	19.5	23.3	23.5	25.9	23.6	23.5	24.8	22.2	19.7	23.2	19.1	24.2	22.5
19	IET29954	23.1	14.1	14.8	15.2	19.6	21.7	27.2	19.4	22.9	13.1	10.6	14.5	19.9	19.2	26.1	18.3
20	IET29955	21.7	26.1	23.2	23.8	24.4	24.4	24.8	24.1	22.5	23.7	21.2	23.2	24.5	22.3	23.4	23.2
21	IET29956	23.2	22.3	22.9	19.8	22.8	23.9	22.9	22.6	23.9	22.8	20.8	18.5	22.6	20.8	21.0	21.6
22	IET29957	21.2	21.7	23.1	24.8	18.7	19.4	20.7	21.0	22.0	20.6	20.9	22.3	18.7	14.9	19.2	19.7
23	IET29958	25.4	25.6	23.1	27.3	26.2	24.8	27.7	25.8	25.6	24.7	21.7	26.3	26.2	23.0	26.1	25.0
24	IET29959	26.2	26.0	23.2	23.7	25.3	22.4	25.9	24.7	26.0	23.8	21.4	21.5	25.4	18.2	24.6	23.3
25	IET29960	26.9	22.3	21.2	25.2	20.4	24.2	19.6	22.5	26.9	20.8	19.2	22.3	20.3	21.9	17.6	21.2
	Mean	**24.7**	**23.2**	**21.7**	**23.9**	**22.3**	**23.0**	**23.3**	**23.0**	**24.8**	**22.4**	**19.5**	**22.2**	**22.2**	**20.0**	**21.3**	**21.8**
	LSD (Treat)			0.38**						LSD(Treat x Genotype)				1.91			
	LSD (Location x Treat)			1.08**						LSD (Location x Treat x Genotype)				ns			
	LSD (Genotype)			1.35**						CV(%)				11.4			
	LSD (Location x genotype			3.81**													

Table 6.3.14 Influence of Heat Stress on Harvest index (%) at different AICRIP centers in Kharif 2021

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	MTU	PNR	PTB	REWA	TTB		IIRR	MTU	PNR	PTB	REWA	TTB	
1	29173 (R)	46.2	39.5	57.9	30.6	45.8	45.6	42.3	42.2	33.8	50.7	24.4	3.0	38.6	31.0
2	CO-51	51.6	40.4	38.7	28.6	39.2	44.5	38.8	51.6	34.0	50.4	23.3	27.3	28.1	34.0
3	IET29938	51.1	40.8	46.6	29.2	40.7	37.3	39.3	49.1	36.9	52.2	21.3	4.5	31.0	30.9
4	IET29939	50.9	39.9	37.0	28.1	37.7	46.7	38.3	47.1	37.4	46.7	24.0	6.2	38.1	31.9
5	IET29940	51.7	40.3	53.5	33.8	33.9	48.0	42.2	49.2	38.7	60.9	28.7	2.4	44.4	36.1
6	IET29941	49.9	41.1	45.3	28.8	37.7	36.9	38.3	36.3	34.1	57.1	27.1	3.4	41.1	32.3
7	IET29942	50.9	38.7	36.3	31.1	35.8	39.5	37.6	48.5	39.0	45.9	23.2	2.5	31.6	30.6
8	IET29943	49.2	39.9	62.6	26.2	33.5	39.7	39.6	44.6	36.9	41.2	24.9	1.4	39.3	30.5
9	IET29944	48.9	40.4	41.2	27.5	36.5	41.0	37.6	51.5	37.6	50.4	23.3	1.8	34.7	31.8
10	IET29945	52.0	38.4	36.9	26.0	31.6	39.0	35.7	52.7	31.3	39.7	24.5	1.8	32.3	29.5
11	IET29946	51.1	39.4	50.4	25.1	32.9	39.3	37.6	48.2	34.6	44.8	25.4	1.2	33.2	30.4
12	IET29947	52.2	39.1	37.3	25.0	36.8	33.5	35.6	44.7	33.1	50.9	27.6	2.7	30.0	30.9
13	IET29948	50.0	40.8	33.5	28.6	33.3	41.0	36.5	37.0	35.7	49.7	26.7	3.2	33.3	30.3
14	IET29949	51.0	41.5	46.7	25.8	34.1	34.5	37.1	48.3	37.7	47.2	27.1	3.0	36.0	32.3
15	IET29950	50.3	41.3	38.9	25.2	33.7	36.6	35.9	49.0	37.9	64.2	21.1	2.5	28.3	32.0
16	IET29951	51.2	39.8	46.2	28.8	32.0	40.8	38.2	41.4	32.8	47.4	27.7	11.2	35.8	32.0
17	IET29952	48.8	42.2	41.3	32.7	50.1	44.1	41.7	39.2	40.6	51.3	23.1	38.3	33.6	35.6
18	IET29953	51.2	42.5	39.6	30.3	37.2	47.6	39.8	42.6	41.1	55.8	21.6	11.6	31.7	32.3
19	IET29954	48.5	36.0	37.0	25.0	43.4	36.8	36.0	43.2	30.1	54.1	16.0	9.4	24.1	27.6
20	IET29955	49.1	39.4	33.2	23.9	40.4	36.2	35.2	47.7	37.8	41.2	21.1	3.3	29.4	28.8
21	IET29956	46.4	41.5	35.9	30.1	38.2	43.1	37.9	49.0	33.8	41.9	27.7	9.2	39.4	32.7
22	IET29957	47.1	42.5	44.4	26.8	30.8	39.3	36.8	51.8	38.5	39.4	28.5	12.3	35.1	33.5
23	IET29958	49.2	41.3	38.7	28.8	31.3	44.1	37.5	50.0	39.7	52.8	27.9	3.5	38.9	34.4
24	IET29959	45.8	42.1	35.0	22.5	41.8	35.8	35.1	33.5	36.4	44.1	24.0	3.5	27.4	27.6
25	IET29960	45.2	40.6	28.4	21.8	36.7	38.1	33.2	40.1	34.9	30.1	20.7	2.2	28.9	25.4
	Mean	**49.6**	**40.4**	**41.7**	**27.6**	**37.0**	**40.4**	**37.7**	**45.5**	**36.2**	**48.4**	**24.4**	**6.9**	**33.8**	**31.4**
	LSD (Treat)			ns					LSD(Treat x Genotype)				ns		
	LSD (Location x Treat)			3.29**					LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)			3.34*					CV(%)				22.6		
	LSD (Location x genotype			11.6**											

Table: 6.3.15 **Simultaneous selection for yield and stability under high temperature regimes**

Genotype	*Mean Yield (g/m^2)*	*Yield Rank (Y^n)*	*Adj.rank*	*Adjustment to Yield rank (Y^n)*	*Stability Variance (σ_i^2)*	*Stability Rating (S)*	*YSi = (Y+S)*	*...*
29173 (R)	378.6	12	-1	11	25638ns	0	11	
CO-51	444.4	23	1	24	78137**	-8	16	+
IET29938	408.4	19	1	20	48174*	-4	16	+
IET29939	418.0	21	1	22	58362**	-8	14	+
IET29940	455.4	25	1	26	43321*	-4	22	+
IET29941	357.1	7	-1	6	18499ns	0	6	
IET29942	353.2	5	-1	4	20364ns	0	4	
IET29943	401.6	18	1	19	26754ns	0	19	+
IET29944	373.1	10	-1	9	48007*	-4	5	
IET29945	356.9	6	-1	5	56853*	-4	1	
IET29946	395.8	16	1	17	10930 ns	0	17	+
IET29947	385.8	14	1	15	21883 ns	0	15	+
IET29948	395.3	15	1	16	11553 ns	0	16	+
IET29949	414.8	20	1	21	7293 ns	0	21	+
IET29950	365.8	9	-1	8	4860 ns	0	8	
IET29951	348.3	4	-1	3	23309 ns	0	3	
IET29952	452.0	24	1	25	213001 ns	-8	17	+
IET29953	357.6	8	-1	7	24898 ns	0	7	
IET29954	274.8	1	-2	-1	17540 ns	0	-1	
IET29955	320.5	2	-1	1	7611 ns	0	1	
IET29956	382.2	13	-1	12	2563 ns	0	12	+
IET29957	373.7	11	-1	10	14913 ns	0	10	
IET29958	398.0	17	1	18	17729 ns	0	18	+
IET29959	334.1	3	-1	2	27938 ns	0	2	
IET29960	418.9	22	1	23	64869**	-8	15	+
Yield Mean	382.6	+ Selected Genotype on basis of Yi						
Ys Mean	11	Kong, M.S. 1993 Simultaneous Selection for Yield and Stability in Crop Performance Trials: Consequences for Growers. Agronomy J. 85(3):753-757						
LSD(0.05)	78.7							

Table 6.3.16: Influence of elevated temperature on total starch content in chalky and normal seeds of rice genotypes during kharif 2021 season

Genotype	Control			Heat Stress		
	Chalky	Normal	Mean	Chalky	Normal	Mean
29173 (R)	65.69	62.09	63.89	73.09	74.76	73.92
CO-51	64.13	61.89	63.01	84.04	84.43	84.23
IET29938	65.98	66.87	66.43	78.35	82.08	80.22
IET29939	62.62	67.62	65.12	86.47	78.58	82.52
IET29940	57.49	67.20	62.35	87.39	82.15	84.77
IET29941	56.90	54.52	55.71	56.50	77.29	66.90
IET29942	63.36	65.78	64.57	74.08	76.04	75.06
IET29943	60.55	61.19	60.87	70.77	84.01	77.39
IET29944	57.24	68.40	62.82	74.28	65.70	69.99
IET29945	59.42	63.46	61.44	80.88	74.88	77.88
IET29946	60.48	63.79	62.13	71.85	71.90	71.88
IET29947	41.10	35.08	38.09	60.30	60.19	60.25
IET29948	32.84	33.01	32.92	68.24	62.93	65.58
IET29949	56.91	38.00	47.46	89.61	80.94	85.27
IET29950	47.90	62.27	55.08	65.51	65.47	65.49
IET29951	60.10	48.15	54.12	74.73	61.74	68.23
IET29952	58.98	57.23	58.11	90.66	57.90	74.28
IET29953	51.01	49.71	50.36	56.58	63.42	60.00
IET29954	60.64	66.68	63.66	69.12	84.84	76.98
IET29955	63.50	57.58	60.54	65.77	81.23	73.50
IET29956	61.39	67.71	64.55	88.83	86.84	87.83
IET29957	52.84	62.22	57.53	67.60	74.56	71.08
IET29958	53.80	57.71	55.76	79.38	60.57	69.98
IET29959	66.36	69.37	67.87	48.17	84.61	66.39
IET29960	63.47	70.46	66.96	69.57	81.99	75.78
Mean	**57.79**	**59.12**	**58.45**	**73.27**	**74.36**	**73.82**
LSD (Treat)			3.6**			
LSD(Genotype)			12.77**			
LSD(Type)			ns			
LSD(Genotype x Type)			ns			
LSD(Treat x Type)			ns			
LSD(Treat x Genotype x Type)			ns			
CV(%)			14.7			

Fig.6.3.17: Influence of elevated temperature on total starch content in chalky and normal seeds of rice genotypes during kharif 2021 season

Genotype	Control			Heat stress		
	Chalky	Normal	Mean	Chalky	Normal	Mean
29173 (R)	3.11	2.62	2.87	2.56	3.21	2.89
CO-51	3.19	2.87	3.03	3.31	2.79	3.05
IET29938	2.67	2.69	2.68	3.19	2.75	2.97
IET29939	2.73	2.83	2.78	3.05	3.17	3.11
IET29940	3.26	3.03	3.15	2.45	3.31	2.88
IET29941	3.56	3.37	3.46	3.60	3.91	3.76
IET29942	2.85	2.70	2.78	2.61	4.07	3.34
IET29943	2.83	2.89	2.86	3.70	3.26	3.48
IET29944	2.57	3.03	2.80	2.87	3.63	3.25
IET29945	3.44	2.92	3.18	3.37	5.19	4.28
IET29946	2.38	2.42	2.40	3.18	2.93	3.05
IET29947	2.63	2.48	2.55	2.39	2.20	2.30
IET29948	2.86	3.17	3.01	2.70	3.48	3.09
IET29949	2.22	2.29	2.26	2.80	2.28	2.54
IET29950	2.37	2.16	2.27	2.17	2.57	2.37
IET29951	2.57	2.87	2.72	3.16	2.36	2.76
IET29952	2.26	2.42	2.34	2.55	1.94	2.24
IET29953	3.31	2.58	2.94	2.30	2.35	2.32
IET29954	2.68	2.55	2.61	2.98	3.42	3.20
IET29955	2.72	2.70	2.71	2.43	2.57	2.50
IET29956	2.57	2.71	2.64	2.36	2.87	2.61
IET29957	2.85	2.72	2.79	3.23	3.14	3.19
IET29958	2.33	2.47	2.40	2.69	2.76	2.73
IET29959	2.26	2.90	2.58	3.16	3.17	3.16
IET29960	2.38	2.27	2.33	2.48	2.48	2.48
Mean	**2.74**	**2.70**	**2.72**	**2.85**	**3.03**	**2.94**
LSD (Treat)			0.133**			
LSD(Genotype)			0.47**			
LSD(Type)			ns			
LSD(Genotype x Type)			0.66**			
LSD(Treat x Type)			0.14*			
LSD(Treat x Genotype x Type)			0.94**			
CV(%)			14.57			

6.4 Physiological Characterization of selected rice genotypes for multiple abiotic stress tolerance

Locations: NRRI, TTB, PTB, KRK, MTU, FZB and CBT

Global climate change is a grim reality that has already started impacting agriculture worldwide. Rice, a key staple food crop in the world and India, offers food and nutrition security to millions of the global population. Abiotic (water, soil, atmospheric) stresses affect yield and quality of rice. In India the crop is grown under varying climatic and soil conditions under diverse ecologies spread over about 43 Mha. Rice productivity is highly constrained by abiotic stresses affecting once or at different times individually or in a combination of two or more stresses. Climate change due to global warming is causing the frequent occurrence of various abiotic stress. In view of these observations we formulated an experiment to physiologically characterize rice genotypes or tolerance to multiple abiotic stresses. For this, the same set of rice genotypes are subjected to three different stresses *viz*. (i) salinity (equivalent to 12 dS m-1 of NaCl) and (ii) osmotic or dehydration stress (1 and 2% mannitol solution equivalent to -3.0 to -5.0 bars osmotic potential) at early seedling stage along with evaluation of their anaerobic germination potential by imposing 8-10 cm of standing water above the soil surface after direct sowing of the seeds. For salinity and osmotic stress, the seedlings were initially grown in Yoshida's solution as per the hydroponic assay protocol provided by Gregory et al. (1997) and when the plants reached 3-4 leaf stages they were subjected to salinity and osmotic stresses separately by adding required quantity of NaCl and mannitol, respectively. One set of plants were maintained as control for comparison by keeping under normal Yoshida's solution. Anaerobic germination potential was tested by sowing the seeds in soil filled (5 cm soil depth) plastic trays and filling the trays with 10 cm of water just after sowing. The seeds were allowed to germinate under water and final observations were recorded after 21 days. One set of trays were kept without adding water to record their germination potential under aerobic condition. A total of 25 rice entries were tested at different locations for their tolerance potential against three different stresses. The results obtained for various traits are presented subsequently.

Anaerobic Germination:

Evaluation of genotypes for anaerobic germination potential (AGP) was conducted at NRRI, TTB and FZB centers. The AGP of each genotypes were worked out by dividing the germination percent (GP) of a genotype under anaerobic condition by the GP of the same

genotype under aerobic condition. The mean AGP of all genotypes across all locations varied from 37.1% (NRRI) to 82.96% (FZB) with an overall experimental CV of 6.91% **(Table 6.4.2)**. Two of the tolerant checks Rashpanjor and IR64-AG recorded an overall mean AGP of 83 and 69%, respectively across all locations. One of the genotype Kalakeri showed 77, 94 and 100% AGP at NRRI, TTB and FZB centers, respectively. This genotype recorded the highest mean AGP (across three location) of 90%, followed by Dular (82%), IET-27051 (77%), CR-2862-IC-10 (76%), Black Gora (72%) and IET-27865 (70%). The AGP ranged from 60-70% in three other genotypes i.e., White Gora (65%), Vandana (63%) and CR-3818-IC-157 (63%) **(Fig. 6.4.1)**. The AGP of rest of the genotypes was recorded to <60% considering the average data of all locations. Hence, the genotype Kalakeri, Dular, IET-27051, CR-2862-IC-10, Black Gora and IET-27865 can be recommended as genotypes highly tolerant to anaerobic germination, while genotypes like White Gora, Vandana and CR-2862-IC-157 can be considered tolerant to anaerobic germination process.

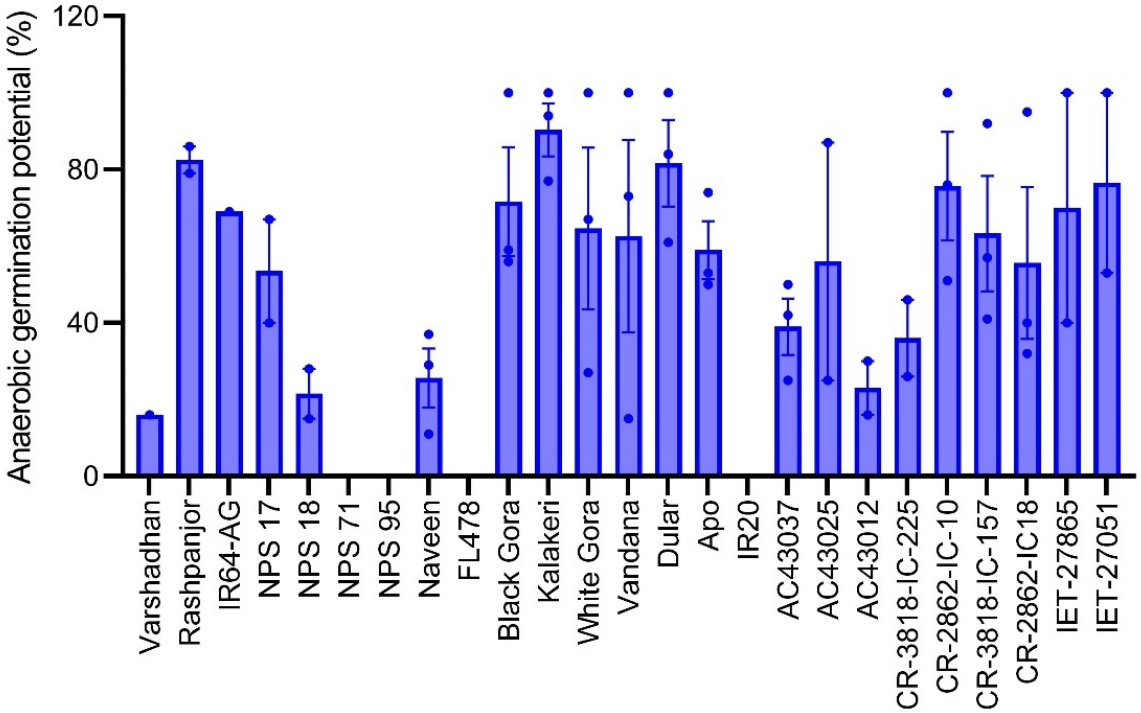


Fig. 6.4.1 *Mean AGP (%) of rice genotypes recorded after under 21 days of germination stage submergence stress tested at three different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

Besides AGP, underwater elongation of epicotyl is an important determinant for tolerance to AG stress in rice. The length of the epicotyl was recorded after 21 days of sowing for the germinated seedlings under anaerobic conditions. The data showed significant variation between the genotypes at the average epicotyl length (of all genotypes) varied from 24.04 cm at NRRI to 36.98 cm at FZB with an overall experimental mean of 28.63 cm and CV of 4.3%

across all locations (Table 6.5.3). The mean epicotyl length was highest in Vandana and CR-2862-IC-10 (36 cm), followed by Kalakeri and White Gora (35 cm), Black Gora (34 cm) and CR-3818-IC-157 after 21 days of AG (Fig. 6.4.2). But the epicotyl length was found significantly low in some genotypes like AC43012 (14 cm), Varshadhan (18 cm), NPS18 (21 cm) and AC43037 (23 cm). We found a significant correlation (R^2 = 0.3991) between AGP and length of epicotyl measured after 21 days of stress, which signifies greater the epicotyl elongation under AG condition, more is anaerobic germination potential of that particular genotypes (Fig. 6.4.3).

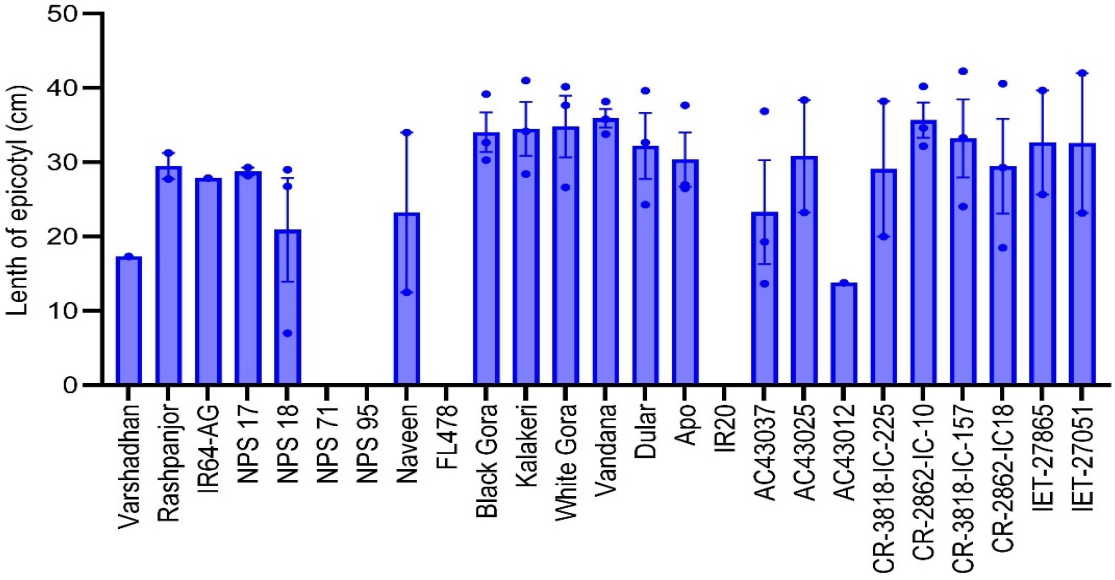


Fig. 6.4.2 *Mean length of epicotyl (cm) of rice genotypes recorded after under 21 days of germination stage submergence stress tested at three different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

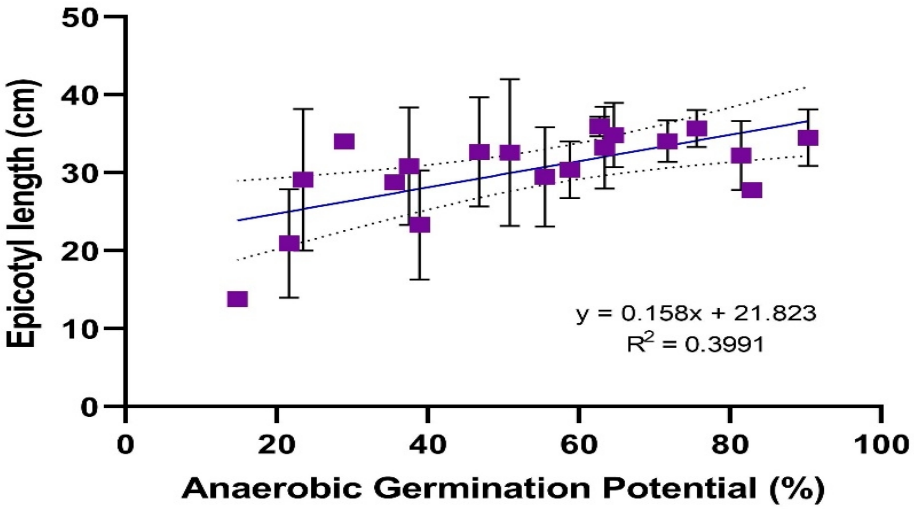


Fig. 6.4.3 *An XY-scatter plot showing simple linear regression between anaerobic germination potential and epicotyl length of rice genotypes under 14 days of complete submergence tested at three different locations. Error bars representing SE (mean) of all locations.*

Salinity Stress:

Screening for salinity tolerance was conducted at NRRI, CBT, KJT, KRK, PTB and MTU centers. Root and shoot length and total plant dry biomass under salinity stress are vital tolerance trait for rice genotypes at seedling stage. Salinity stress significantly reduced the mean (average of all locations) root and shoot length (Fig. 6.4.4). Mean root length in control and salinity stress was 12.02 cm and 6.84 cm respectively. The mean root length for all genotypes was reduced by >24.11% (average of all the genotypes) over control. The highest reduction was recorded in IET27051 (36%) followed by NPS17 (35 %) over control, whereas NPS18 (16%) has recorded the lowest reduction followed by Black Gora (17%) and White Gora (18%). Mean shoot length in control and salinity tolerance was 17.5 and 7.7 cm, respectively. All the genotypes had shown the mean reduction of about 19% over the control. The highest reduction in shoot length was observed in NPS71 (31%) followed by NPS18, Naveen and AC43037 (29%) whereas the genotype, Black Gora showed the lowest reduction of 8% over control, followed by NPS95 and Kalakeri (9%).

