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All India Coordinated Research Project on Rice (AICRPR)




2024

Diamond Jubilee Year

भाकृअनुप-भारतीय चावल अनुसंधान संस्थान

ICAR - Indian Institute of Rice Research

Indian Council of Agricultural Research

Rajendranagar, Hyderabad - 500 030, India

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(ENTOMOLOGY AND PLANT PATHOLOGY)

All India Coordinated Research Project on Rice

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PREFACE

Rice is the most important food crop of our country and identifying solutions for issues faced in cultivation and production of the crop is the key answer for national food security. ICAR-Indian Institute of Rice Research has the major mandate of handling the All India Coordinated Research Project on Rice (AICRPR), involving multi-disciplinary and multi-location testing of varietal, crop production and crop protection technologies through their research efforts and has been in the service of the farmers' for increasing and sustaining rice production and productivity to meet the national goal of food security. About 400 scientists, belonging to ICAR - Indian Institute of Rice Research, 45 funded and more than hundred voluntary centers of State Agricultural Universities, Departments of Agriculture, ICAR Institutes and Private Undertakings work towards progress of rice research under the umbrella of AICRPR.

This volume reports the salient findings of experimental trials in Entomology and Pathology conducted during 2024. The scientists involved in AICRPR system conducted majority of the trials allocated showing their commitment to the programme. The major goal of Crop Protection programme of AICRPR is to develop broad based, environmental-friendly, cost effective and adoptable IPM technologies which can help in alleviating socio-economic constraints by providing gainful benefits for rice farmers in the country. Emphasis is on ecologically safe and cost-effective pest management components such as host plant resistance, ecological studies, semio-chemicals, biocontrol agents, influence of agronomic practices, utilization as well as need-based application of safe chemicals and also identification of new pests and diseases in Rice ecosystem in India along with recording of weather parameters. Regular monitoring of pest occurrence at various locations across nation is undertaken to know changing pest scenario and to have timely management interventions. The change in virulence pattern of major pests and diseases is also monitored in hot spot locations. Efforts are underway to build decision support systems for assisting farmers in decision making.

I compliment the efforts of the entire staff of Entomology and Plant Pathology including Principal Investigators, Cooperating Scientists, technical and supporting personnel for their contribution in bringing out this document containing salient findings of this year's research pertaining to crop protection technologies across diverse ecosystem for increasing and stabilizing rice production in India. The findings are useful and relevant and can be integrated and implemented for effective pest management by the end user.

(R. M. Sundaram)
11-04-2025.

ENTOMOLOGY

2. ENTOMOLOGY TRIALS
Kharif 2024

***Rabi* 2023-24**

***Kharif* 2024**

SUMMARY

All India Coordinated Entomology Programme was organized and conducted during *kharif* 2024 with seven major trials encompassing various aspects of rice Entomology. During *kharif* 2024, 345 experiments were conducted (99.14%) out of 348 experiments at 41 locations (IIRR, 30 funded & 10 voluntary centres) in 22 states and one Union Territory. Details of scientists involved in the program at headquarters, cooperating centres and the performance of centres is provided in Appendices I and II.

2.1 Host plant resistance studies comprised of six screening experiments involving 1967 entries which included 1674 pre-breeding lines, 111hybrids, four varieties, 8 donors and 170 check varieties. These entries were evaluated against 14 insect pests in 281 valid tests (58 greenhouse reactions and 223 field reactions). The results of these reactions identified 136 entries (6.91 % of the tested entries) as promising against various insect pests. Of these promising entries, 24 entries (17.65%) were under retesting. The trial wise summary of the results of the evaluations are given below

Planthopper screening trial (PHS): Evaluation of 150 entries in Planthopper screening trial (PHS) against the two planthoppers BPH and WBPH in 13 greenhouse tests and 10 field tests at 17 locations identified 17 entries and three checks as promising in 5 to 12 tests. Nine breeding lines *viz*., MTU 2721-7-1-2-1, MTU 2720-28-2-1-1, MTU 2721-7-1-2-2, RP 6740-SP-M-MS-70, MTU 2716-28-2-1-2, MTU 2716-28-2-2-2, RP 5977-MS-112*, ISM B-8 and JGL 38935 were promising in the second year of testing.

In **Gall midge Screening Trial (GMS)** 75 entries were evaluated in 11 field tests against 11 populations of gall midge which helped in identification of 11entries as most promising with nil damage in 3-6 tests of the 11 valid tests. RMS(ISM24) and NLR 5942-13-1-1-1-1 were promising in 5 tests each. WGL 1909, NLR 5942-36-3-3-1-5 and RGL 294 recorded nil damage in 4 tests. Of these, RMS(ISM24), WGL1909, RGL294 and RMS (ISM26) were under second year of testing. RNR 35008 was promising at both Nellore and Gangavathi.

Field evaluation of 35 entries, including susceptible and resistant checks replicated twice at 22 locations in the **Leaf Folder Screening