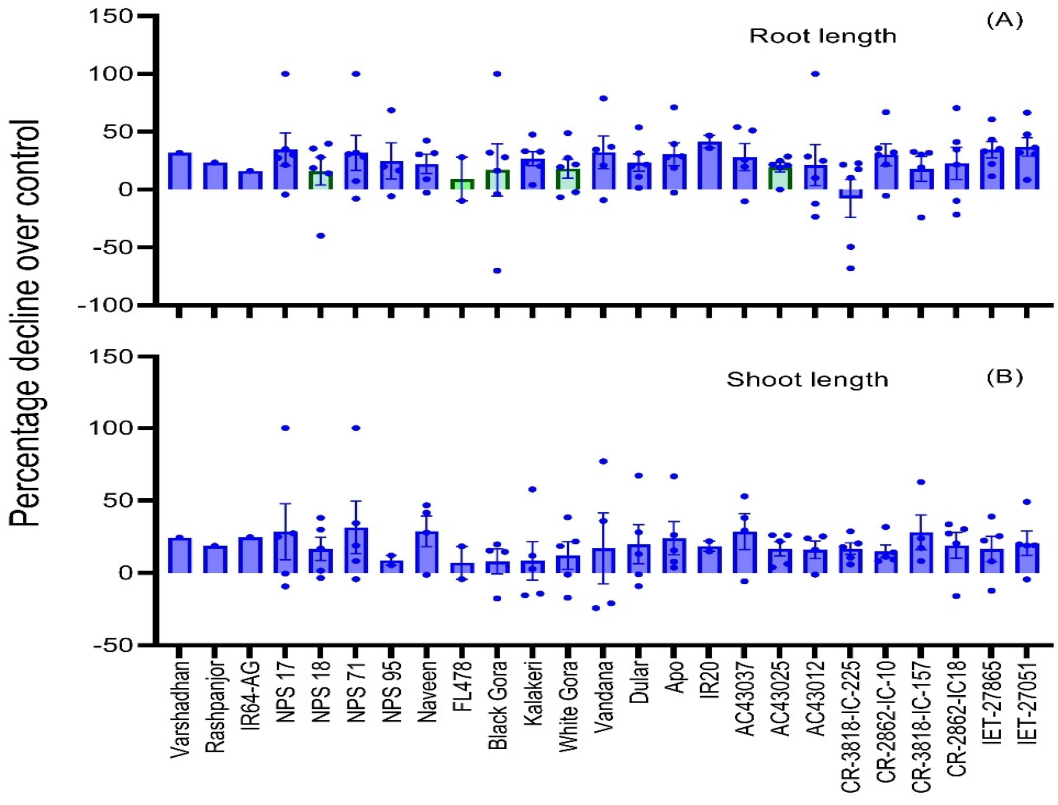


Fig. 6.4.4 *Changes in root length (A) and shoot length (B) of 25 rice entries (mean of all locations) in response to 12 dS m^{-1} salinity stress imposed at seedling stage tested at six different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

Salinity stress considerably reduced the total plant dry biomass (g) (Fig. 6.4.5A). Salt stress reduced the mean plant dry biomass by 32.12% (average of all the genotypes at all the locations). Total plant dry biomass in control and salinity stress was 0.09 and 0.04 g, respectively. The highest reduction was recorded in AC43037 (67%) and the least reduction in AC43025 (13%) followed by CR-3818-IC-225 (17%), Vandana (19%), Dular (25%) and CR-2862-IC-10 (25%). Salinity treatment also significantly reduced total leaf chlorophyll content. The mean leaf chlorophyll content in control and in salinity stress was 1.78 (mg g^{-1} FW) and 0.62 (mg g^{-1} FW) respectively. Overall there was a reduction of 30.06% in total leaf chlorophyll content and the highest reduction was noticed in CR-2862-IC-10(48%) and the genotypes, AC43012 (9%) and NPS71(14%) has recorded lowest reduction in leaf chlorophyll content (Fig. 6.4.5B).

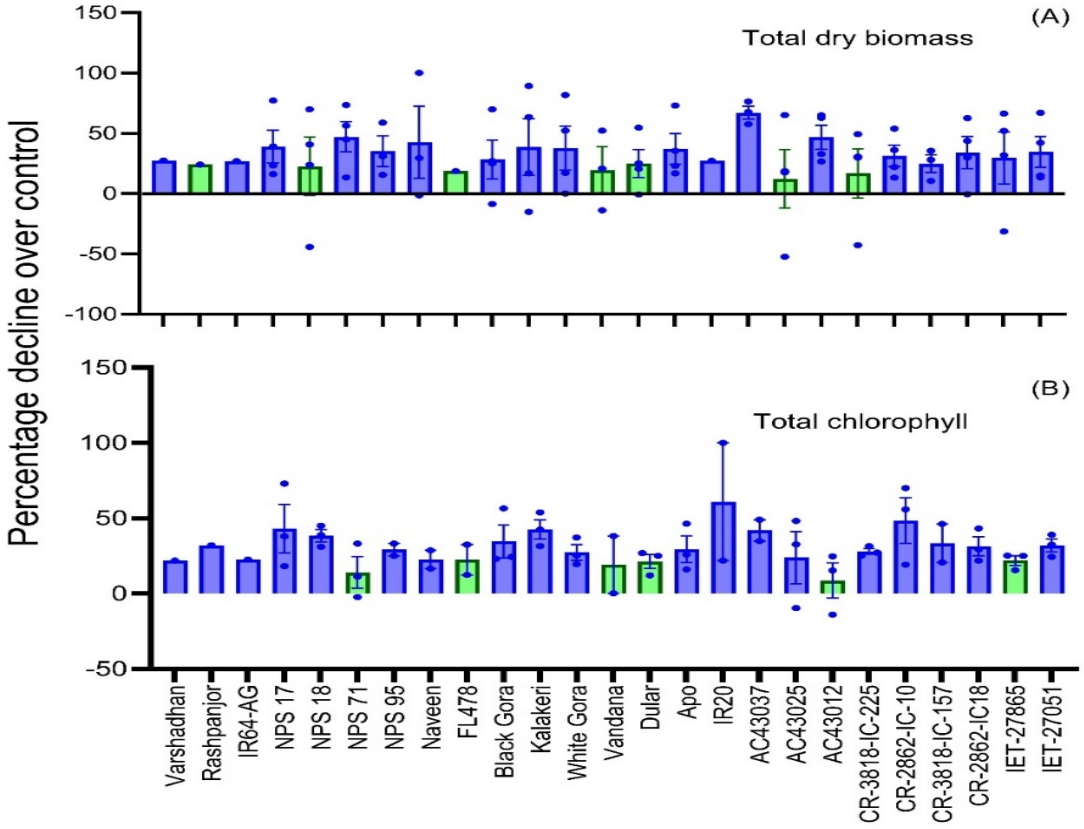


Fig. 6.4.5 *Changes in total dry biomass (A) and total chlorophyll content (B) of 25 rice entries (mean of all locations) in response to 12 dS m^{-1} salinity stress imposed at seedling stage tested at six different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

The shoot Na^+/K^+ ratio under salt stress and visual salt injury (VSI) scores of the genotypes were also recorded at NRRI centres, which showed significant variations between the studied genotypes (Fig. 6.4.6).The shoot Na^+/K^+ratio was varied between 0.483 − 1.840 in the studied genotypes. Besides the tolerant check FL478 (0.483), the lowest shoot Na^+/K^+ratio was observed in AC43025 has shown lowest shoot Na^+/K^+ratio of 0.64 followed by AC43037

and CR-2862-IC-10 (0.82), CR-3818-IC-225 (0.83) and Apo (0.89), while the highest Na^+/K^+ratio was observed in NPS71 (1.84). Among these genotypes, the VSI score of '3' was recorded in five genotypes *viz*., FL478, CR-2862-IC-10, CR-3818-IC-225, AC43025, AC43037 which can be considered as highly tolerant to seedling stage salinity stress. Besides, we also observed a significant correlation between the shoot Na^+/K^+ ratio of these genotypes with VSI score in the present study.

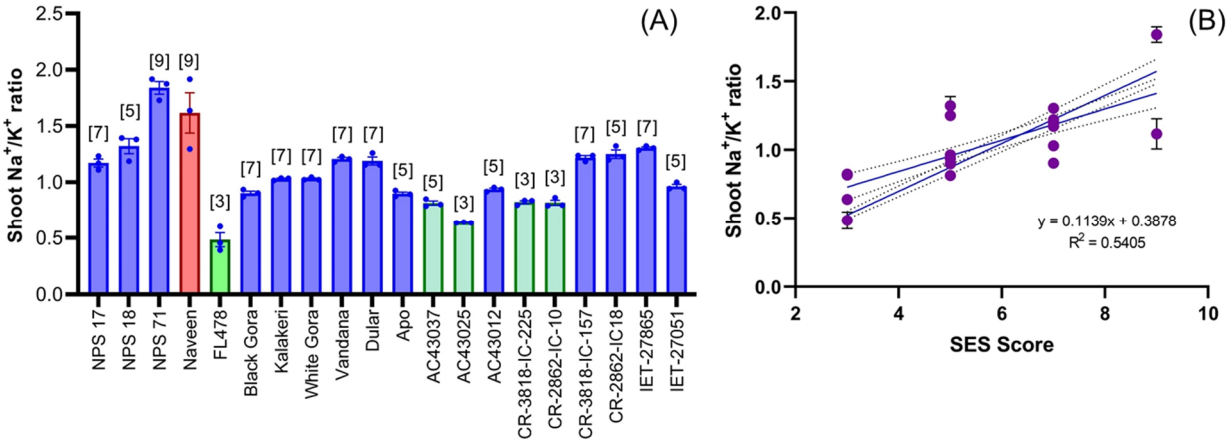


Fig. 6.4.6 *Changes in shoot Na^+/K^+ ratio and visual salt injury (VSI) score (A) and XY-scatter plot showing simple linear regression between shoot Na^+/K^+ ratio and visual salt injury (VSI) score (B) of 25 rice entries (mean of all locations) in response to 12 dS m^{-1} salinity stress imposed at seedling stage tested at NRRI center. Error bars representing SE (mean) of all biological replicates.*

Osmotic/dehydration Stress:

Screening for osmotic/dehydration stress were conducted at NRRI, KJT, MTU, PTB and TTB centres. Osmotic/dehydration stress was imposed by using the1% and 2% mannitol solution in the hydroponic media. Mannitol@1% and2%causedoverallreductioninthe root and shoot dry weight across the genotypes and centres under study. Significant difference in different studied traits were observed between 1% and 2% mannitol treatment across different locations. The mean root dry weight was reduced by 18% in 1% mannitol treatment, whereas in 2%mannitol treatment it was reduced by 67% as compared to that of control (Fig. 6.4.7A). Mean root dry weight in control, 1% mannitol and 2% mannitol was 17.5, 12.9 and11.0g, respectively. Highest and least reduction in root dry weight was recorded in IR20 and IET-27051, respectively under 1% mannitol treatment, whereas in 2% mannitol treatment the highest and least reduction was observed in IR64-AG and CR-3818-IC-225, respectively. Compared to mean root dry weight, mean shoot dry weight was less affected by osmotic stress by mannitol treatment (8 and 20% reduction was observed in 1% and 2% mannitol treatment, respectively). All the genotypes recorded significant reduction in shoot dry weight over control under 1% mannitol treatment except Vandana, CR-3818-IC-225 and AC43037 (Fig. 6.4.7B).

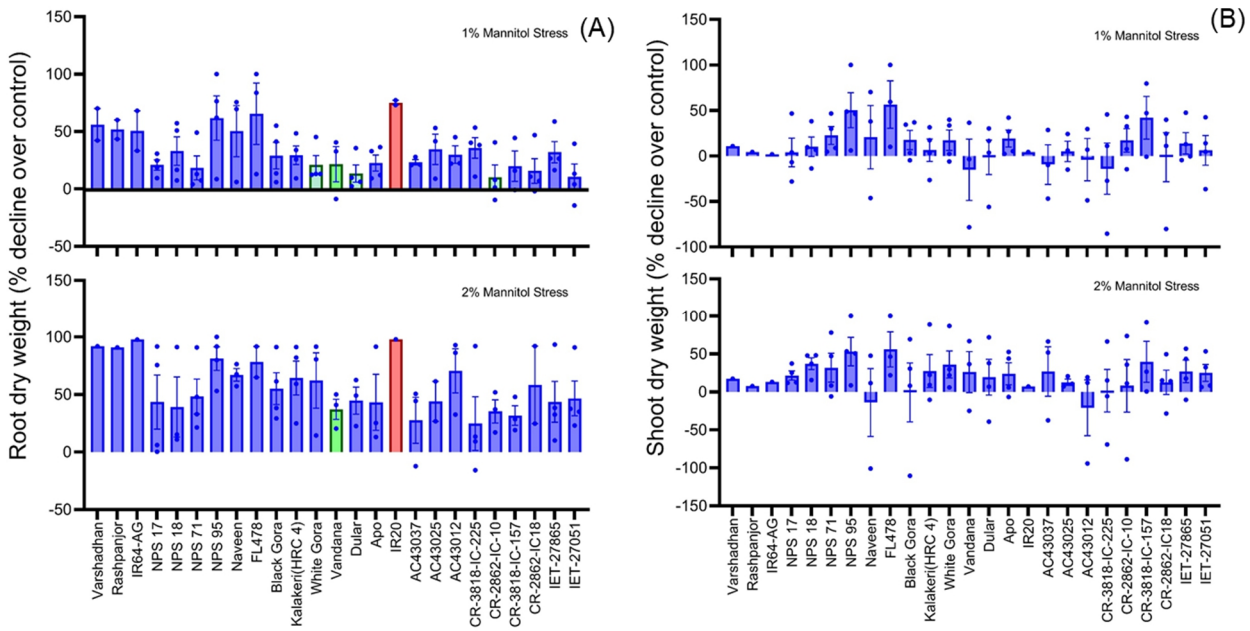


Fig. 6.4.7 *Changes in root (A) and shoot dry biomass (B) of 25 rice entries (mean of all locations) in response to 1 and 2% mannitol induced osmotic stress imposed at seedling stage tested at five different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

The effect of stress levels (1% and 2% mannitol) on shoot length was not found significant in the present study. In 1% mannitol treatment, shoot length was reduced by 40%, whereas in 2% mannitol it was reduced by 45% as compared to that of control (Fig. 6.4.8A). Mean shoot length in control, 1% mannitol and 2% mannitol was 17.5, 12.9 and 11.0 cm, respectively. In 1% mannitol highest reduction in shoot length was observed in NPS95, whereas the least reduction was observed in AC43012. In 2% mannitol the greatest reduction was shown by NPS95 and least reduction by CR-2862-IC18. Root length was more affected by both the levels of water stress treatments than the shoot length. The genotypes, NPS17, Black Gora and CR-3818-IC-157 were least affected by both 1% and 2% mannitol treatments as compared to control plants(Fig. 6.4.8B). A similar response was observed in chlorophyll content, which reduced significantly under both 1 and 2% mannitol treatment as compared to control. The highest reduction was observed in Naveen (45%), followed by FL478 (25%) overcontrolwhiletheleastreductionwasshownbyApo(4%),followedbyAC43037(6%) over control (Fig. 6.4.9).

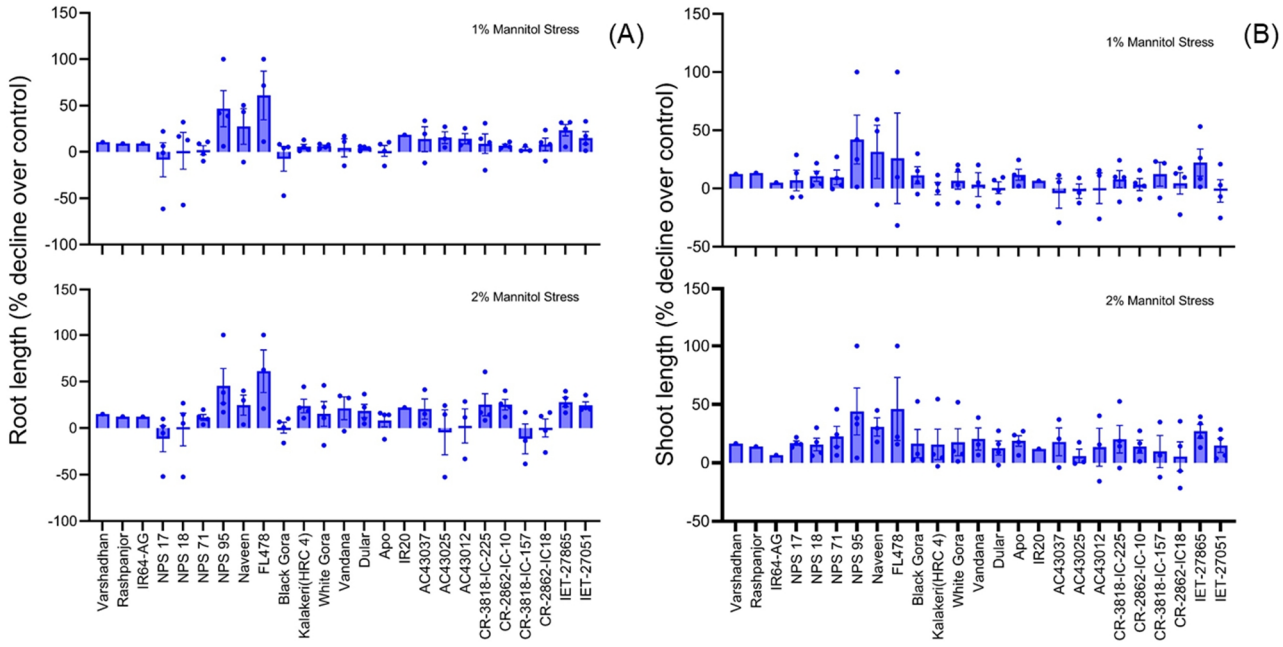


Fig. 6.4.8 *Changes in root (A) and shoot length (B) of 25 rice entries (mean of all locations) in response to 1 and 2% mannitol induced osmotic stress imposed at seedling stage tested at five different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

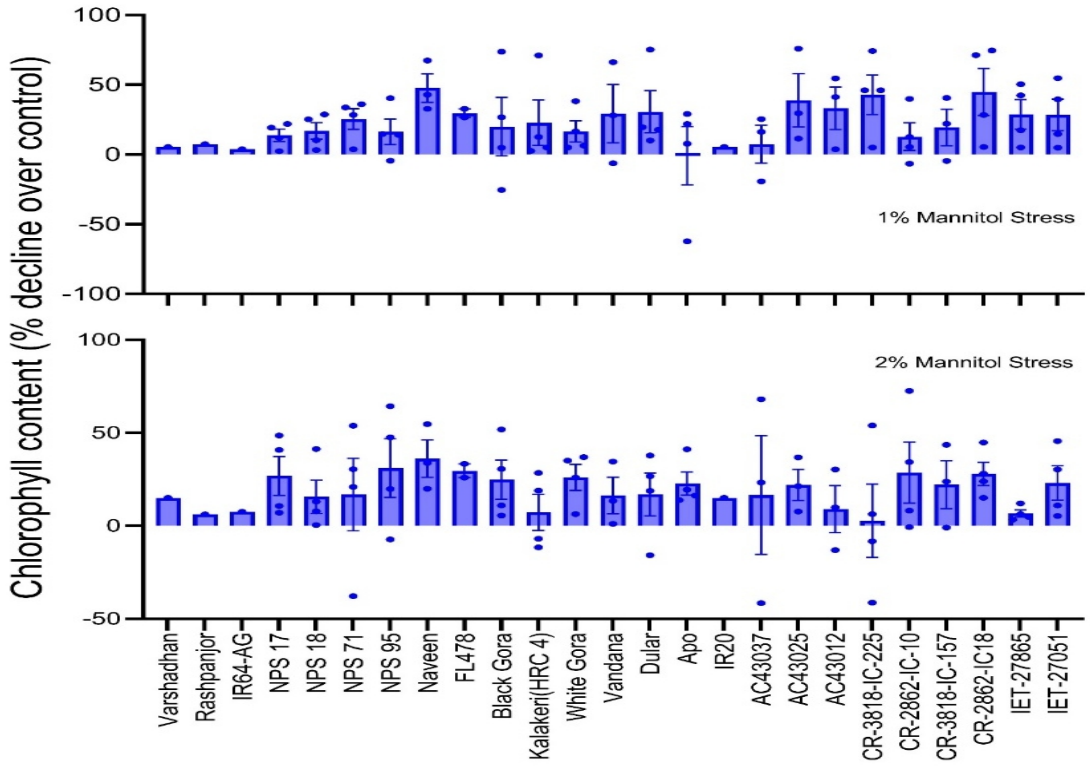


Fig. 6.4.9 *Changes in chlorophyll content of 25 rice entries (mean of all locations) in response to 1 and 2% mannitol induced osmotic stress imposed at seedling stage tested at five different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

Summary and Conclusion:

Screening of 25 rice accessions for multiple abiotic stress tolerance was conducted at 7 AICRIP centers for their anaerobic germination potential and tolerant against salinity (12 dS m^{-1}) and osmotic/dehydration (1 and 2% mannitol) stresses at seedling stage. All the genotypes including tolerant checks recorded reduction in key physiological traits *viz*. germination percentage, epicotyl length, shoot and root dry weight, shoot and root length, leaf chlorophyll content and shoot Na^+/K^+ ratio in response to different abiotic stresses. Based on the multi-locational performance (considering all studied traits) of these genotypes under AG stress, we found Kalakeri, Dular, IET-27051, CR-2862-IC-10, Black Gora and IET-27865 are highly tolerant to AG stress, besides two tolerant checks Rashpanjor and IR64-AG. Hence, these genotypes may be recommended as suitable donors having high anaerobic germination potential. Similarly, genotypes *viz*., FL478, AC43037, CR-2862-IC-10, CR-3818-IC-225 and AC43025 were found to be tolerant to seedling stage salinity stress with relatively less shoot Na^+/K^+ ratio and lower VSI score. Besides, genotypes *viz*., AC43037, AC43012, Dular, CR-3818-IC-225, IET-27051 and CR-2862-IC-10 showed considerable osmotic stress tolerance under 1% and 2% mannitol stress in this multi-locational trial. Considering the performance of these 25 tested entries, one entry CR-2862-IC-10 was tolerant to all the abiotic stresses (AG, salinity and osmotic), while three genotypes (IET-27051, CR-2862-IC-10, Dular) were found tolerant to both AG and osmotic stresses and three genotypes (AC43037, CR-3818-IC-225, CR-2862-IC-10) were tolerant to salinity and osmotic stresses (Table 6.4.1).

Table 6.4.1 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)	Kalakeri, Dular, IET-27051, CR-2862-IC-10, Black Gora, IET-27865, Rashpanjor
2.	Salinity stress (SS)	FL478, AC43037, CR-2862-IC-10, CR-3818-IC-225, AC3025
3.	Osmotic stress (OS)	AC43037, AC43012, Dular, CR-3818-IC-225, IET-27051, CR-2862-IC-10
4.	AG + SS	CR-2862-IC-10
5.	AG + OS	IET-27051, CR-2862-IC-10, Dular
6.	SS + OS	AC43037, CR-3818-IC-225, CR-2862-IC-10
7.	AG + SS+ OS	CR-2862-IC-10

Table 6.4.2 Effect of 21 days of submergence stress on anaerobic germination potential (%) of rice genotypes during *Kharif* 2021 at different locations. NG: Not germinated

Sl. No.	Entries	NRRI	TTB	PTB	Grand Mean
1.	Varshadhan	16	--	--	16
2.	Rashpanjor	--	79	86	83
3.	IR64-AG	69	--	--	69
4.	NPS17	--	40	67	54
5.	NPS18	15	28	--	22
6.	NPS71	0	0	0	0
7.	NPS95	0	0	0	0
8.	Naveen	11	29	37	26
9.	FL478	0	0	0	0
10.	Black Gora	56	59	100	72
11.	Kalakeri	77	94	100	90
12.	White Gora	27	67	100	65
13.	Vandana	15	73	100	63
14.	Dular	61	84	100	82
15.	Apo	50	74	53	59
16.	IR20	0	0	0	0
17.	AC43037	25	42	50	39
18.	AC43025	25	--	87	56
19.	AC43012	16	30	--	23
20.	CR-3818-IC-225	--	26	46	36
21.	CR-2862-IC-10	51	76	100	76
22.	CR-3818-IC-157	41	57	92	63
23.	CR-2862-IC18	40	32	95	56
24.	IET-27865	--	40	100	70
25.	IET-27051	--	53	100	77
Exp. Mean		37.1	54.56	82.96	56.72
CD		13.03	10.2	7.93	6.47
CV%		21.06	11.26	5.75	6.91

Table 6.4.3 Effect of 21 days of submergence stress on epicotyl growth (cm) of rice genotypes during *Kharif* 2021 at different locations. NG: Not germinated

Sl. No.	Entries	NRRI	TTB	PTB	Grand Mean
1.	Varshadhan	18	--	--	18
2.	Rashpanjor	31	--	28	30
3.	IR64-AG	28	--	--	28
4.	NPS17	--	30	28	29
5.	NPS18	7	29	28	21
6.	NPS71	0	0	0	0
7.	NPS95	0	0	0	0
8.	Naveen	13	--	34	24
9.	FL478	0	0	0	0
10.	Black Gora	33	30	39	34
11.	Kalakeri	29	34	41	35
12.	White Gora	27	38	40	35
13.	Vandana	36	34	37	36
14.	Dular	24	33	40	32
15.	Apo	27	27	38	31
16.	IR20	0	0	0	0
17.	AC43037	14	19	37	23
18.	AC43025	23	--	39	31
19.	AC43012	--	14	--	14
20.	CR-3818-IC-225	--	20	38	29
21.	CR-2862-IC-10	35	32	40	36
22.	CR-3818-IC-157	24	33	42	33
23.	CR-2862-IC18	18	29	41	29
24.	IET-27865	--	26	40	33
25.	IET-27051	--	23	--	23
Exp. Mean		37.1	24.04	28.19	36.98
CD		13.03	3.17	3.13	2.32
CV%		21.06	7.9	6.65	3.77

6.5 Screening of Rice Genotypes for Submergence Tolerance

Locations: NRRI, TTB, PTB and CBT

In the era of global climate change, rice cultivation especially in the rain-fed ecology faces multi-facet problems due to incidence of different abiotic stresses. Erratic and sudden excessive rainfall imparts various excess water stresses in rice like submergence, waterlogging, stagnant flooding etc. With the recent trend in changing rainfall pattern, the frequency of occurrence of such extreme events creating a havoc are likely to be more in the near future. Submergence is a type of flooding stress, which is defined as a condition, where the entire plant is fully immersed under water (a phenomenon termed as complete submergence) or at least part of the shoot terminal is maintained above the water surface (a phenomenon termed as partial submergence). Under submergence, plants face a number of external challenges simultaneously or sequentially, which results in multiple internal stresses, which affect the plant growth and survival. Genetic variability in the plant response to flooding includes the quiescence scheme, which allows underwater endurance of a prolonged period, escape strategy through stem elongation, and alterations in plant architecture and metabolism. Keeping this in view, during *Kharif*2021, a trial was formulated to evaluate promising rice genotypes for submergence tolerance.

The trial was conducted at four different AICRIP centers i.e., Titabar (TTB), Assam; NRRI (CTC), Odisha; Patambi (PTB), Kerala and Coimbatore (CBT), T.N. Thirty promising rice genotypes (including tolerant and susceptible checks) were tested for 14 days of complete submergence and key the tolerance traits were recorded across the locations. Among the four centers, data received from CBT centre was not included in the final analysis and interpretation of result due to inconsistent performance of the check lines. The mean data of other three centers showed significant variability between the studied genotypes for all three studied traits *viz*., survival rate (%), elongation ability (%) and final plant height (cm) after desubmergence. The tolerant check Swarna-SUB1 recoded the highest survival rate of 79% (mean of all locations), while it was only 15% in susceptible genotype Naveen. The other susceptible line Swarna, didn't germinate at any of the center. Among the tested lines, highest survival rate was observed in AC43025 (76%), followed by Dular (72%), NPS17 (70%) and NPS18 (70%) (Fig. 6.5.1; Table 6.5.1).A few other lines such as AC43037 (67%), Black Gora (65%), Mahulata (64%), Gurjari (61%) and Pani Kekua (61%) also showed considerable submergence tolerance (60-70%). Few other lines like NPS71 (58%), Ampaki Bora (57%), Mian Sali (56%), Boga Amona (55%) etc. showed more than 50% survival under 14 days of complete submergence.

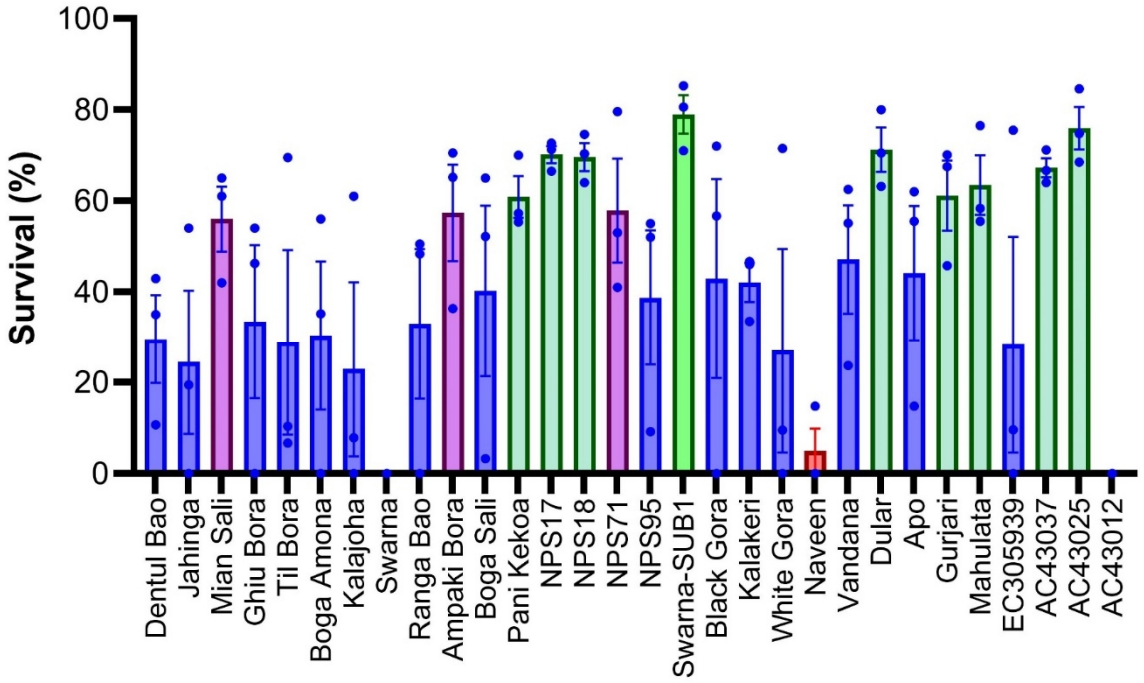


Fig. 6.5.1 *Mean survival rate (%) of rice genotypes under 14 days of complete submergence tested at three different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

Underwater elongation of internodes and subsequent increase in plant height is a key feature of submergence tolerance ability of a genotype governed by *SUB1A* gene action. True submergence tolerant lines usually adopt a quiescence strategy and limits its underwater elongation and thereby preserve energy and carbohydrate reserve that are essential for post submergence recovery and survival. Based on the data from all locations, a significant increase in plant height was observed as a result of submergence stress, although the extent of increase varied significantly between the tested lines (Fig. 6.5.2; Table 6.5.2). Interestingly, the plant height of all the promising genotypes showing >50% survival rate was ranged from 38–53 cm at the end of 14-day stress period, while it was least (36 cm) in Swarna-SUB1. It suggests that most the tested genotypes followed quiescence strategy and remained under water for the complete period of submergence stress, which might be due to *SUB1A* gene action.

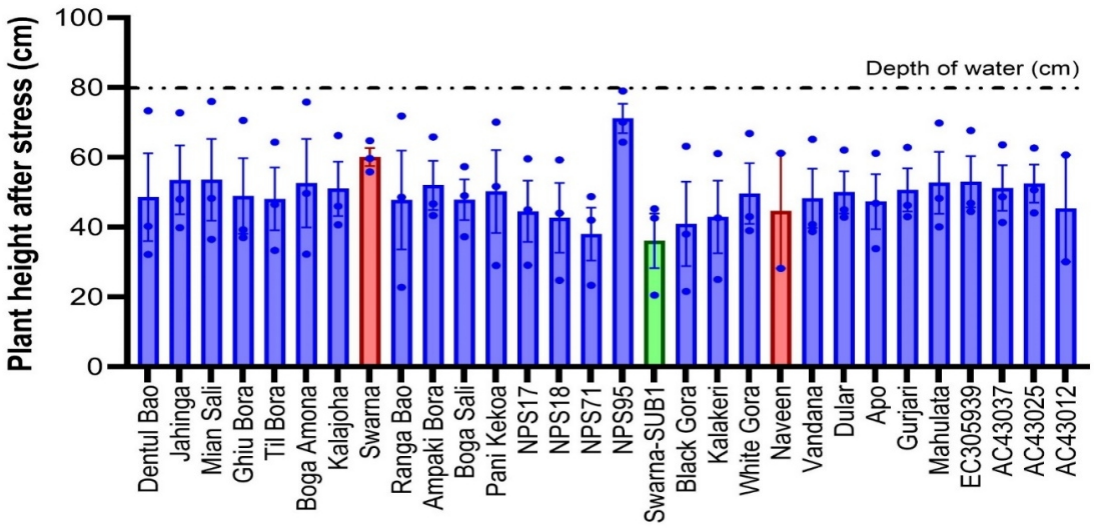


Fig. 6.5.2 *Mean plant height (cm) of rice genotypes under 14 days of complete submergence tested at three different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

The elongation ability (EA) of these genotypes were also varied significantly. The EA of Swarna-SUB1 was found to be least (35%), followed by AC43037 (43%), NPS18 (44%), Black Gora (45%), NPS71 (47%) and NPS17 (49%) (Fig. 6.5.3; Table 6.5.3). The EA of most of the promising lines (showing >50% survival rate) were at par with the EA of tolerant check Swarna-SUB1, but a few of them like Mahulata (79%), Dular (78%), Mian Sali (71%), Ampaki Bora etc. showed significantly higher EA than Swarna-SUB1, indicating probable existence of differential submergence tolerance mechanism in these genotypes which needs further studies. In general, we observed a significant correlation ($R^2 = 0.3053$) between survival rate and EA of the tested lines taking into consideration of the data of all the genotypes across all the locations (Fig. 6.5.4).

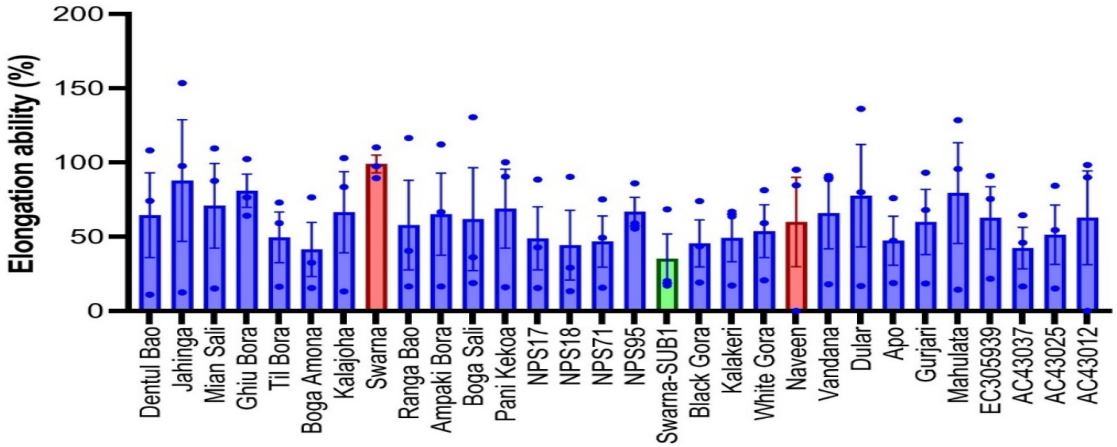


Fig. 6.5.3 *Mean elongation ability (%) of rice genotypes under 14 days of complete submergence tested at three different locations. Error bars representing SE (mean) of all locations and scattered dots are representing mean of individual location.*

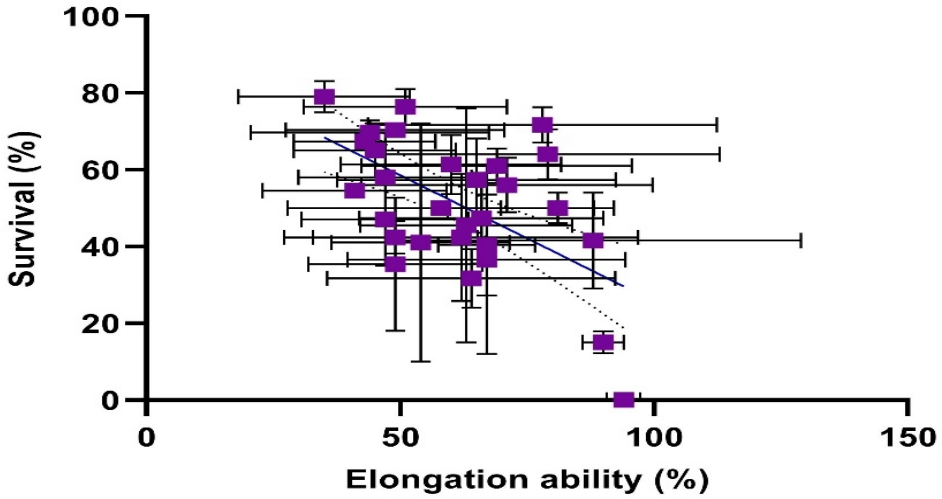


Fig. 6.5.4 *An XY-scatter plot showing simple linear regression between survival rate and elongation ability of rice genotypes under 14 days of complete submergence tested at three different locations. Error bars representing SE (mean) of all locations.*

Summary & Conclusion:

Thirty different rice genotypes were included in the trial which was conducted at four different locations (NRRI, TTB, PTB and CBT), out of which the data received from CBT center was not included in the final analysis due to inconsistent performance of the check genotypes. The survival rate was found to be highest in Swarna-SUB1 (tolerant check) across different locations, while susceptible check Naveen showed only 15% survival. The center wise mean survival rate (%) varied from 48.18% (CTC) to 62.2% (PTB) with mean of 54.71% for all genotypes across all the locations. Among the tested entries, four genotypes i.e., AC43025, Dular, NPS17 and NPS18 showed more than 70% survival under 14 days of complete submergence and their survival rate was statistically at par with tolerant check. Five other entries *viz*. AC43037, Black Gora, Mahulata, Gurjari and Pani Kekua showed 60-70% survival, while four other entries viz., NPS71, Ampaki Bora, Mian Sali and Boga Amona showed 55-60% survival under stress. Hence, these three group of genotypes can be considered as highly tolerant, tolerant and moderately tolerant to submergence stress, respectively, based on the mean survival data of all locations. These genotypes may be used as potential donors for improving submergence tolerance trait in high yielding cultivars.

Table 6.5.1 Effect of 14 days of submergence stress on survival rate (%) on rice genotypes during *Kharif* 2021 at different locations. NG: Not Germinated

Sl. No.	Entries	NRRI	TTB	PTB	Grand Mean
1.	Dentul Bao	17	35	43	32
2.	Jahinga	--	54	29	42
3.	Mian Sali	42	61	65	56
4.	Ghiu Bora	--	54	46	50
5.	Til Bora	16	70	20	35
6.	Boga Amona	--	56	53	55
7.	Kalajoha	12	61	--	37
8.	Swarna	NG	NG	NG	NG
9.	Ranga Bao	--	51	49	50
10.	Ampaki Bora	36	71	65	57
11.	Boga Sali	10	65	52	42
12.	Pani Kekoa	56	70	57	61
13.	NPS17	71	67	73	70
14.	NPS18	75	64	70	70
15.	NPS71	53	41	80	58
16.	NPS95	14	52	55	40
17.	Swarna-SUB1	85	71	81	79
18.	Black Gora	--	72	58	65
19.	Kalakeri	34	46	47	42
20.	White Gora	--	72	10	41
21.	Naveen	10	20	15	15
22.	Vandana	24	63	55	47
23.	Dular	80	71	64	72
24.	Apo	23	62	56	47
25.	Gurjari	46	68	70	61
26.	Mahulata	59	77	56	64
27.	EC305939	15	76	--	46
28.	AC43037	71	64	67	67
29.	AC43025	85	69	75	76
30.	AC43012	0	0	0	0
Exp. Mean		48.18	62.2	55.55	54.71
CD		17.29	12.96	22.91	15.84
CV%		21.74	12.72	25.15	17.69

Table 6.5.2 Effect of 14 days of submergence stress on plant height (in cm after stress) on rice genotypes during *Kharif* 2021 at different locations. NG: Not germinated

Sl. No.	Entries	NRRI	TTB	PTB	Grand Mean
1.	Dentul Bao	74	40	32	49
2.	Jahinga	73	48	40	54
3.	Mian Sali	76	48	37	54
4.	Ghiu Bora	71	39	37	49
5.	Til Bora	2	64	46	37
6.	Boga Amona	76	50	33	53
7.	Kalajoha	66	46	41	51
8.	Swarna	NG	NG	NG	NG
9.	Ranga Bao	72	49	23	48
10.	Ampaki Bora	66	47	43	52
11.	Boga Sali	57	49	37	48
12.	Pani Kekoa	70	52	29	50
13.	NPS17	59	45	29	44
14.	NPS18	60	44	25	43
15.	NPS71	49	42	23	38
16.	NPS95	64	70	29	54
17.	Swarna-SUB1	43	45	20	36
18.	Black Gora	63	38	22	41
19.	Kalakeri	61	43	25	43
20.	White Gora	67	43	39	50
21.	Naveen	61	--	28	45
22.	Vandana	65	41	39	48
23.	Dular	62	43	45	50
24.	Apo	61	47	34	47
25.	Gurjari	63	43	46	51
26.	Mahulata	70	48	40	53
27.	EC305939	68	47	44	53
28.	AC43037	63	49	41	51
29.	AC43025	63	51	44	53
30.	AC43012	61	--	30	46
Exp. Mean		48.18	62.01	47.52	35.6
CD		17.29	13.14	12.61	11.48
CV%		21.74	12.96	16.2	19.73

Table 6.5.3 Effect of 14 days of submergence stress on elongation ability (%) on rice genotypes during *Kharif* 2021 at different locations. NG: Not germinated

Sl. No.	Entries	NRRI	TTB	PTB	Grand Mean
1.	Dentul Bao	74	11	108	64
2.	Jahinga	98	13	154	88
3.	Mian Sali	88	15	110	71
4.	Ghiu Bora	102	64	77	81
5.	Til Bora	59	16	73	49
6.	Boga Amona	76	15	33	41
7.	Kalajoha	84	13	103	67
8.	Swarna	NG	NG	NG	NG
9.	Ranga Bao	117	17	40	58
10.	Ampaki Bora	67	17	112	65
11.	Boga Sali	36	19	131	62
12.	Pani Kekoa	91	16	100	69
13.	NPS17	89	15	43	49
14.	NPS18	90	13	29	44
15.	NPS71	75	16	49	47
16.	NPS95	59	86	56	67
17.	Swarna-SUB1	69	17	20	35
18.	Black Gora	74	19	43	45
19.	Kalakeri	67	17	64	49
20.	White Gora	81	21	59	54
21.	Naveen	95	--	85	90
22.	Vandana	89	18	91	66
23.	Dular	80	17	136	78
24.	Apo	76	19	47	47
25.	Gurjari	68	19	93	60
26.	Mahulata	96	14	128	79
27.	EC305939	75	22	91	63
28.	AC43037	46	17	65	43
29.	AC43025	55	15	84	51
30.	AC43012	98	--	90	94
Exp. Mean		48.18	78.81	24	80.42
CD		17.29	40.68	9.96	46.57
CV%		21.74	31.58	25.36	35.44

6.6 Screening of rice varieties for tolerance to low light stress

Locations: IIRR, KJT, MTU, NRRI, PNR, RPUR and TTB

Agriculture is nothing but the utilization of solar radiation with soil moisture and nutrients. Light is the single most important environmental factors regulating various plant growth and development processes. Therefore, duration, intensity and type of light are equally important in respect of various processes of plant such as photosynthesis and thus determine the crop yield. Rice gain yield and quality are regulated by light intensity. Low light reduces tillering, panicle and spikelet numbers, and grain weight and quality. Low light during the grain-filling stage decreased the starch synthase activity in grains, which directly inhibits grain filling and enhances the occurrence of chalky rice. Thus low light intensity is a critical abiotic stress that reduces rice yield and quality. Rice yield is comparatively low during the *kharif* season in eastern and north eastern regions of India; primarily due to cloudy days with inadequate light intensity. It is reported that grain yield correlates positively with solar radiation especially during the reproductive stage. It is estimated that accumulative solar radiation of 200 hours and bright sunshine during 30 days before harvest could be optimum for grain yield. But low light intensity (200-300 cal $cm^{-2}day^{-1}$) for few hours of bright sun shine (mean about 4 hr day^{-1}) prevailing during *kharif* season is a major limitation for rice production.

Keeping the above points in view a trial was constituted in the 51th ARGM to screen elite germplasm from AICRIP trails for low light stress tolerance and identify donors to improve the breeding program in low light stress tolerance environment. The trail was conducted at 7 locations with material from AVT-2 (obtained from eastern and north eastern India) and screened for tolerance to low light stress with Swarnaprabha as check, along with IR8 as susceptible check. The trail was conducted with split plot (RCBD) design with 3 replications with light regimes as main plot treatment and genotypes as sub plot treatments. Low light was imposed immediately after transplanting by enclosed the plants in shade net (50% transmittance). The shade net was supported by metal rods/bamboo poles.

At panicle initiation stage mean total chlorophyll content varied from 1.99 (NRRI) to 4.87 (RPUR) mg/g fw under control treatment and 2.13 (PNR) to 3.55 (KJT) mg/g fw under low light stress treatment (Table 6.6.1). Low light stress did not affect the mean total chlorophyll content (mean of all locations and entries) significantly. Under low light stress >50% of the entries have shown the increase in mean total chlorophyll content (mean of the entry at different locations). Further, increase of about 54% and 24% in the mean total chlorophyll content was observed under low light stress treatment at KJT and NRRI centers

over control treatment respectively. Entry Swarnasub-1 recorded the highest total chlorophyll content followed by IET27538 at Karjat and the lowest by IET28281. At NRRI center, entry IET27538 has recorded the highest total chlorophyll content (3.84 mg/g fw) followed by IET30408 (3.40 mg/g fw) and the lowest by IET29032 (1.85 mg/g fw). The interaction effect of Location x treatment was significant meaning thereby the treatment varied across locations. Under control treatment Raipur center recorded the highest total chlorophyll content. At Raipur entry IET28281 recorded the highest total chlorophyll content (6.76 mg/g fw) followed by IET28276 (6.40 mg/g fw) whereas entry IR8 (2.49 mg/g fw). However, all the entries under low light stress treatment have shown a general reduction over the control treatment at Raipur center. At Pantnagar center, entry IET27538 (2.82 mg/g fw) recorded the highest total chlorophyll content followed by IET26744 (R) (2.81 mg/g fw) and the lowest by IET28276 (1.17 mg/g fw) under low light stress treatment. Under control treatment IET30408 (3.54 mg/g fw) recorded the highest total chlorophyll content followed by IET26744 (R) (3.22 mg/g fw) and the least by IET29026 (1.34 mg/g fw). The interaction effect of Location x genotype was significant implying the response of genotype to treatment varied with across location.

At flowering stage (Table 6.6.2), mean total chlorophyll content ranged from 1.85 (TTB) to 5.44 (KJT) mg/g fw in low light stress treatment and 1.69 (PNR) to 4.08 (MTU) mg/g fw in control treatment. The tested entries significantly ($p<0.01$) affected by low light stress at flowering stage for total chlorophyll content. >90% entries have shown the increase in mean (mean of an entry at different locations) total chlorophyll content under the influence of the low light stress. At Karjat center IR8 (7.73 mg/g fw) recorded the highest total chlorophyll content followed by IET30408 (6.48 mg/g fw) and the least by IET29031 (3.62 mg/g fw) under low light stress treatment, whereas under control treatment the highest total chlorophyll content was shown by Swarna sub-1 (4.10 mg/g fw) followed by IET30410 (3.86 mg/g fw) and the lowest by IET30409 (2.57 mg/g fw). At flowering stage, the interaction between Location x Genotype was found to be significant ($p<0.01$), similarly the interaction between Location x Treatment was also significant meaning thereby the response of genotype to treatment varied with location and treatment effect also varied across locations. Karjat and NRRI centers has shown an enhancement of about 65% mean (of all entries) total chlorophyll content as over control as a result of low light stress treatment. At NRRI center IET30411 (4.49 mg/g fw) has shown the highest total chlorophyll content followed by Chiranj (3.95 mg/g fw) and the lowest was shown by IET28276 (2.44 mg/g fw) whereas under control condition IR8 (2.93 mg/g fw) has recorded the highest and the IET28276 (1.37 mg/g fw) has shown the lowest.

Plant height is an important agronomic trait that significantly contributes to crop yields. Therefore, understanding plant height can help in rice yield improvement. Table 6.6.3 shows, low light stress treatment significantly affected the tested genotypes for plant height (cm). Mean plant height ranged from 108.3 to 174.9 cm in low light stress treatment whereas in control treatment from 101.7 to 208.8 cm. At Maruteru center, significant enhancement of plant height was observed as a result of shading in almost all entries barring one or two. The highest enhancement over control was observed in IET30411, Swarna sub-1 and Swarnaprabha respectively and least was recorded by IET29031. At NRRI center entry Varshadhan has shown the highest enhancement followed by IET30411 and IR8 respectively. At IIRR center entry IET29032 and Swarnaprabha has shown the highest enhancement over control respectively. Highest enhancement of plant height over control among all the centers was observed at Pantnagar center, entries IET26744 (R) recorded the highest enhancement over control among all the entries at all the centers, followed by Swarnaprabha, IET28281 and IET29026. At Titabr center, the entry IET29031 has recorded the highest followed by IET29026 and IET30408 Interaction between Location x Genotype, Location x Treatment and Genotype x Treatment was found to be significant ($p<0.01$) implying that the response of genotype to treatment varied with location, treatment effect also varied across locations and also there was a variation in genotypic response to the treatment.

Table 6.6.4 shows the data for panicle weight (gm^{-2}) under the influence of low light stress on various entries. It can be observed that in comparison with control, almost all the entries at all the centres have recorded reduction in the panicle weight under the influence of low light stress. Panicle weight ranged from 98 gm^{-2} (NRRI) to1186 gm^{-2} (RPUR) under shading treatment whereas under control it ranged from 208 gm^{-2} to 1705 gm^{-2}. The interaction between Location x Genotype was found to be significant ($p<0.01$), similarly the interaction between Location x Treatment was also significant meaning thereby the response of genotype to treatment varied with location and treatment effect also varied across locations. The greatest reduction among all the centers was recorded at NRRI center. However, at Pantnagar center some of the entries have shown significant enhancement in panicle weight over control.

The influence of low light stress on grain number per panicle on various rice varieties was shown in Table 6.6.5. Low light stress significantly influenced the grain number per panicle and entries also have significantly varied in their response to the treatment. A general reduction of grain number per panicle was observed under the influence of shading. The grand mean (mean of all the entries and all the centres) ranged from 81 in shading to 98 in control. Among

the centres, Raipur (136) has shown the highest and the Pantnagar (24) has shown the lowest under low light stress whereas Titabar (164) has shown the highest and the lowest was shown by Pantnagar (35). The interaction between Location x Genotype was found to be significant ($p<0.01$) and the interaction between Location x Treatment was also significant meaning thereby the response of genotype to treatment varied with location and treatment effect also varied across locations.

Spikelet number per panicle varied from 86 (NRRI) to 145 (PNR) under shading and 129 (NRRI) to 198 (TTB) under control. The shading treatment did not affect the genotypes significantly and the response of the genotypes to treatment was also non-significant Table 6.6.6. However, some of the entries at IIRR centre have shown the least reduction in spikelet number per panicle such as IET29026 followed by IET26744 (R) under stress treatment. At Karjat centre many of the entries have either shown the lest reduction or higher spikelet number per panicle over control (though non-significant) under stress treatment. Similarly, at Maruteru centre the entries have shown the minimal reduction in spikelet number per panicle compared to the control. At NRRI centre the entry IET 29026 has shown the highest enhancement of spikelet number per panicle over control followed by IET27547 and the highest reduction was shown by Swarna Sub-1 over control. At Pantnagar almost half of the entries have shown the enhancement over control, prominent among them are Gayatri, Swarnaprabha and IET28281 etc. The interaction between location x genotype was non-significant implying thereby the response of genotype to treatment varied with location and the interaction between location x treatment was also significant meaning treatment effect also varied across locations.

The grain yield (g/m^2) ranged from 61 (NRRI) to 345 g/m^2 (IIRR) under low light stress treatment whereas under control treatment from 182 (PNR) to 646 g/m^2 (IIRR). Table 6.6.7 shows that low light stress treatment significantly affected the genotypes. Under

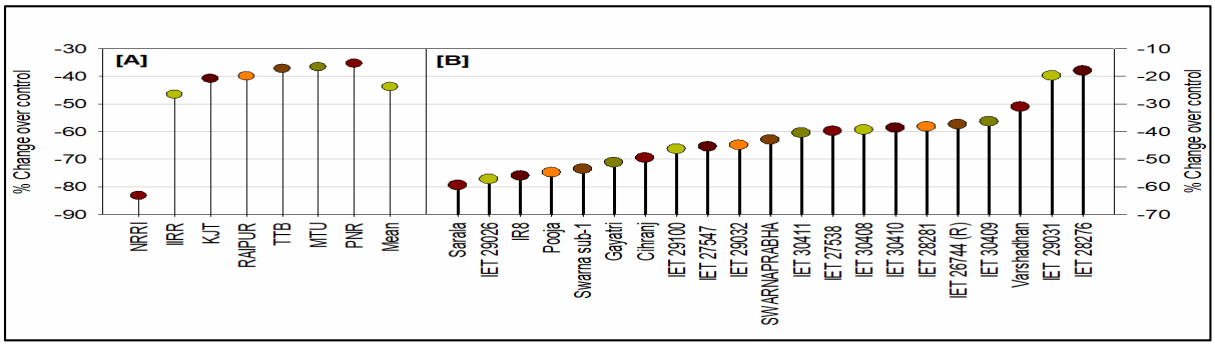


Fig. 6.6.1. *Influence of low light stress on* grain yield (g/m^2) *a) mean of all the genotypes b) mean of all the locations.*

low light stress treatment grain yield reduced significantly as compared to control and reduction was in the tune of 54%. Also genotypes varied significantly in their response to the treatment. The interaction between location x genotype and location x treatment was significant meaning thereby the response of genotype to treatment varied with location and treatment effect also varied across locations. Among entries Sarala has recorded the highest reduction of 58% of mean grain yield and IET28276 followed by IET29031 the least 18% and 20% respectively. The greatest reduction was observed at NRRI center Fig. 6.6.1. At IIRR centre, entry Varshadhan and at Raipur centre entry IET27547 has shown significant increase in the grain yield over control. The interaction between location x genotype was found to be significant ($p<0.01$), similarly the interaction between location x treatment was also significant meaning thereby the response of genotype to treatment varied with location and treatment effect also varied across locations.

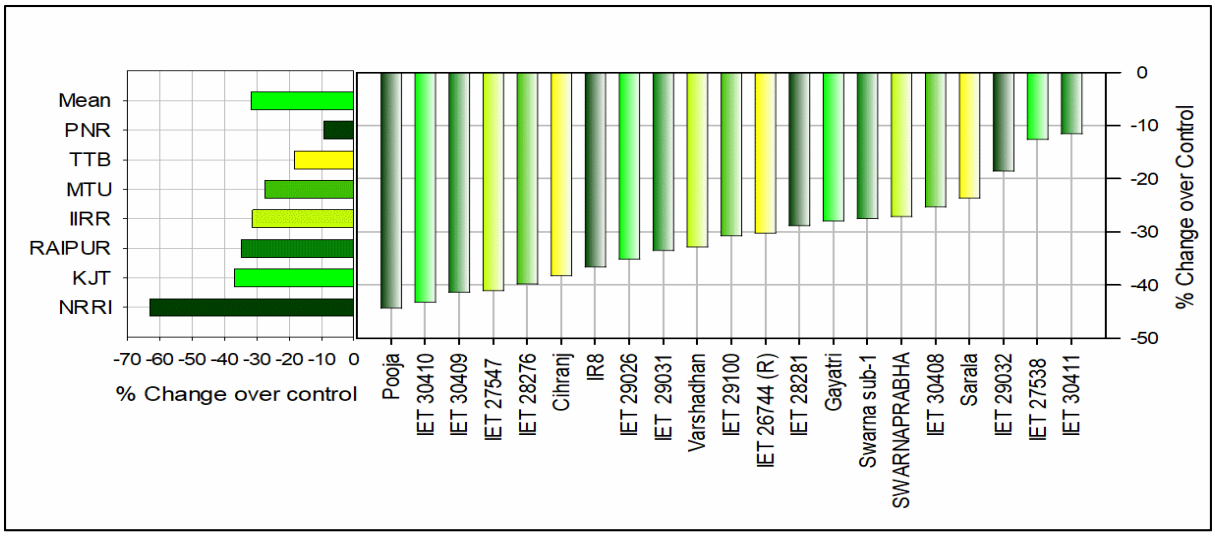


Fig. 6.6.2. *Influence of low light stress on total dry matter (g/m^2) a) mean of all the genotypes b) mean of all the locations.*

The mean (all the entries and all the centres) total dry matter (g/m^2) under low light stress treatment was 1124 g/m^2 whereas 1334 g/m^2 under control treatment Table 6.6.8. Low light stress significantly affected the total dry matter of the rice entries and also all the entries have differentially responded to the treatment. In general low light stress negatively affected the total dry matter and rice entries have recorded the reduction in total dry matter except few. Mean total dry matter reduced by about 15% due to low light stress. Mean total dry matter ranged from 386 (NRRI) to 2512 (RPUR) (g/m^2) under low light stress and 714 (NRRI) to 3187(RPUR) (g/m^2) under control condition. At IIRR centre entry IET29031 and IET29026 have shown least reduction. Further at Raipur centre some of the genotypes have recorded

increase in total dry matter under the influence of low light stress over control such as entry IET29032, IET27538, IET30411 and Sarala. The interaction between location x treatment was significant meaning thereby treatment effect also varied across locations. Among entries Pooja has recorded the highest reduction of 43% of mean total dry matter and IET30411 the least 12%. The highest reduction in the total dry matter was observed at NRRI centre and the least at PNR centre Fig. 6.6.2.

Table 6.6.9 shows the influence of low light stress on 1000 grain weight (g) on different rice varieties. The tested genotypes were significantly affected by low light

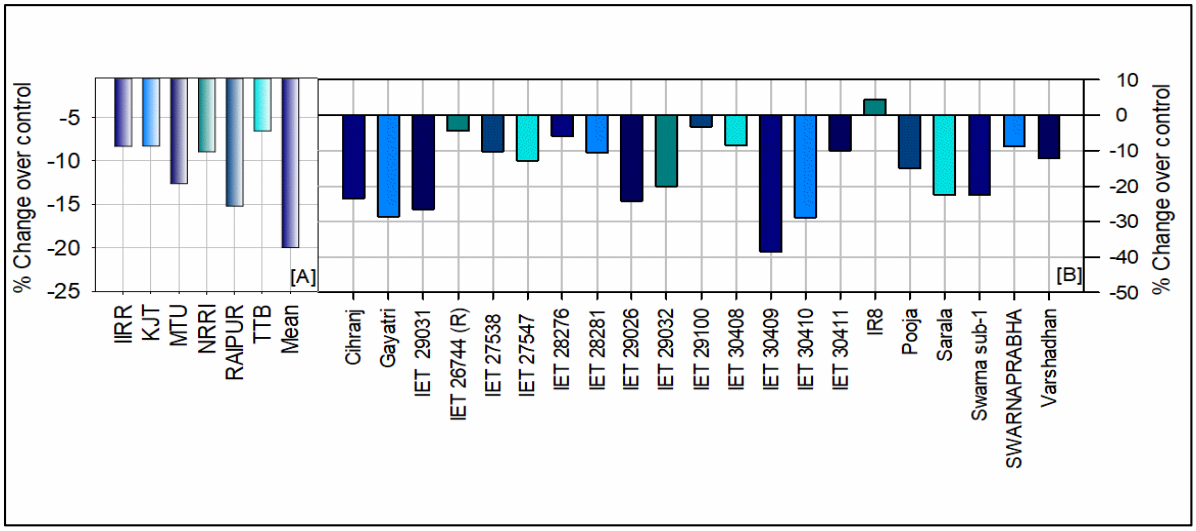


Fig. 6.6.3. *Influence of low light stress on 1000 grain weight (g) a) mean of all the genotypes b) mean of all the locations.*

stress and also all the entries have differentially responded to the treatment. 1000 grain weight ranged from 17.4 (RPUR) to 20.5 (MTU) (g) under low light stress and 20.5 (PNR) to 23.5 (MTU) g under control condition. The 1000 grain weight was significantly influenced by treatment. The interaction between location x genotype was found to be significant ($p<0.01$) and the interaction between location x treatment was also significant meaning thereby the response of genotype to treatment varied with location and treatment effect also varied across locations. Shading reduced the 1000 grain weight significantly in all the entries at all the centers by about 5-30%. However, few entries have performed better in stress treatment over control. At IIRR center, entry IR8, IET29100 and Varshadhan; at NRRI center, IR8, IET30408 and Varshadhan; at Raipur IR8, Pooja and Sarala & at Titabar, Chiranj, IET29026, IET29032, IET30411 and Sarala have recorded higher 1000 grain weight over control.In grand mean (mean performance of an entry at all the centers) of 1000 grain weight, IR8 have recorded the increase in under stress, that signifies the consistent performance of the entry across all the

locations. Entry IET30409 has shown the highest reduction 1000 grain weight over control while IET29100 the least and IR8 has shown enhancement Fig. 6.6.3.

Influence of low light stress on Harvest index (%) was shown in Table 6.6.10. Under influence of low light stress, all the entries across location have shown reduction in HI. The mean reduction was in the tune of about 26%. Mean HI ranged from 13.6 (PNR) to 38.0 (RPUR) in low light stress and 17.9 (PNR) to 46.8 (RPUR) under control condition. The shading treatment significantly affected the HI of rice entries and the entries also significantly differed in their response to treatment Fig. 6.6.4. The highest reduction was observed at NRRI centre (55%) and the least at Karjat (12%). Entry IET30409 has shown the highest mean reduction over control whereas Swarnaprabha has shown the least. The interaction between location x genotype was found to be significant ($p<0.01$), similarly the interaction between location x treatment was also significant meaning thereby the response of genotype to treatment varied with location and treatment effect also varied across locations.

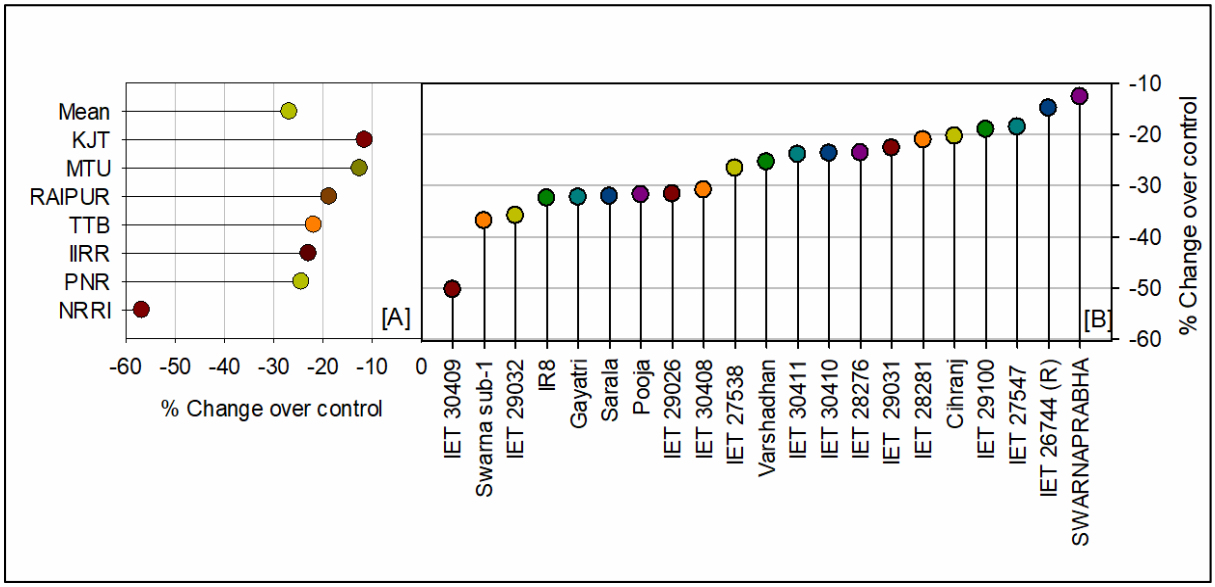


Fig. 6.6.4. *Influence of low light stress on* Harvest index (%) *a) mean of all the genotypes b) mean of all the locations.*

Although overall reduction in HI at all the centres was observed, few entries have recorded better performance under stress over their control counterpart. Entry Swarnaprabha at IIRR centre, IET26744 (R), IET27547, IET28276, IET 30410, Sarala and Swarnaprabha

&IET27547, IET28281 and IET29100 recorded better performance under stress over control.

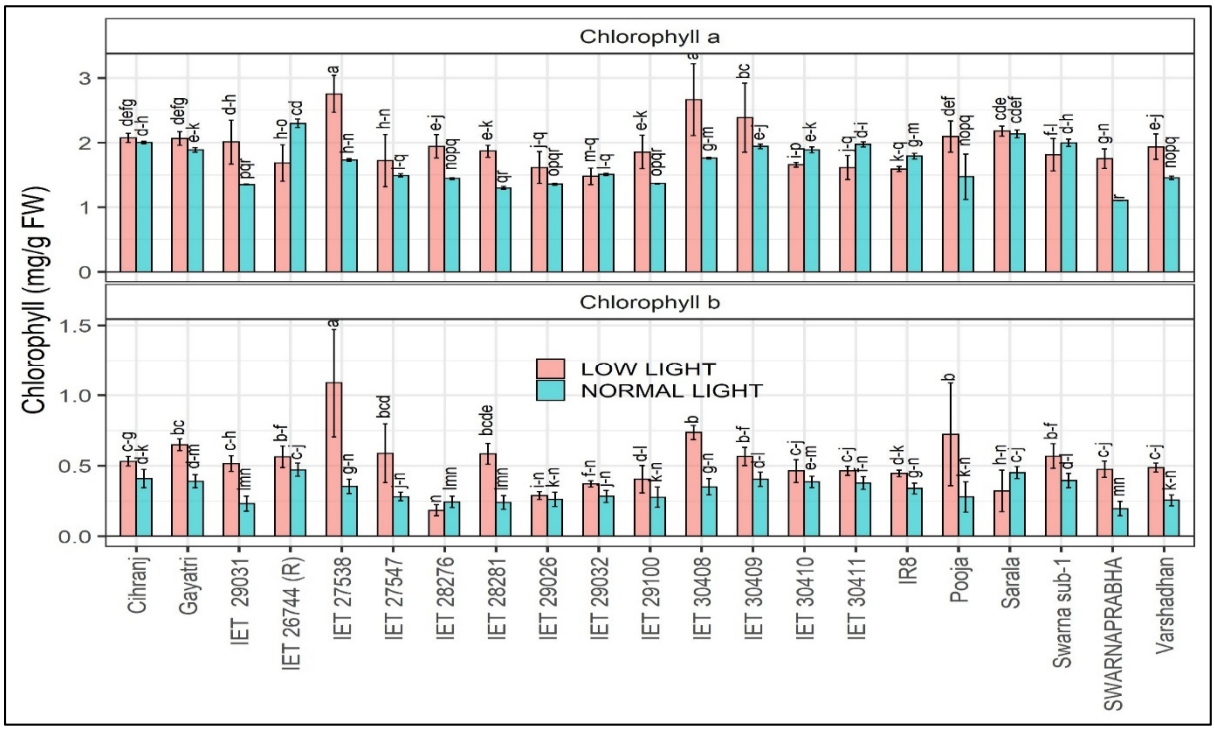


Fig. 6.6.5. Effect of low light stress on leaf chlorophyll a content (mg/g fw) and chlorophyll b content (mg/g fw) measured at PI stage. Each bar represents the mean of three replications.

Fig. 6.6.5 shows low light stress significantly affected the leaf chlorophyll a content (mg/g fw) and chlorophyll b content (mg/g fw) over the control at PI stage. Among all the entries under stress treatment 47% and 66% entries of leaf chlorophyll a content and leaf chlorophyll b content have shown increase over control respectively. Entry Gayatri, IET29031, IET27538, IET28276, IET28281, IET29100, IET30408, Swarnaprabha and Varshadhan have recorded significant increase in the leaf chlorophyll a content across locations. IET27538 has shown the highest leaf chlorophyll a content followed by IET30408 and lowest by IET29032 under low light stress. In case of leaf chlorophyll b content highest was recorded by IET27538 followed by IET30408 and lowest by IET28276 under low light stress. Few entries have also shown the significant decrease IET26744 (R), IET30410, IET30411 and IR8. In case leaf chlorophyll b content, entry Chiranj, Gayatri, IET29031, IET27538, IET27543, IET28281, IET29032, IET29100, IET30408, IET30409, IET30411, IR8, Swarna Sub-1, Swarnaprabha and Varshadhan have recorded significant increase in the leaf chlorophyll b content over control. None of the entries have shown significant decrease the leaf chlorophyll b content over control.

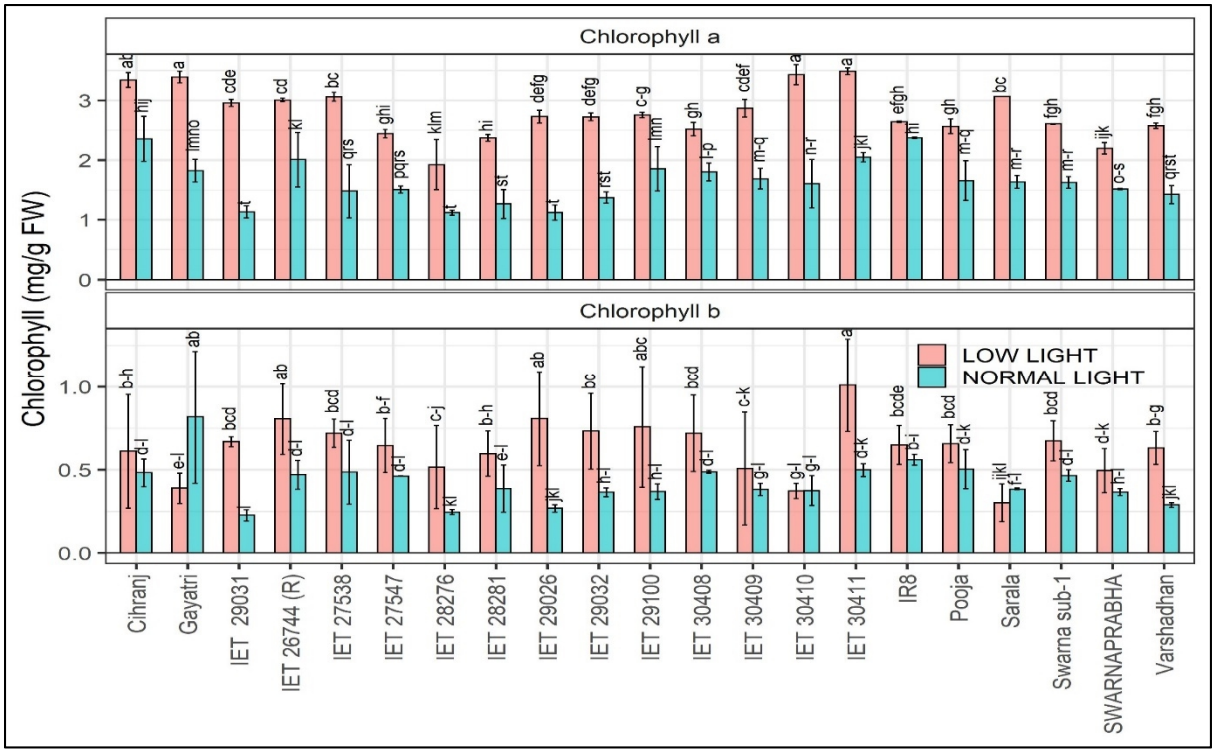


Fig. 6.6.6. Effect of low light stress on leaf chlorophyll a content (mg/g fw) and chlorophyll b content (mg/g fw) measured at flowering stage. Each bar represents the mean of three replications.

Contrary to PI stage, at flowering stage all the entries have shown significant increase in the leaf chlorophyll a content (mg/g fw) Fig. 6.6.6. The increase roughly was in the range of 20-50%. Entry IET30411 has recorded highest leaf chlorophyll a content followed by IET30410 and lowest by IET28276 under low light stress. While in case of leaf chlorophyll b content (mg/g fw) only 10 entries have shown significant increase, two entries namely Gayatri and Sarala have shown reduction over control though non-significant and nine entries were non-significant. Entry IET30411 has recorded highest leaf chlorophyll b content followed by IET29026 and lowest by Sarala under low light stress.

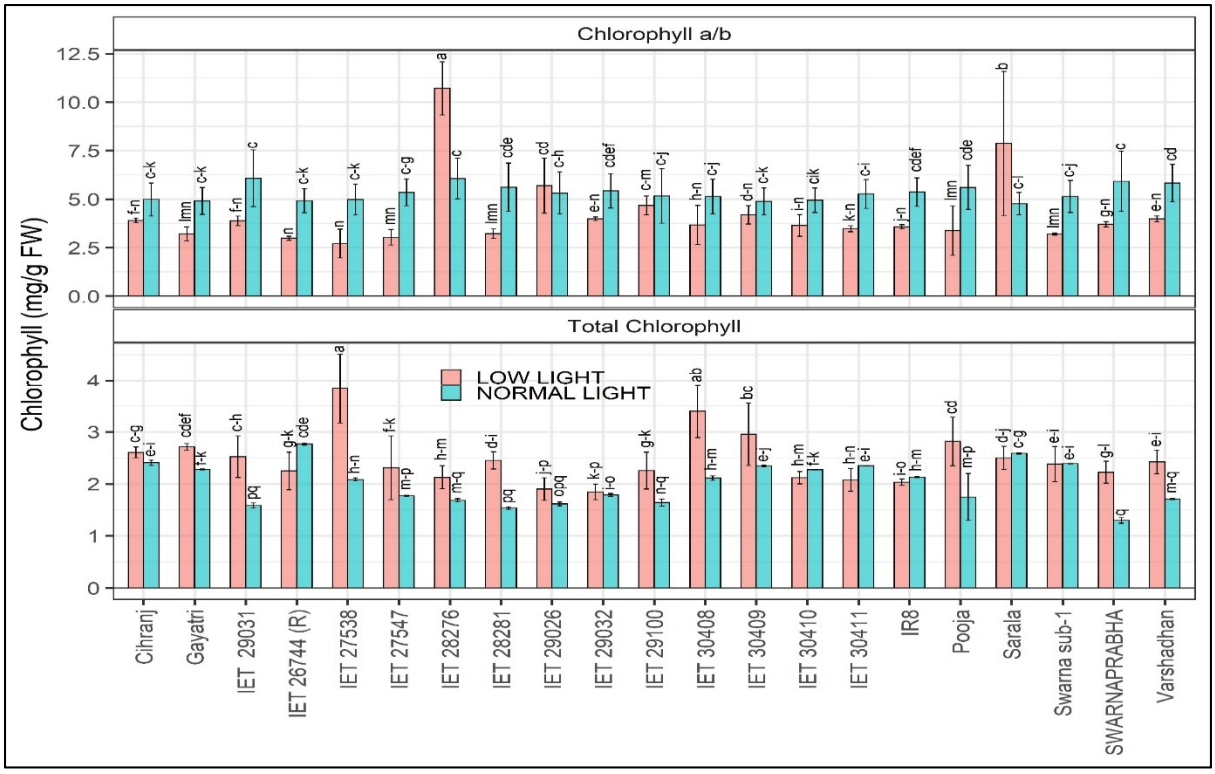


Fig. 6.6.7. Effect of low light stress on leaf chlorophyll a/b ratio and total chlorophyll (mg/g fw) measured at PI stage.

Fig. 6.6.7 shows low light stress has significantly reduced the leaf chlorophyll a/b ratio of all the entries at PI stage compared to control except for few. Out of 21 entries 13 have shown significant decrease in the leaf chlorophyll a/b ratio. Entry IET28276 and Sarala has shown the increase in leaf chlorophyll a/b ratio over control. In case of total chlorophyll (mg/g fw) at PI stage there was a mixed response, few entries have shown significant increase in the total chlorophyll over control while others have shown decrease. Entry IET27538 followed by IET30408 has shown a significant increase in low light stress treatment.

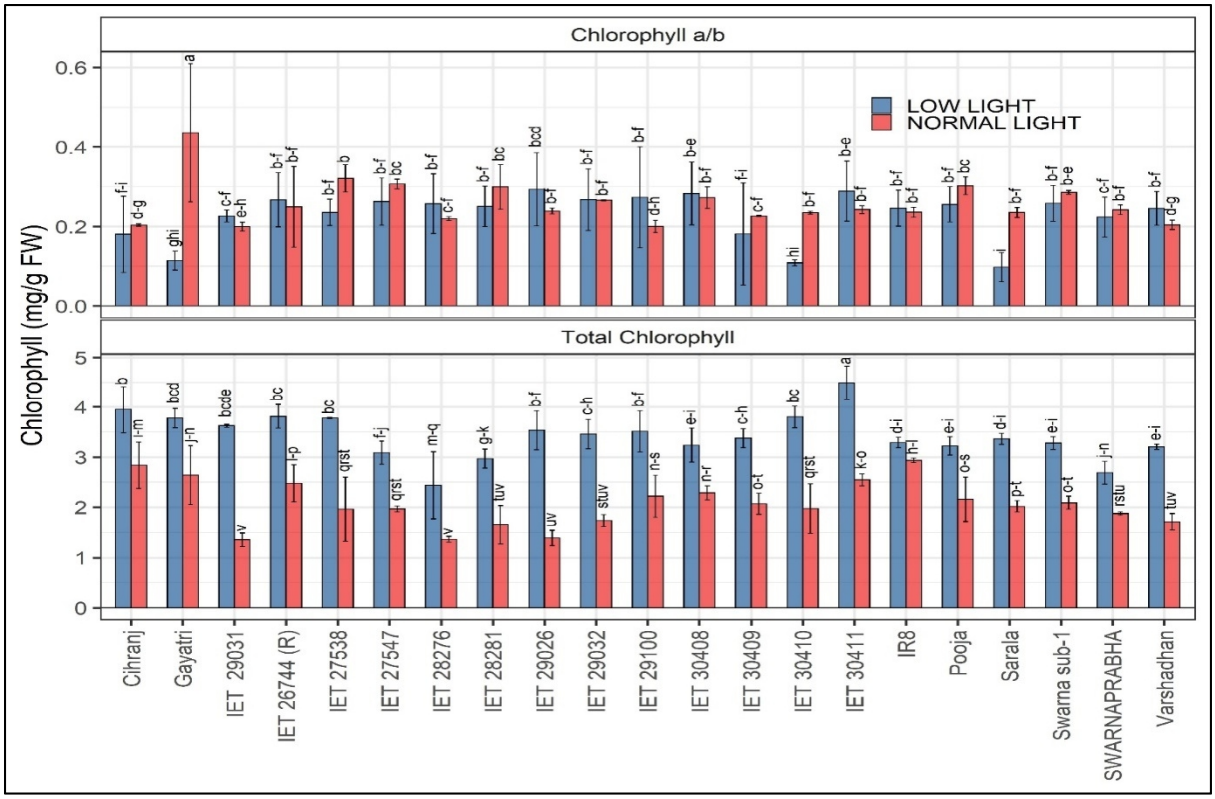


Fig. 6.6.8. Effect of low light stress on leaf chlorophyll a/b ratio and total chlorophyll (mg/g fw) measured at flowering stage.

Fig. 6.6.8 shows at flowering stage, there was no significant effect of low light stress entries in terms of leaf chlorophyll a/b ratio. Low light stress treatment and control treatment was at par with each other in almost all the entries except Gayatri, IET30410 and Sarala. In these entries a significant reduction of leaf chlorophyll a/b ratio was observed. In case of total chlorophyll at flowering stage, all the entries recorded a significant increase. The increase was in the tune of roughly about 8% to >60%.

Summary & Conclusion

Light is the single most important environmental factors regulating various plant growth and development processes of rice. In view of the importance of low light tolerance in rice crop a new trial was formulated during the 51st Annual Rice Workers Group Meeting of AICRIP. During this year 15 AVT entries were tested at 7 locations varieties including Swarnaprabha as check variety. Result indicated low light stress resulted in significant loss in yield and its components. The mean grain yield was reduced by 54% under low light stress treatment. Maximum reduction in grain yield under low light treatment was observed at NRRI (80%) followed by IIRR and KJT where the reduction in grain yield is >40%. The reduction in grain

yield was highest in Sarala, followed by IET 29026 and IR8. The reduction was minimum in case of IET28276 (<20% reduction) over control. In case of the remaining genotypes the reduction in grain yield is very high <30% over control, suggesting that none of the tested genotypes are tolerant to low light stress. Amongst the 21 entries tested only IET28276 and IET29031 show relative tolerance to low light stress.

Table 6.6.2.1 Influence of Low-Light Stress on Days to flowering in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	100	92	103	106	135	89	86	102	102	94	101	110	131	89	77	101
2	Gayatri	120	116	118	117	127	102	108	115	120	116	115	120	121	102	103	114
3	IET 29031	120	125	107	124	144	105	95	117	120	124	104	125	143	105	86	115
4	IET 26744 (R)	116	108	102	112	149	89	94	110	116	111	100	110	136	89	88	107
5	IET 27538	115	104	0	114	134	89	99	109	116	102	0	115	139	89	90	109
6	IET 27547	115	105	113	117	142	95	95	112	115	107	111	112	135	95	89	109
7	IET 28276	120	123	0	130	135	95	0	86	120	123	0	126	138	95	0	86
8	IET 28281	115	114	111	118	140	95	99	113	116	114	109	116	135	95	91	111
9	IET 29026	116	122	115	124	146	105	108	119	115	121	113	125	142	105	103	118
10	IET 29032	116	116	119	130	139	105	108	119	115	117	115	125	145	105	102	118
11	IET 29100	116	96	102	105	135	89	93	105	115	95	99	110	131	89	86	104
12	IET 30408	116	104	0	116	133	95	98	110	116	104	0	113	138	95	91	109
13	IET 30409	115	114	0	120	136	104	0	98	120	115	0	122	143	104	0	101
14	IET 30410	116	115	0	122	135	104	0	99	116	112	0	118	130	104	0	97
15	IET 30411	98	75	101	97	123	102	83	96	97	116	99	97	140	102	75	104
16	IR8	99	92	97	97	138	89	85	100	98	92	95	97	124	89	76	96
17	Pooja	116	114	103	112	132	92	90	108	115	115	102	111	143	92	83	109
18	Sarala	120	123	115	133	119	105	109	118	120	123	114	122	125	105	102	116
19	Swarna sub-1	115	104	103	114	130	89	95	107	115	102	102	112	122	89	87	104
20	Swarnaprabha	98	80	101	85	125	95	77	94	97	79	99	93	142	95	70	96
21	Varshadhan	120	117	120	123	138	110	109	119	120	116	118	125	148	110	103	120
	Mean	**113**	**108**	**108**	**115**	**135**	**97**	**96**	**105**	**114**	**110**	**106**	**114**	**136**	**97**	**89**	**104**
	LSD(Treatment)					ns				LSD(Location x Genotype)					4.50**		
	LSD(Location x Treat)					1.35**				LSD(Location x Treat x Genotype)					ns		
	LSD(Genotype)					1.29*				CV(%					3		
	LSD(Treat x Genotype)					ns											

Table 6.6.2.2 Influence of Low-Light Stress on Days to maturity in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	134	124	131	137	166	135	125	136	136	122	130	141	168	135	107	134
2	Gayatri	150	150	147	147	169	142	142	150	149	149	145	152	169	142	132	148
3	IET 29031	150	154	136	154	169	142	130	148	149	154	135	156	169	142	115	146
4	IET 26744 (R)	149	141	134	146	169	137	130	144	146	144	131	146	166	137	118	141
5	IET 27538	148	136	0	146	169	135	136	124	147	133	0	146	168	135	118	141
6	IET 27547	145	136	141	148	169	135	130	143	145	139	141	146	165	135	117	141
7	IET 28276	151	154	0	160	169	130	0	127	150	152	0	156	169	130	0	126
8	IET 28281	148	149	141	148	161	130	136	145	143	147	137	147	168	130	119	142
9	IET 29026	148	152	145	154	169	142	142	150	146	151	141	156	169	142	132	148
10	IET 29032	148	147	147	161	169	148	141	152	146	147	145	156	169	148	131	149
11	IET 29100	148	126	134	136	169	130	157	143	146	127	128	146	153	130	115	135
12	IET 30408	148	139	0	147	169	130	134	145	146	138	0	146	169	130	120	141
13	IET 30409	148	147	0	151	169	142	0	126	149	151	0	152	169	142	0	127
14	IET 30410	148	149	0	152	169	142	0	127	146	143	0	148	163	142	0	124
15	IET 30411	131	110	130	128	169	142	122	133	131	148	129	128	168	142	106	136
16	IR8	132	126	127	128	169	135	120	134	131	123	125	128	169	135	105	131
17	Pooja	147	146	135	146	160	133	124	141	145	146	133	144	169	133	111	140
18	Sarala	150	152	143	164	169	148	146	153	149	152	142	154	165	148	130	149
19	Swarna sub-1	147	136	134	146	169	137	131	143	145	134	133	146	168	137	115	140
20	Swarnaprabha	132	114	131	115	166	137	111	129	130	110	130	126	143	137	99	125
21	Varshadhan	151	152	150	154	169	148	145	153	148	152	147	156	169	148	131	150
	Mean	**146**	**140**	**130**	**146**	**168**	**138**	**133**	**143**	**144**	**141**	**136**	**146**	**166**	**138**	**118**	**141**
	LSD(Treatment)					ns				LSD(Location x Genotype)					3.00**		
	LSD(Location x Treat)					0.90**				LSD(Location x Treat x Genotype)					ns		
	LSD(Genotype)					1.14*				CV(%					1.48		
	LSD(Treat x Genotype)					ns											

Table 6.6.1 Influence of Low-Light Stress on total chlorophyll in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	0.00	3.84	0.00	2.60	2.21	3.65	0.00	2.46	0.00	3.79	0.00	2.41	1.91	4.67	0.00	2.56
2	Gayatri	0.00	3.03	0.00	2.71	2.04	2.81	0.00	2.12	0.00	2.14	0.00	2.28	1.77	5.25	0.00	2.29
3	IET 29031	0.00	3.98	0.00	2.52	2.10	4.90	0.00	2.70	0.00	2.43	0.00	1.58	2.13	5.84	0.00	2.39
4	IET 26744 (R)	0.00	3.91	0.00	2.25	2.81	2.85	0.00	2.36	0.00	2.23	0.00	2.76	3.22	3.95	0.00	2.43
5	IET 27538	0.00	4.05	0.00	3.84	2.82	4.01	0.00	2.94	0.00	2.10	0.00	2.08	2.98	4.64	0.00	2.36
6	IET 27547	0.00	3.52	0.00	2.31	2.32	5.30	0.00	2.69	0.00	2.29	0.00	1.77	2.29	6.40	0.00	2.55
7	IET 28276	0.00	3.12	0.00	2.12	1.17	4.94	0.00	2.27	0.00	2.11	0.00	1.68	1.95	5.27	0.00	2.20
8	IET 28281	0.00	2.46	0.00	2.45	1.53	4.17	0.00	2.12	0.00	2.14	0.00	1.54	1.62	6.76	0.00	2.41
9	IET 29026	0.00	3.43	0.00	1.90	1.92	4.03	0.00	2.26	0.00	2.40	0.00	1.62	1.34	5.10	0.00	2.09
10	IET 29032	0.00	3.61	0.00	1.85	1.74	3.61	0.00	2.16	0.00	2.23	0.00	1.79	2.00	4.03	0.00	2.01
11	IET 29100	0.00	3.43	0.00	2.25	2.36	3.40	0.00	2.29	0.00	1.77	0.00	1.64	1.59	4.64	0.00	1.93
12	IET 30408	0.00	3.74	0.00	3.40	2.22	4.04	0.00	2.68	0.00	2.73	0.00	2.11	3.54	4.60	0.00	2.60
13	IET 30409	0.00	3.19	0.00	2.95	2.29	2.98	0.00	2.28	0.00	2.77	0.00	2.34	2.22	5.41	0.00	2.55
14	IET 30410	0.00	3.26	0.00	2.12	2.07	1.88	0.00	1.87	0.00	1.69	0.00	2.27	3.20	3.22	0.00	2.08
15	IET 30411	0.00	3.26	0.00	2.08	1.65	4.75	0.00	2.35	0.00	2.45	0.00	2.35	2.17	5.37	0.00	2.47
16	IR8	0.00	3.57	0.00	2.03	2.60	2.37	0.00	2.11	0.00	1.38	0.00	2.13	2.32	2.49	0.00	1.66
17	Pooja	0.00	3.91	0.00	2.81	2.51	3.22	0.00	2.49	0.00	2.78	0.00	1.75	2.45	4.47	0.00	2.29
18	Sarala	0.00	3.21	0.00	2.50	1.64	4.51	0.00	2.37	0.00	3.04	0.00	2.58	2.88	6.01	0.00	2.90
19	Swarna sub-1	0.00	4.38	0.00	2.38	2.67	2.70	0.00	2.43	0.00	2.42	0.00	2.39	1.95	3.35	0.00	2.02
20	Swarnaprabha	0.00	3.91	0.00	2.22	1.72	5.09	0.00	2.59	0.00	1.24	0.00	1.30	1.71	6.09	0.00	2.07
21	Varshadhan	0.00	3.42	0.00	2.42	1.98	3.78	0.00	2.32	0.00	2.02	0.00	1.71	2.43	5.04	0.00	2.24
	Mean	**0.00**	**3.55**	**0.00**	**2.48**	**2.13**	**3.74**	**0.00**	**2.38**	**0.00**	**2.31**	**0.00**	**1.99**	**2.28**	**4.87**	**0.00**	**2.29**
	LSD(Treatment)					ns				LSD(Location x Genotype)					0.17**		
	LSD(Location x Treat)					0.14**				LSD(Location x Treat x Genotype)					ns		
	LSD(Genotype)					ns				CV(%					18.2		
	LSD(Treat x Genotype)					ns											

Table 6.6.2 Influence of Low-Light Stress on total chlorophyll in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	0.00	5.22	3.55	3.95	2.55	2.84	1.65	3.30	0.00	3.79	3.78	2.84	2.37	3.85	3.04	3.28
2	Gayatri	0.00	6.10	2.95	3.78	2.61	1.94	1.44	3.14	0.00	3.12	4.62	2.64	2.61	4.38	2.80	3.36
3	IET 29031	0.00	3.62	3.93	3.62	2.23	2.42	2.04	2.98	0.00	2.74	4.51	1.36	2.02	3.36	2.72	2.78
4	IET 26744 (R)	0.00	4.55	3.79	3.81	2.37	2.24	1.61	3.06	0.00	3.72	4.48	2.48	1.89	3.33	3.04	3.16
5	IET 27538	0.00	6.41	0.00	3.78	2.55	2.84	1.75	2.89	0.00	3.06	0.00	1.96	2.01	3.48	2.55	2.61
6	IET 27547	0.00	5.44	4.02	3.09	2.60	3.59	2.28	3.50	0.00	3.16	4.58	1.97	1.45	4.69	3.17	3.17
7	IET 28276	0.00	3.79	0.00	2.44	2.22	3.46	0.00	2.38	0.00	3.42	0.00	1.37	1.79	3.79	0.00	2.07
8	IET 28281	0.00	5.56	3.10	2.97	2.02	2.22	2.73	3.10	0.00	2.87	3.81	1.65	1.06	4.81	2.83	2.84
9	IET 29026	0.00	4.60	3.37	3.54	2.70	2.48	1.75	3.07	0.00	3.29	3.98	1.39	1.81	3.56	3.17	2.87
10	IET 29032	0.00	6.34	3.49	3.46	3.22	2.64	1.44	3.43	0.00	3.45	3.74	1.73	0.98	3.06	2.21	2.53
11	IET 29100	0.00	4.90	2.93	3.51	3.66	2.41	1.88	3.22	0.00	3.18	3.59	2.22	1.51	3.65	2.80	2.82
12	IET 30408	0.00	6.48	0.00	3.24	2.75	2.83	2.28	3.52	0.00	2.72	0.00	2.29	1.36	3.40	2.77	2.51
13	IET 30409	0.00	4.85	0.00	3.37	2.37	1.92	0.00	2.50	0.00	2.57	0.00	2.07	1.23	4.35	0.00	2.04
14	IET 30410	0.00	6.12	0.00	3.80	1.93	1.29	0.00	2.63	0.00	3.86	0.00	1.98	1.73	2.63	0.00	2.04
15	IET 30411	0.00	5.38	3.34	4.49	3.36	2.84	1.73	3.52	0.00	3.74	3.83	2.55	1.41	3.45	2.71	2.95
16	IR8	0.00	7.73	3.09	3.29	2.44	1.96	2.13	3.44	0.00	2.94	3.70	2.93	2.30	2.08	2.47	2.74
17	Pooja	0.00	4.98	3.14	3.22	2.70	2.19	2.07	3.05	0.00	3.26	3.86	2.16	1.81	3.44	3.05	2.93
18	Sarala	0.00	5.47	3.58	3.36	2.43	2.67	1.67	3.20	0.00	3.04	4.40	2.02	1.47	4.17	2.54	2.94
19	Swarna sub-1	0.00	5.79	3.22	3.28	2.54	2.19	1.30	3.05	0.00	4.10	4.66	2.09	1.96	2.84	2.79	3.07
20	Swarnaprabha	0.00	5.17	3.08	2.69	3.38	3.67	1.87	3.31	0.00	3.59	4.24	1.88	1.34	4.67	3.26	3.16
21	Varshadhan	0.00	6.18	3.47	3.21	3.41	2.50	1.73	3.42	0.00	3.27	4.02	1.71	1.35	3.76	2.65	2.79
	Mean	**0.00**	**5.44**	**3.18**	**3.41**	**2.67**	**2.51**	**1.85**	**3.18**	**0.00**	**3.28**	**4.08**	**2.06**	**1.69**	**3.65**	**2.82**	**2.93**
	LSD(Treatment)					ns				LSD(Location x Genotype)					0.68**		
	LSD(Location x Treat)					0.08**				LSD(Location x Treat x Genotype)					ns		
	LSD(Genotype)					0.193*				CV(%					18.3		
	LSD(Treat x Genotype)					ns											

Table 6.6.3 Influence of Low-Light Stress on plant height (cm) flowering in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	96.0	164.8	127.7	99.7	155.0	154.3	119.5	131.0	93.8	227.2	119.0	96.8	115.3	149.0	113.5	130.7
2	Gayatri	105.8	97.4	122.3	98.6	133.0	129.3	91.5	111.1	104.3	124.3	111.3	91.2	92.7	142.7	76.5	106.1
3	IET 29031	138.5	161.1	151.7	127.3	175.0	170.4	139.0	151.9	132.8	169.6	148.3	122.0	141.3	154.9	106.5	139.4
4	IET 26744 (R)	103.5	151.3	143.3	109.6	188.7	148.0	111.5	136.6	104.2	177.4	132.0	113.4	113.5	132.2	98.5	124.5
5	IET 27538	99.8	161.2	0.0	97.4	111.3	137.4	103.5	118.5	105.7	207.6	0.0	94.9	108.0	133.9	89.0	123.2
6	IET 27547	117.2	220.5	141.0	108.6	134.0	148.7	118.5	141.2	119.7	245.6	133.7	106.7	112.7	146.2	125.5	141.4
7	IET 28276	131.2	193.7	0.0	122.7	174.7	167.9	0.0	131.7	136.7	199.7	0.0	113.5	129.3	167.4	0.0	149.3
8	IET 28281	102.7	198.5	131.0	101.1	138.0	140.6	103.0	130.7	106.8	203.5	122.3	90.3	118.0	133.7	89.0	123.4
9	IET 29026	131.2	135.3	117.3	114.7	182.0	167.9	163.0	144.5	119.2	144.3	106.3	114.3	135.3	168.9	137.5	132.3
10	IET 29032	135.0	157.2	137.0	137.5	164.0	170.6	146.5	149.7	118.3	198.4	127.3	120.4	134.3	160.0	124.0	140.4
11	IET 29100	107.0	238.4	131.0	101.6	138.0	151.9	134.0	143.1	130.7	318.3	126.7	99.4	126.3	149.3	118.0	152.7
12	IET 30408	97.5	163.2	0.0	101.3	121.0	138.6	100.0	120.3	101.8	164.7	0.0	98.2	93.0	132.7	78.0	111.4
13	IET 30409	97.5	164.2	0.0	105.5	100.3	130.2	0.0	99.6	105.2	215.4	0.0	97.1	106.7	125.6	0.0	130.0
14	IET 30410	100.0	201.2	0.0	107.4	141.3	140.8	0.0	115.1	107.5	239.5	0.0	105.8	113.3	136.9	0.0	140.6
15	IET 30411	94.0	124.7	117.7	93.9	103.3	137.0	104.0	110.7	94.5	156.8	97.7	79.7	101.7	132.6	101.0	109.1
16	IR8	81.5	210.1	118.3	96.3	121.0	158.4	108.0	127.7	90.3	326.8	107.3	83.7	97.3	139.8	90.0	133.6
17	Pooja	98.0	164.2	121.7	98.7	132.5	136.9	107.8	122.8	102.5	170.5	113.7	95.0	102.5	133.9	89.8	115.4
18	Sarala	100.8	122.5	162.7	106.0	113.3	146.4	100.0	121.7	100.0	142.5	152.0	98.5	99.3	140.9	88.5	117.4
19	Swarna sub-1	79.2	258.8	114.7	100.0	134.7	120.6	94.0	128.8	99.7	311.4	96.7	94.6	122.0	124.2	88.0	133.8
20	Swarnaprabha	128.8	268.1	163.0	111.8	166.0	183.2	141.0	166.0	113.5	324.2	149.7	102.9	108.3	175.6	129.5	157.7
21	Varshadhan	138.8	126.8	142.3	144.4	175.0	172.7	136.5	148.1	130.8	155.3	132.7	123.3	130.5	149.2	113.5	133.6
	Mean	**108.3**	**174.9**	**133.9**	**108.3**	**142.5**	**149.5**	**117.8**	**131.0**	**110.0**	**208.8**	**123.5**	**101.7**	**113.8**	**143.8**	**104.6**	**130.8**
	LSD(Treatment)				1.39					LSD(Treat x Genotype)				6.55*			
	LSD(Location x Treat)				4.86**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				6.10**					CV(%				8.65			
	LSD(Location x Genotype)				16.14**												

Table 6.6.2.3 Influence of Low-Light Stress on shoot weight (g/m2) in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	628	511	452	247	1127	1255	692	702	829	765	587	628	1131	2431	879	1036
2	Gayatri	556	586	757	315	515	1138	806	668	1050	980	882	495	677	1374	766	889
3	IET 29031	1733	703	771	630	687	536	762	832	1661	1132	934	701	753	2046	877	1158
4	IET 26744 (R)	937	486	575	245	527	994	844	658	1141	788	661	573	820	1602	798	912
5	IET 27538	617	574	0	259	636	1512	546	690	1188	906	0	447	723	732	684	780
6	IET 27547	809	590	632	200	866	821	503	632	1043	750	928	622	926	1470	800	934
7	IET 28276	853	800	0	638	556	1157	0	667	837	1195	0	682	691	3354	0	1126
8	IET 28281	737	590	842	213	620	1238	639	697	730	921	1096	540	845	1881	707	960
9	IET 29026	1885	846	753	191	572	2274	862	1055	1688	1292	972	742	655	4441	820	1516
10	IET 29032	1121	744	730	614	571	1855	714	907	1293	1210	938	685	728	1453	646	993
11	IET 29100	656	558	564	164	865	1437	453	671	979	784	642	649	770	1444	732	857
12	IET 30408	542	464	0	215	755	1046	604	604	1260	621	0	383	928	909	605	784
13	IET 30409	626	554	0	298	1117	798	0	566	1062	871	0	636	871	2449	0	981
14	IET 30410	645	821	0	145	577	1247	0	572	1103	1178	0	584	780	2021	0	944
15	IET 30411	577	352	374	110	483	1400	539	548	581	450	422	429	513	1330	658	626
16	IR8	574	432	565	186	845	1214	609	632	560	590	795	561	1085	1683	717	856
17	Pooja	539	452	559	167	798	1793	680	712	678	673	667	545	836	4500	738	1234
18	Sarala	567	632	574	204	580	1546	774	697	1024	929	767	424	778	1990	836	964
19	Swarna sub-1	558	338	752	71	829	1303	576	633	656	562	859	431	822	1759	604	813
20	SWARNAPRABHA	461	345	573	140	437	1609	566	590	638	561	784	371	751	1312	636	722
21	Varshadhan	1283	747	596	669	926	1206	775	886	1435	1194	905	813	930	2742	654	1239
	Mean	**793**	**572**	**629**	**277**	**713**	**1326**	**663**	**710**	**1005**	**865**	**803**	**568**	**811**	**2156**	**734**	**950**
	LSD(Treatment)					34*				LSD(Location x Genotype)					362**		
	LSD(Location x Treat)					118**				LSD(Location x Treat x Genotype)					ns		
	LSD(Genotype)					148**				CV(%					22.35		
	LSD(Treat x Genotype)					ns											

Table 6.6.4 Influence of Low-Light Stress on panicle weight (g/m2) in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	352	493	0.0	184	190	1395	295	485	976	616	0.0	523	297	2169	625	867
2	Gayatri	248	281	0.0	58	176	948	270	330	670	303	0.0	416	67	738	524	453
3	IET 29031	877	438	0.0	138	196	527	378	426	969	443	0.0	508	284	1486	519	701
4	IET 26744 (R)	589	411	0.0	125	285	1124	299	472	696	410	0.0	493	233	2095	567	749
5	IET 27538	454	503	0.0	79	166	1454	324	497	1044	563	0.0	404	217	807	493	588
6	IET 27547	358	611	0.0	85	288	641	406	398	820	649	0.0	562	311	1500	603	741
7	IET 28276	494	543	0.0	166	175	727	0	351	650	559	0.0	496	254	1389	0	558
8	IET 28281	515	521	0.0	51	266	1704	507	594	637	571	0.0	412	417	1974	549	760
9	IET 29026	462	386	0.0	135	240	1484	318	504	706	375	0.0	638	118	2960	604	900
10	IET 29032	359	425	0.0	200	98	1211	248	423	763	495	0.0	512	243	1396	423	639
11	IET 29100	465	644	0.0	65	135	1165	345	470	850	771	0.0	591	245	1623	534	769
12	IET 30408	319	485	0.0	82	123	1235	420	444	876	496	0.0	253	176	1485	519	634
13	IET 30409	345	546	0.0	44	166	1028	0	355	720	631	0.0	496	98	1620	0	594
14	IET 30410	303	533	0.0	65	93	628	0	270	821	633	0.0	527	172	600	0	459
15	IET 30411	566	268	0.0	27	274	1658	328	520	739	425	0.0	416	207	1032	482	550
16	IR8	272	746	0.0	27	128	576	372	353	840	1087	0.0	494	146	1288	464	720
17	Pooja	319	461	0.0	99	204	1996	390	578	741	435	0.0	522	198	3732	578	1034
18	Sarala	221	350	0.0	89	230	1496	273	443	594	416	0.0	377	208	798	484	479
19	Swarna sub-1	373	646	0.0	17	359	1287	228	485	706	851	0.0	369	85	1724	529	711
20	Swarnaprabha	622	971	0.0	102	184	976	352	534	843	1141	0.0	292	285	1324	629	752
21	Varshadhan	640	361	0.0	209	478	843	300	472	670	423	0.0	642	108	2048	509	733
	Mean	**431**	**504**	**0.0**	**98**	**212**	**1186**	**293**	**454**	**776**	**579**	**0.0**	**476**	**208**	**1705**	**464**	**701**
	Grand Total	603.2	541.2	0.0	286.6	209.6	1445.9	378.6	577.5	LSD(Location x Genotype)				ns			
	LSD(Treatment)				29.15*					LSD(Location x Treat x Genotype)				ns			
	LSD(Location x Treat)				101.5**					CV(%				28.5			
	LSD(Genotype)				ns												
	LSD(Treat x Genotype)				336**												

Table 6.6.2.4 Influence of Low-Light Stress on panicle number/m2 in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	240	194	264	100	217	216	171	200	303	243	308	130	167	260	268	240
2	Gayatri	213	190	341	92	183	187	187	199	360	304	352	160	150	221	303	264
3	IET 29031	323	137	418	118	217	195	160	224	250	236	484	145	250	195	234	256
4	IET 26744 (R)	400	199	352	135	217	182	222	244	413	299	418	216	217	368	293	318
5	IET 27538	337	215	0	58	200	168	225	172	403	233	0	158	267	456	261	254
6	IET 27547	333	180	385	63	183	185	226	222	283	292	418	183	200	240	305	275
7	IET 28276	267	173	0	85	200	126	0	122	203	273	0	135	233	165	0	144
8	IET 28281	327	170	352	53	183	280	245	230	283	268	440	167	267	494	273	313
9	IET 29026	323	158	308	133	167	200	162	207	320	236	341	228	167	184	278	251
10	IET 29032	283	182	374	108	117	168	129	194	283	259	418	157	200	184	205	244
11	IET 29100	363	213	275	73	150	189	242	215	343	261	363	203	250	380	276	297
12	IET 30408	333	212	0	102	150	261	221	183	440	324	0	188	183	297	273	244
13	IET 30409	297	214	0	58	183	213	0	138	350	302	0	205	150	213	0	174
14	IET 30410	297	228	0	60	167	182	0	133	373	270	0	250	233	380	0	215
15	IET 30411	443	213	264	45	217	192	152	218	330	268	308	193	133	284	249	252
16	IR8	280	195	286	32	150	132	193	181	437	299	341	203	200	315	219	288
17	Pooja	393	213	352	94	217	221	232	246	408	338	396	257	242	442	286	338
18	Sarala	293	248	341	95	200	170	206	222	360	302	407	246	267	221	251	293
19	Swarna sub-1	390	180	297	18	267	225	203	226	387	289	330	200	183	347	273	287
20	Swarnaprabha	303	195	297	103	233	208	208	221	337	270	363	185	200	483	293	304
21	Varshadhan	337	137	352	98	300	152	125	215	257	284	385	165	200	240	254	255
	Mean	**326**	**194**	**255**	**83**	**197**	**194**	**170**	**203**	**342**	**281**	**294**	**192**	**209**	**309**	**231**	**266**
	LSD(Treatment)				5.59**					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				14.8**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				18.6**					CV(%				28.5			
	LSD(Location x Genotype)				ns												

Table 6.6.5 Influence of Low-Light Stress on grain number/panicle in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	60	88	119	61	17	123	93	80	120	113	140	86	34	182	105	125
2	Gayatri	51	0	93	36	0	169	85	87	81	86	102	93	0	180	165	101
3	IET 29031	103	0	122	107	0	124	119	82	145	0	137	168	0	125	163	148
4	IET 26744 (R)	64	73	98	85	0	134	94	91	73	79	112	116	0	138	178	116
5	IET 27538	71	114	0	48	0	124	102	92	111	133	0	147	0	156	155	140
6	IET 27547	40	80	114	53	55	163	128	90	107	94	123	93	73	162	190	121
7	IET 28276	63	60	0	50	0	117	0	58	102	96	0	56	0	164	0	84
8	IET 28281	63	74	98	31	19	173	159	88	86	130	125	120	33	159	173	118
9	IET 29026	40	0	98	79	0	123	100	88	81	74	115	96	0	145	190	100
10	IET 29032	47	0	115	57	0	139	78	87	98	0	128	64	0	162	133	117
11	IET 29100	51	95	97	75	0	127	109	92	97	110	116	130	0	145	169	128
12	IET 30408	42	0	0	32	0	138	132	86	83	40	0	46	0	157	163	98
13	IET 30409	54	0	0	33	0	159	0	82	86	63	0	109	0	183	0	88
14	IET 30410	48	47	0	53	0	126	0	55	97	73	0	190	0	136	0	99
15	IET 30411	48	82	59	35	41	135	103	72	74	92	74	68	38	140	153	91
16	IR8	36	134	176	29	22	139	117	93	91	134	197	56	70	123	146	117
17	Pooja	40	28	100	78	3	138	123	73	79	98	113	128	4	134	182	105
18	Sarala	40	0	122	57	9	127	86	73	81	71	135	246	15	155	153	122
19	Swarna sub-1	52	113	105	10	0	122	72	68	88	108	121	49	0	157	167	98
20	Swarnaprabha	74	90	76	33	24	126	111	76	82	112	91	53	29	157	198	103
21	Varshadhan	70	0	104	43	25	127	95	77	88	0	117	60	50	152	160	111
	Mean	**55**	**83**	**105**	**52**	**24**	**136**	**92**	**81**	**92**	**95**	**122**	**104**	**35**	**152**	**164**	**98**
	LSD(Treatment)				2.51**					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				6.65**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				6.34*					CV(%				17.8			
	LSD(Location x Genotype)				22.01**												

Table 6.6.6 Influence of Low-Light Stress on spikelet number/panicle in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	77	71	146	105	115	96	116	104	143	63	150	109	128	115	234	135
2	Gayatri	100	195	107	54	212	476	106	179	146	191	108	119	98	119	194	139
3	IET 29031	154	219	157	165	112	94	150	150	193	218	158	196	118	89	191	166
4	IET 26744 (R)	127	142	120	139	150	104	117	128	125	128	123	161	214	106	209	152
5	IET 27538	106	116	0	80	165	102	127	116	162	101	0	168	143	117	182	146
6	IET 27547	74	94	132	135	149	135	161	126	163	143	134	135	104	159	223	152
7	IET 28276	143	238	0	90	116	97	0	114	193	234	0	89	154	138	0	135
8	IET 28281	100	128	130	49	192	114	198	130	135	142	137	152	125	166	204	152
9	IET 29026	154	186	120	142	111	98	127	134	122	170	125	121	123	104	222	141
10	IET 29032	77	176	137	88	142	112	99	119	140	214	139	90	153	110	156	143
11	IET 29100	66	43	122	107	182	96	135	107	133	64	126	144	131	144	195	134
12	IET 30408	75	153	0	46	149	84	166	112	115	130	0	46	120	151	191	126
13	IET 30409	113	162	0	62	150	95	0	97	165	170	0	129	155	155	0	129
14	IET 30410	68	172	0	79	107	109	0	89	125	181	0	213	100	126	0	124
15	IET 30411	57	70	72	63	118	105	129	88	82	70	79	88	118	105	181	107
16	IR8	82	48	203	71	147	97	146	113	115	48	207	77	148	135	171	129
17	Pooja	79	156	119	108	135	104	153	122	119	115	121	145	149	143	213	143
18	Sarala	67	168	137	90	155	118	107	120	128	197	142	284	138	193	179	180
19	Swarna sub-1	86	60	125	16	127	89	90	85	133	88	127	75	121	133	195	125
20	Swarnaprabha	94	50	98	60	150	143	139	105	117	54	102	88	94	131	233	117
21	Varshadhan	103	228	122	64	181	102	120	131	169	219	127	79	166	104	187	150
	Mean	**95**	**138**	**128**	**86**	**145**	**122**	**133**	**121**	**138**	**139**	**135**	**129**	**134**	**131**	**198**	**143**
	LSD(Treatment)				ns					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				18.9**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				ns					CV(%				33.18			
	LSD(Location x Genotype)				62.88**												

Table 6.6.2.5 Influence of Low-Light Stress on grain number/m2 in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	14565	13715	31416	5974	3667	33090	16133	16937	36113	25210	43120	11231	5667	53909	52318	32510
2	Gayatri	11187	0	31812	3195	0	29329	15923	18289	29057	23787	35970	14897	0	35838	50349	31650
3	IET 29031	32392	0	50875	12517	0	24838	19100	27944	36058	0	66484	24275	0	47315	38096	42446
4	IET 26744 (R)	25742	12199	34595	11057	0	39047	21161	23967	29857	22100	46981	25534	0	58605	52351	39238
5	IET 27538	23567	20135	0	2687	0	35242	23931	21112	44777	28112	0	23388	0	65588	40415	40456
6	IET 27547	13230	11755	43879	5003	10017	53181	28737	23686	29386	25337	51535	16967	14700	61331	58218	36782
7	IET 28276	16704	7983	0	4217	0	37905	0	13362	20593	23585	0	7650	0	47207	0	19807
8	IET 28281	20589	9812	34485	1693	3650	52635	39036	23129	24335	31635	54802	20047	8617	69917	47263	36659
9	IET 29026	13433	0	30195	12495	0	42713	16516	23070	25531	15640	39215	20175	0	63353	52793	36118
10	IET 29032	13673	0	42911	6153	0	38022	10444	22241	27950	0	53361	9976	0	67748	27247	37257
11	IET 29100	18484	16859	26543	5748	0	44515	26429	24344	33669	25372	41987	26950	0	65882	46674	40089
12	IET 30408	14221	0	0	3257	0	40162	29430	21768	36578	12128	0	5766	0	67642	44553	33333
13	IET 30409	15923	0	0	1911	0	47439	0	16318	30236	17656	0	22178	0	65304	0	27075
14	IET 30410	14195	8714	0	2832	0	25804	0	10309	35944	17687	0	48116	0	74633	0	35276
15	IET 30411	21327	14603	15664	1635	8933	29310	16261	15391	24073	22531	22858	13163	5017	47708	38239	24798
16	IR8	10264	20610	50501	934	3233	35909	22894	20621	40288	36694	67155	11403	13783	37506	31928	34108
17	Pooja	15863	4951	35118	7005	508	45191	29068	19672	32287	31061	44633	32294	758	54718	52267	35431
18	Sarala	11634	0	41525	5291	1717	38497	17730	19399	29239	19802	55077	60237	4050	52383	38343	37019
19	Swarna sub-1	20032	16410	31185	564	0	33783	14377	16622	33685	28700	39930	9584	0	34243	45657	31966
20	Swarnaprabha	22966	14064	22473	3473	5533	32731	23433	17811	27361	27184	33000	9893	5917	28790	58020	27166
21	Varshadhan	23299	0	36421	4297	7433	43445	12124	21170	22621	0	44880	9887	9850	32991	40717	26824
	Mean	**17689**	**13216**	**34975**	**4952**	**4966**	**38544**	**21263**	**19865**	**30997**	**24123**	**46312**	**20723**	**7595**	**53934**	**45303**	**33619**
	LSD(Treatment)				1015**					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				2686**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				ns					CV(%				25.95			
	LSD(Location x Genotype)				8909**												

Table 6.6.2.6 Influence of Low-Light Stress on spikelet number/m2 in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	18543	11113	38632	10492	24700	26367	20110	21422	43145	13962	46222	14208	21350	34356	62251	33642
2	Gayatri	21821	30481	36498	4857	38500	73667	19911	32248	52397	52703	37862	18989	14650	23701	59148	37064
3	IET 29031	49505	21858	65472	19246	24350	18517	24111	31865	48090	46058	76329	28241	29433	35525	44634	44044
4	IET 26744 (R)	50683	23654	42262	15526	32283	29900	26311	31517	51539	35615	51458	35411	46417	45533	61399	46767
5	IET 27538	35418	20688	0	4534	32800	29200	29767	25401	65453	21554	0	26613	38017	49808	47591	41506
6	IET 27547	24608	13500	50776	8149	27067	43558	36147	29115	44740	38388	56012	24637	20800	59313	68190	44583
7	IET 28276	37418	31693	0	7580	23100	31675	0	18781	39194	57454	0	12059	36050	39942	0	36236
8	IET 28281	32578	17067	45771	2677	35167	34937	48496	30956	38256	34736	60225	25325	33317	73167	55750	45825
9	IET 29026	50170	23019	36850	18944	18450	34242	20954	28947	38545	35953	42724	26934	20567	44733	61617	38725
10	IET 29032	21680	24995	51414	9580	16567	32033	13271	24220	39668	49981	57970	14090	31017	47108	32071	38844
11	IET 29100	24037	7581	33451	8102	27383	33650	32863	23867	46118	15152	45859	29971	32683	65700	53951	41348
12	IET 30408	24764	27013	0	4647	22300	24583	37071	23396	50757	38821	0	8496	22283	67842	51983	40030
13	IET 30409	33466	28427	0	3636	27383	28792	0	21843	57983	46618	0	26177	22933	54817	0	41706
14	IET 30410	20101	32539	0	4306	17833	22683	0	18982	46285	44416	0	53761	23367	69383	0	47442
15	IET 30411	25525	12476	18920	2890	25767	22367	20315	18323	26979	17294	24497	17111	15833	36000	45230	26135
16	IR8	22380	7459	58234	2260	22000	27075	28398	23972	50798	12943	70444	15599	29750	40454	37424	36773
17	Pooja	30986	27926	42042	9803	29650	36408	36196	30430	48768	36155	47883	36710	35892	61147	61106	46809
18	Sarala	19636	35207	46585	8378	30850	35425	22215	28328	46054	54572	57772	69344	36900	65792	45027	53637
19	Swarna sub-1	33123	8625	37224	892	33467	24692	17990	22288	50960	23461	42020	14542	22400	28983	53362	33675
20	Swarnaprabha	29035	7737	29106	6287	34800	37200	29361	24789	39223	12951	36949	16409	18983	24242	68074	30976
21	Varshadhan	34382	22784	42757	6448	54250	34742	15389	30107	43318	55811	48840	13061	33033	21883	47503	37636
	Mean	**30493**	**21080**	**42250**	**7684**	**28560**	**32642**	**26604**	**25752**	**46229**	**35489**	**50192**	**25654**	**28253**	**47754**	**53128**	**40162**
	LSD(Treatment)				1537**					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				4067**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				3875*					CV(%				28.5			
	LSD(Location x Genotype)				13489**												

Table 6.6.7 Influence of Low-Light Stress on grain yield (g/m2) in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	319	308	351	139	186	235	247	255	865	655	470	416	289	323	521	506
2	Gayatri	191	0	371	35	67	238	225	188	539	423	530	332	78	358	437	385
3	IET 29031	745	0	484	92	126	187	315	325	826	0	626	415	154	381	433	405
4	IET 26744 (R)	460	331	357	85	104	196	250	255	555	443	488	373	111	403	473	407
5	IET 27538	379	414	0	48	105	156	270	229	886	515	0	345	160	344	410	380
6	IET 27547	243	333	426	41	189	219	339	256	640	571	706	469	194	198	505	469
7	IET 28276	342	282	0	104	80	280	0	217	487	489	0	369	84	428	0	265
8	IET 28281	424	334	327	23	137	314	422	283	532	636	650	335	264	332	458	458
9	IET 29026	270	0	334	85	89	267	266	187	578	253	617	518	142	453	504	438
10	IET 29032	298	0	452	147	76	242	207	203	627	0	640	429	145	388	352	369
11	IET 29100	403	450	256	32	180	261	288	267	714	647	521	509	189	458	448	498
12	IET 30408	265	0	0	47	77	162	350	180	745	263	0	187	169	286	433	297
13	IET 30409	260	0	0	22	55	318	0	164	573	297	0	364	89	478	0	257
14	IET 30410	259	161	0	32	124	252	0	167	716	320	0	373	149	346	0	272
15	IET 30411	511	326	176	20	143	188	274	234	668	535	267	301	286	294	406	394
16	IR8	208	368	279	20	83	120	311	198	730	607	442	377	312	301	388	451
17	Pooja	241	136	322	69	128	178	325	200	616	561	472	444	225	299	482	443
18	Sarala	156	0	373	52	89	135	228	148	474	433	556	339	94	248	405	364
19	Swarna sub-1	295	245	317	8	64	222	190	191	606	498	482	313	191	357	442	413
20	Swarnaprabha	544	388	283	30	265	176	294	283	714	710	478	238	343	462	526	496
21	Varshadhan	542	0	373	144	87	110	251	251	513	0	703	529	102	279	424	364
	Mean	**345**	**291**	**343**	**61**	**117**	**211**	**281**	**223**	**646**	**492**	**540**	**380**	**182**	**351**	**447**	**397**
	LSD(Treatment)				9.5**					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				25**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				23.8*					CV(%				18.41			
	LSD(Location x Genotype)				82.9**												

Table 6.6.8 Influence of Low-Light Stress on total dry matter (g/m2) in different rice varieties during Kharif 2021 at different centers

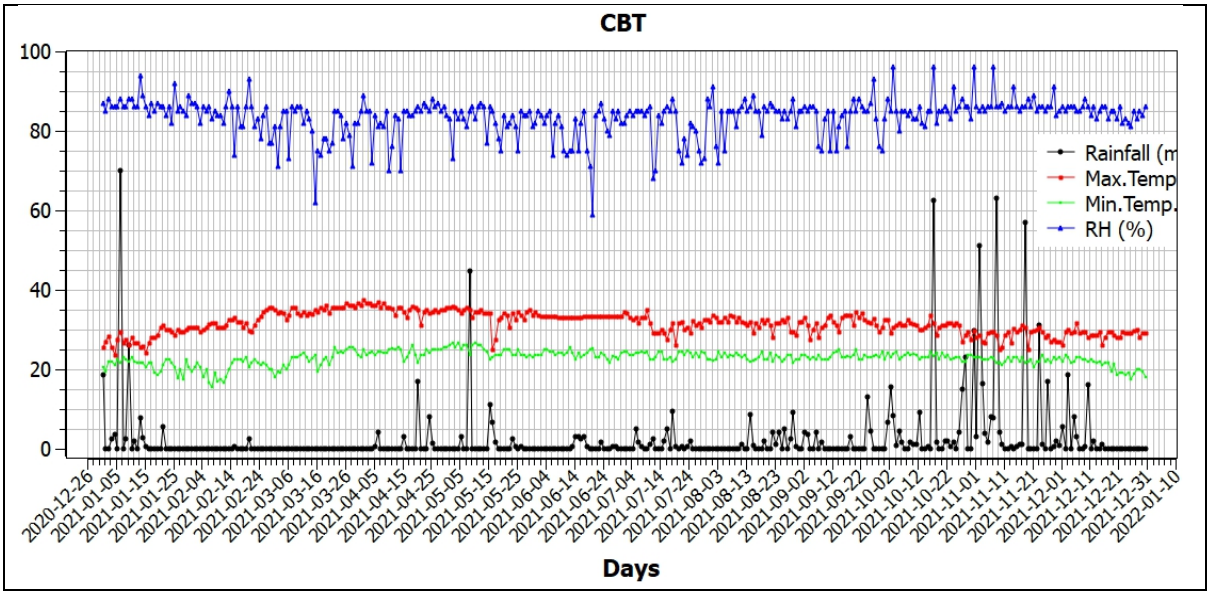
S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	980	841	803	432	1317	2650	1112	1162	1805	1503	1057	1151	1427	4600	1620	1880
2	Gayatri	804	437	1129	373	691	2085	1233	964	1719	1075	1412	910	744	2112	1394	1338
3	IET 29031	2611	1036	1255	819	883	1063	1268	1276	2630	1926	1560	1210	1037	3532	1529	1918
4	IET 26744 (R)	1526	868	931	370	811	2119	1305	1133	1837	1086	1149	1066	1053	3697	1471	1623
5	IET 27538	1071	985	0	338	802	2965	953	1186	2232	1217	0	851	940	1539	1265	1356
6	IET 27547	1167	885	1058	285	1153	1462	968	997	1863	1435	1634	1185	1237	2970	1505	1690
7	IET 28276	1347	764	0	954	731	1884	0	1136	1487	1073	0	1178	945	4743	0	1885
8	IET 28281	1252	882	1169	265	887	2942	1221	1231	1367	1573	1747	952	1262	3855	1343	1728
9	IET 29026	2347	550	1087	325	811	3759	1343	1460	2394	678	1590	1379	773	7401	1530	2249
10	IET 29032	1479	750	1182	864	669	3066	1099	1301	2056	1365	1578	1198	972	2850	1159	1597
11	IET 29100	1122	1119	821	230	1000	2601	854	1107	1830	1498	1163	1239	1016	3067	1363	1597
12	IET 30408	861	677	0	297	878	2281	1105	1016	2136	700	0	637	1103	2394	1189	1360
13	IET 30409	971	678	0	342	1283	1826	0	1020	1782	739	0	1131	969	4069	0	1738
14	IET 30410	948	506	0	210	670	1875	0	842	1923	798	0	1111	952	2621	0	1481
15	IET 30411	1142	871	550	137	756	3058	948	1066	1319	1271	689	845	720	2361	1228	1205
16	IR8	846	917	844	213	972	1790	1072	951	1400	1307	1237	1054	1231	2970	1284	1498
17	Pooja	857	740	881	266	1001	3789	1175	1244	1418	1339	1139	1067	1034	8232	1404	2233
18	Sarala	788	644	947	293	810	3042	1195	1103	1618	1136	1324	801	986	2788	1451	1443
19	Swarna sub-1	931	659	1070	88	1189	2590	910	1062	1361	1165	1341	800	906	3483	1198	1465
20	Swarnaprabha	1083	981	856	242	621	2585	1002	1053	2105	1287	1608	1455	1038	4790	1242	1932
21	Varshadhan	1923	649	969	878	1404	2049	1219	1299	1781	1237	1348	1043	1019	3861	1363	1661
	Mean	**1223**	**781**	**972**	**386**	**924**	**2512**	**1110**	**1124**	**1502**	**1009**	**888**	**714**	**972**	**3187**	**1069**	**1334**
	LSD(Treatment)				59*					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				207**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				197*					CV(%				24.5			
	LSD(Location x Genotype)				ns												

Table 6.6.9 Influence of Low-Light Stress on 1000 grain weight (g) in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)						Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	21.9	24.8	22.1	18.5	20.7	23.1	17.6	24.0	24.7	24.2	20.2	21.4	23.7	23.0	23.0
2	Gayatri	17.0	0.0	18.8	16.7	13.9	16.3	13.8	18.5	19.2	20.2	24.7	16.4	16.9	19.3	19.3
3	IET 29031	22.9	0.0	20.6	21.7	14.5	23.0	17.1	22.9	0.0	23.4	24.8	19.5	25.8	23.3	23.3
4	IET 26744 (R)	17.9	21.7	18.8	19.2	15.9	19.0	18.7	18.6	18.5	21.1	18.0	21.2	20.2	19.6	19.6
5	IET 27538	16.0	20.6	0.0	16.7	17.7	15.3	17.2	19.8	19.5	0.0	19.0	22.0	15.7	19.2	19.2
6	IET 27547	18.0	21.0	23.2	22.2	17.5	18.4	20.1	21.7	23.8	25.9	24.3	22.7	19.7	23.0	23.0
7	IET 28276	20.9	22.8	0.0	24.0	20.0	0.0	17.5	23.6	22.1	0.0	24.8	22.7	0.0	18.6	18.6
8	IET 28281	20.5	17.1	21.0	19.1	20.0	19.9	19.6	21.8	21.3	22.8	21.6	22.3	21.9	22.0	22.0
9	IET 29026	19.9	0.0	22.8	20.8	17.6	24.3	17.6	22.7	16.2	27.4	22.7	23.2	26.8	23.2	23.2
10	IET 29032	21.3	0.0	21.8	24.6	19.2	25.0	18.6	22.4	0.0	25.9	20.2	21.4	26.8	23.3	23.3
11	IET 29100	21.8	24.7	22.0	19.0	15.5	17.6	20.1	21.1	22.9	24.4	19.6	19.1	17.6	20.8	20.8
12	IET 30408	18.6	0.0	0.0	17.6	18.1	19.6	18.5	20.4	24.4	0.0	17.2	19.1	19.8	20.2	20.2
13	IET 30409	16.3	0.0	0.0	18.5	14.2	0.0	12.3	18.9	18.9	0.0	20.5	21.5	0.0	20.0	20.0
14	IET 30410	18.1	18.5	0.0	19.1	14.8	0.0	14.1	19.7	18.1	0.0	21.6	20.0	0.0	19.8	19.8
15	IET 30411	23.9	24.6	20.9	24.3	13.0	24.8	21.9	27.8	25.2	23.2	26.1	18.5	25.3	24.3	24.3
16	IR8	24.5	17.8	15.6	25.4	18.9	14.6	19.5	18.2	17.6	22.2	16.6	22.2	15.0	18.6	18.6
17	Pooja	15.2	10.4	18.8	18.3	18.9	16.6	16.4	19.0	18.8	19.8	20.2	20.5	17.3	19.3	19.3
18	Sarala	13.4	0.0	18.6	16.0	22.1	20.6	15.1	16.2	20.2	20.4	18.7	19.6	21.9	19.5	19.5
19	Swarna sub-1	14.6	16.9	19.8	6.4	15.7	16.6	15.0	18.0	17.3	21.5	22.9	19.2	17.1	19.3	19.3
20	Swarnaprabha	23.5	25.6	22.8	19.6	17.1	20.3	21.5	26.1	24.9	27.0	25.8	16.9	20.6	23.5	23.5
21	Varshadhan	23.1	0.0	20.7	17.7	18.3	20.2	20.0	22.7	0.0	26.3	15.6	21.1	28.1	22.8	22.8
	Mean	**19.3**	**19.0**	**20.5**	**19.3**	**17.4**	**19.7**	**16.9**	**21.0**	**20.8**	**23.5**	**21.2**	**20.5**	**21.1**	**21.1**	**21.1**
	LSD(Treatment)				0.24**				LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				0.59**				LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				0.62*				CV(%				7.31			
	LSD(Location x Genotype)				1.98**											

Table 6.6.10 Influence of Low-Light Stress on Harvest Index (%) in different rice varieties during Kharif 2021 at different centers

S.No.	Genotypes	Treated (Low light)							Grand Mean	Control							Grand Mean
		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB		IIRR	KJT	MTU	NRRI	PNR	RAIPUR	TTB	
1	Cihranj	32.5	36.6	43.6	32.8	14.2	36.0	22.2	31.1	48.0	43.5	44.4	36.0	20.3	49.2	32.2	39.1
2	Gayatri	22.9	0.0	32.9	9.5	9.8	42.2	18.2	22.6	31.1	39.3	37.5	36.4	10.5	47.4	31.3	33.4
3	IET 29031	28.8	0.0	38.5	11.3	14.4	32.9	24.9	25.1	31.4	0.0	40.1	34.3	15.0	46.1	28.3	32.5
4	IET 26744 (R)	29.8	38.1	38.2	22.8	12.9	40.8	19.1	28.8	30.3	40.9	42.5	34.3	10.6	46.4	32.2	33.9
5	IET 27538	34.4	42.0	0.0	14.4	13.1	27.5	28.9	26.7	39.7	42.3	0.0	40.6	17.2	46.3	32.5	36.4
6	IET 27547	20.5	37.6	40.2	14.5	16.4	40.0	35.3	29.2	34.3	39.8	43.2	39.5	15.8	45.1	33.5	35.9
7	IET 28276	25.0	36.9	0.0	11.0	11.0	42.9	0.0	21.1	32.2	45.5	0.0	31.3	8.9	48.2	0.0	27.7
8	IET 28281	33.8	37.9	28.0	8.8	15.4	39.7	34.6	28.3	38.9	40.4	37.2	35.2	21.0	44.0	34.4	35.9
9	IET 29026	11.1	0.0	30.7	26.0	10.9	40.0	19.8	23.1	24.2	37.1	38.8	37.7	18.4	47.3	33.0	33.8
10	IET 29032	20.2	0.0	38.2	17.0	11.5	42.0	19.9	21.3	30.3	0.0	40.5	35.8	15.1	45.9	31.4	33.2
11	IET 29100	36.0	40.2	31.2	13.7	18.0	41.1	34.0	30.6	38.4	43.2	44.8	41.0	18.6	45.7	32.9	37.8
12	IET 30408	30.7	0.0	0.0	15.7	8.8	30.1	31.7	23.4	34.9	37.4	0.0	29.3	15.4	49.5	36.6	33.8
13	IET 30409	26.8	0.0	0.0	6.3	4.3	43.2	0.0	16.1	32.1	40.1	0.0	32.3	9.3	48.5	0.0	32.5
14	IET 30410	27.2	31.7	0.0	15.3	18.5	40.8	0.0	26.7	36.9	40.1	0.0	33.8	15.7	48.6	0.0	35.0
15	IET 30411	44.4	37.4	32.0	14.9	19.3	41.1	28.9	31.1	50.6	42.1	38.7	35.6	39.9	46.6	33.0	41.0
16	IR8	21.6	40.1	33.1	9.4	8.6	40.7	29.0	26.1	52.0	46.4	35.8	35.6	25.4	44.6	30.3	38.6
17	Pooja	27.9	19.1	36.5	26.4	12.7	34.2	27.6	26.3	43.1	41.9	41.6	41.7	21.8	46.1	34.4	38.7
18	Sarala	19.8	0.0	39.4	17.9	11.1	31.0	19.0	23.0	29.3	38.2	42.0	42.3	9.5	48.2	27.9	33.9
19	Swarna sub-1	31.6	37.1	29.7	2.9	5.3	40.8	21.8	24.2	44.6	42.7	35.9	39.2	21.0	47.6	37.3	38.3
20	Swarnaprabha	49.4	39.5	33.0	12.5	42.7	40.7	29.3	35.3	48.4	41.6	37.9	35.8	33.3	46.3	39.8	40.5
21	Varshadhan	28.4	0.0	38.6	16.6	6.2	34.5	20.6	24.1	24.3	0.0	43.8	36.4	9.8	45.9	34.1	32.4
	Mean	**28.7**	**36.5**	**35.2**	**15.7**	**13.6**	**38.0**	**25.8**	**25.9**	**37.2**	**41.3**	**40.3**	**36.4**	**17.9**	**46.8**	**33.1**	**35.4**
	LSD(Treatment)				0.63**					LSD(Treat x Genotype)				ns			
	LSD(Location x Treat)				1.67**					LSD(Location x Treat x Genotype)				ns			
	LSD(Genotype)				2.10**					CV(%				12.9			
	LSD(Location x Genotype)				5.56**												



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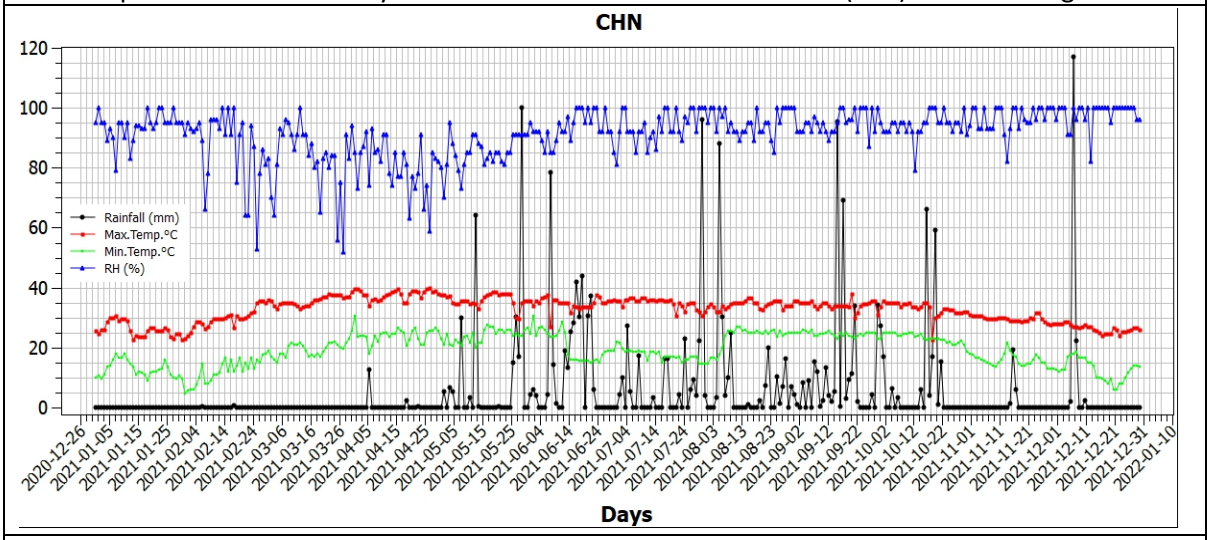

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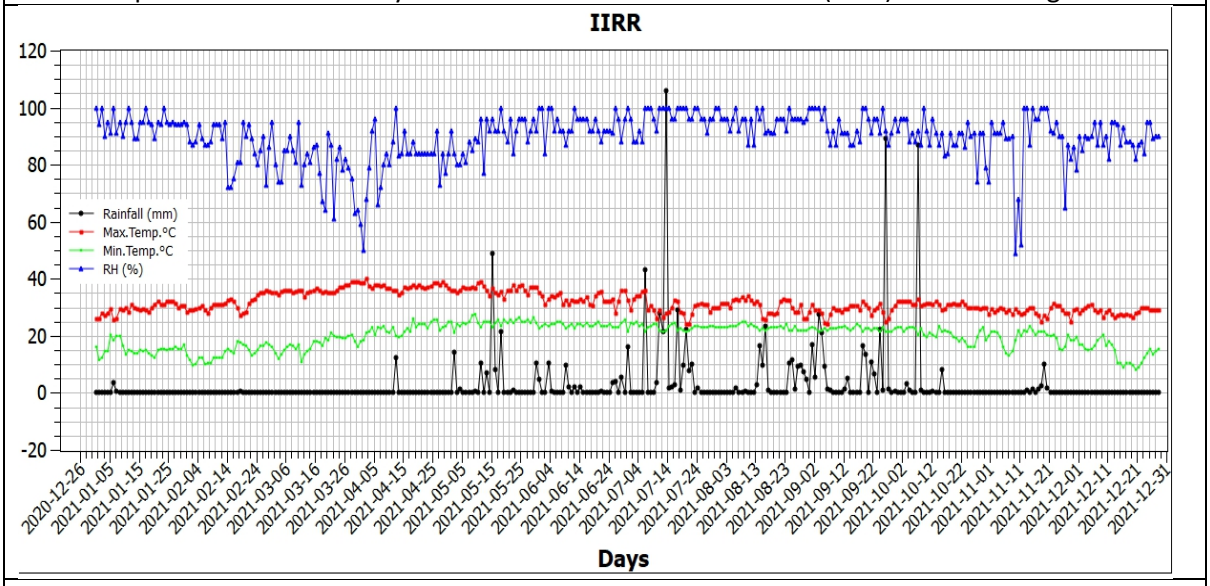

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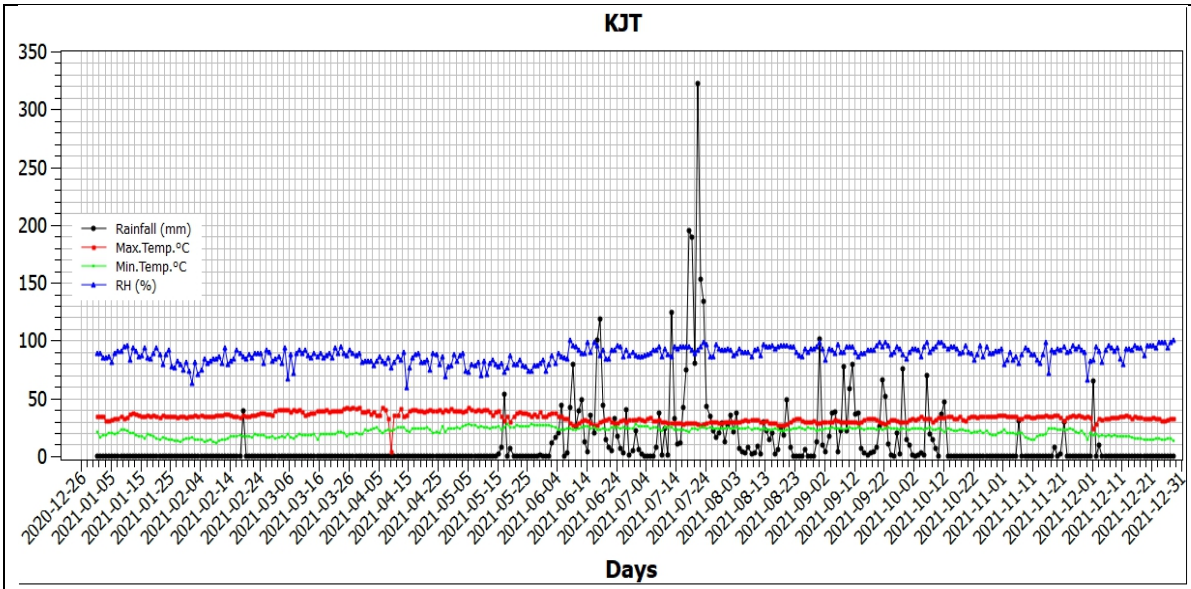

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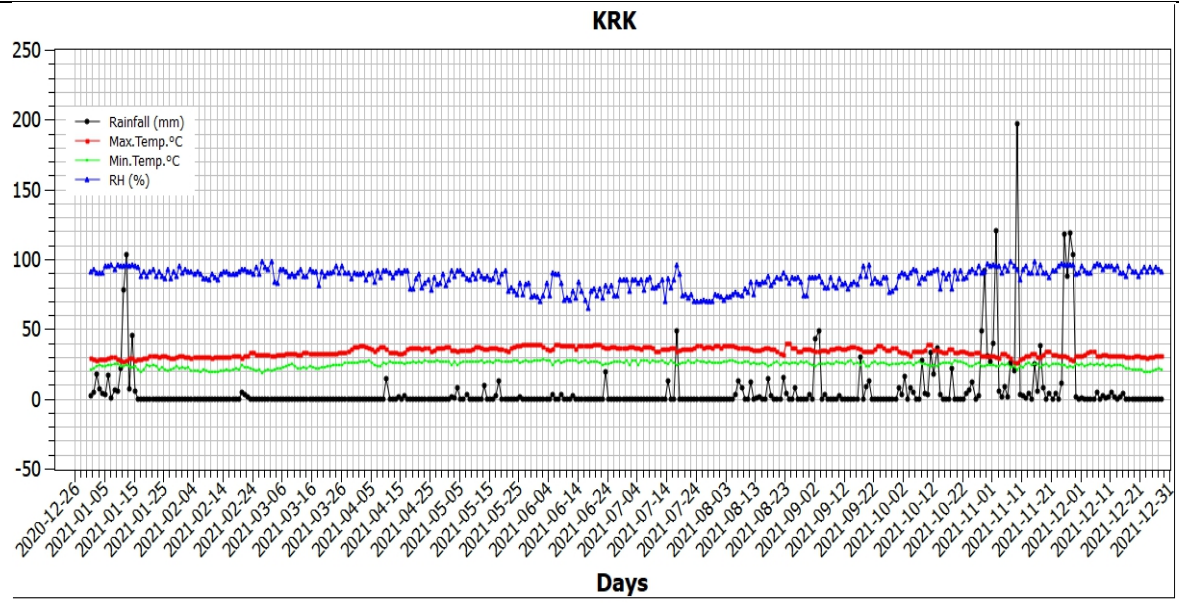
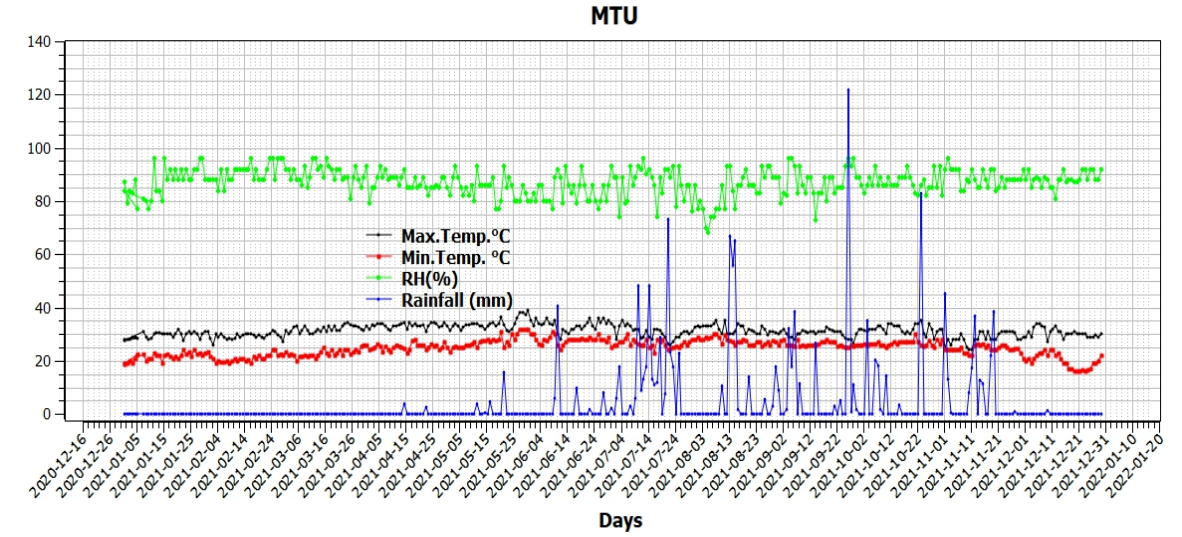


Temperature and Humidity and Rainfall recorded at Karaikal (KRK) centre during 2021



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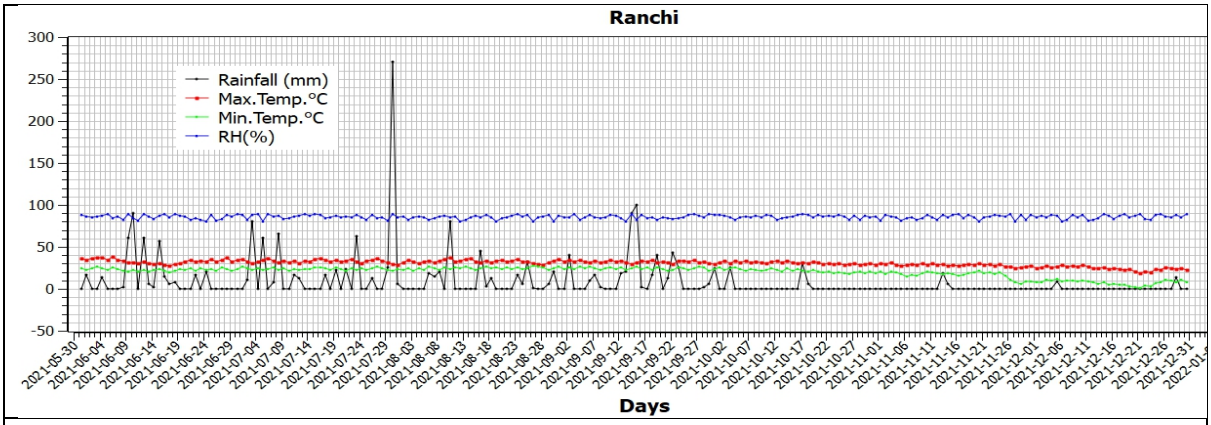
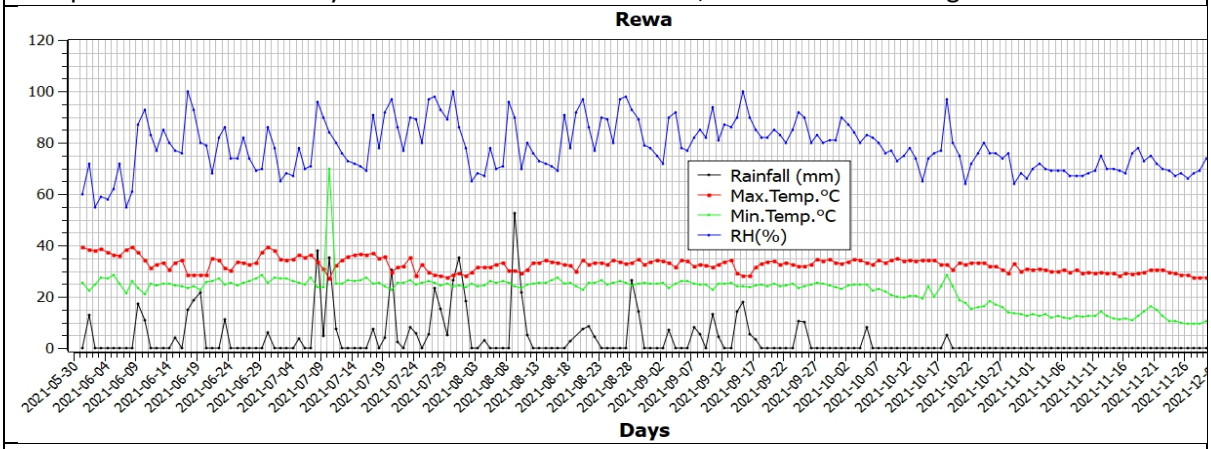


Temperature and Humidity and Rainfall recorded at BAU, Ranchi centre during 2021



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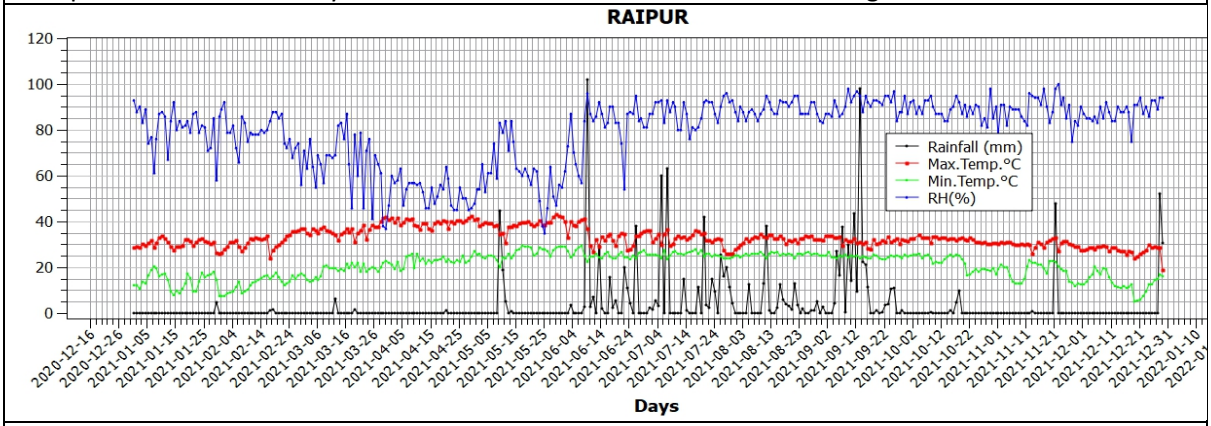
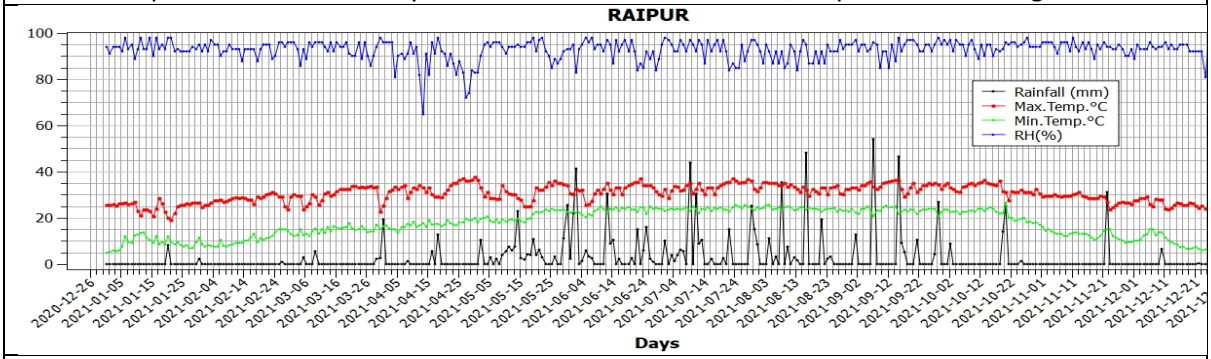


Temperature and Humidity and Rainfall recorded at IGKV, Raipur centre during 2021



Temperature and Humidity and Rainfall recorded at AAU, Titabar centre during 2021

A P P E N D I X - I

Rice cultures of Physiology

	SILICON		**RFU**		**HT**			**LLS**		**SUBMERGENCE**		**MAS**	**RFU (Rabi 2020-21 at Titabar)**	
S.No	**Entries**	**S.No**	**Entries**	**S.No**	**Entries**		**S.No**	**Entries**	**S.No.**	**Entries**	**S.No.**	**Entries**	**S.No.**	**Entries**
1	27P63	21	IL 19273	1	29173 (R)	IVT-E-TP	1	Cihranj	1	Dentul Bao	1	Varshadhan	1	Anjali
2	DRR Dhan-48	22	IL 19279	2	CO-51	IVT-E-TP	2	Gayatri	2	Jahinga	2	Rashpanjor	2	GNV Ageti
3	HRI-174	23	IL 19283	3	IET29938	IVT-E-TP	3	IET 29031	3	Mian Sali	3	IR64-AG	3	IET 26753
4	IIRRH-143	24	IL 19284	4	IET29939	IVT-E-TP	4	IET 26744 (R)	4	Ghiu Bora	4	NPS 17	4	IET 27523
5	IIRRH-148	25	IL 19288	5	IET29940	IVT-E-TP	5	IET 27538	5	Til Bora	5	NPS 18	5	IET 27525
6	Sahabhagidhan	26	IL 19329	6	IET29941	IVT-E-TP	6	IET 27547	6	Boga Amona	6	NPS 71	6	IET 28241
7	US-312	27	IL 19344	7	IET29942	IVT-E-TP	7	IET 28276	7	Kalajoha	7	NPS 95	7	IET 28242
8	US-314	28	IL 19345	8	IET29943	IVT-E-TP	8	IET 28281	8	SWARNA	8	Naveen	8	IET 28248
		29	IL 19346	9	IET29944	IVT-E-TP	9	IET 29026	9	Ranga Bao	9	FL478	9	IET 28250
	RFU	30	IL 19347	10	IET29945	IVT-E-TP	10	IET 29032	10	Ampaki Bora	10	Black Gora	10	IET 28253
1	IL 19072	31	IL 19435	11	IET29946	IVT-E-TP	11	IET 29100	11	Boga Sali	11	Kalakeri (HRC 4)	11	IET 28256
2	IL 19074	32	IL 19451	12	IET29947	IVT-E-TP	12	IET 30408	12	Pani Kekoa	12	White Gora	12	IET 28258
3	IL 19081	33	IL19204	13	IET29948	IVT-E-TP	13	IET 30409	13	NPS17	13	Vandana	13	IET 28259
4	IL 19082	34	IL19206	14	IET29949	IVT-E-TP	14	IET 30410	14	NPS18	14	Dular	14	IET 28825
5	IL 19091	35	K. Hamsa	15	IET29950	IVT-E-TP	15	IET 30411	15	NPS71	15	APO	15	IET 28834
6	IL 19096	36	WGL-14	16	IET29951	IVT-E-TP	16	IR8	16	NPS95	16	IR20	16	IET 28836
7	IL 19128			17	IET29952	IVT-E-TP	17	Pooja	17	Swarna Sub-1	17	AC43037	17	IET 29024
8	IL 19132			18	IET29953	IVT-E-TP	18	Sarala	18	Black Gora (HRC82)	18	AC43025	18	IR-64
9	IL 19148			19	IET29954	IVT-E-TP	19	Swarna sub-1	19	Kalakeri (HRC4)	19	AC43012	19	KMR-3R
10	IL 19162			20	IET29955	IVT-E-TP	20	Swarnaprabha	20	White Gora (HRC68)	20	CR-3818-IC-225	20	N-22
11	IL 19181			21	IET29956	IVT-E-TP	21	Varshadhan	21	Naveen	21	CR-2862-IC-10	21	RP 63389-155
12	IL 19185			22	IET29957	IVT-E-TP			22	Vandana	22	CR-3818-IC-157	22	RP 63389-24
13	IL 19198			23	IET29958	IVT-E-TP			23	Dular	23	CR-2862-IC18	23	RP 63389-9
14	IL 19202			24	IET29959	IVT-E-TP			24	APO	24	IET-27865	24	Shabhagidhan
15	IL 19208			25	IET29960	IVT-E-TP			25	DTC 34	25	IET-27051	25	Vandana
16	IL 19211								26	DTC 40			26	Varalu
17	IL 19215								27	DTC 187				
18	IL 19222								28	AC43037				
19	IL 19247								29	AC43025				
20	IL 19253								30	AC43012				

APPENDIX-II

Details of Introgression lines used in 6.2: screening elite rice cultivars for drought tolerance trial

Sl. No.	Entry No	Background
1	19181	Krishna Hamsa
2	19185	Krishna Hamsa
3	19198	Krishna Hamsa
4	19202	Krishna Hamsa
5	19204	Krishna Hamsa
6	19206	Krishna Hamsa
7	19208	Krishna Hamsa
8	19211	Krishna Hamsa
9	19215	Krishna Hamsa
10	19222	Krishna Hamsa
11	19247	Krishna Hamsa
12	19253	Krishna Hamsa
13	19273	Krishna Hamsa
14	19279	Krishna Hamsa
15	19072	WGL 14
16	19074	WGL 14
17	19081	WGL 14
18	19082	WGL 14
19	19091	WGL 14
20	19096	WGL 14
21	19128	WGL 14
22	19132	WGL 14
23	19148	WGL 14
24	19162	WGL 14
25	19283	WGL 14
26	19284	WGL 14
27	19288	WGL 14
28	19329	WGL 14
29	19344	WGL 14
30	19345	WGL 14
31	19346	WGL 14
32	19347	WGL 14
33	19435	WGL 14
34	19451	WGL 14
35	Krishna Hamsa	RP
36	WGL 14	RP

The 36 **introgression lines** were derived from **multi-parent** inter crosses in the background of Krishna Hamsa (S.No 1 to 14) and WGL14 (S.No 15 to 34).

In the development of ***ILs with Krishna Hamsa as recurrent parent:***

Six donor parents were used-(1) IRBB60 (2) Tetep (3) IR 71033-121-15-B (4) IR 96321-1447-561-B-1 (5) IR 81896-96-B-B-195 and (6) IR74371-46-1-1-13 (for multiple stress resistance/tolerance to bacterial blight, blast and drought tolerance with introgression of *xa5, xa13, Xa21, Pi9, Pi54, Bph20, Bph21, qDTY1.1, qDTY2.1, qDTY3.1* and *qDTY12.1* in various combinations)

In the development of ***ILs with WGL14 as recurrent parent***:

Nine donors were used- (1) Improved Samba Mahsuri, (2) RP Bio Patho-1, (3) RP Patho-3, (4) RP 5925-24, (5) RP 5925-23, (6) IR 96321-1447-561-B-1, (7) IR 81896-96-B-B-195, (8) IR 74371-46-1-1-13 and (9) Rathu Heenati. (for multiple stress resistance/tolerance to bacterial blight, blast, gall midge and drought tolerance with introgression of *xa5, xa13, Xa21, Pi9, Pi54, Gm4, Gm8, Bph3, Bph17, qDTY1.1, qDTY2.1, qDTY3.1* and *qDTY12.1* in various combinations)

The ILs were developed as part of DBT funded project on **"Marker assisted introgression of different traits to develop new generation rice varieties".**

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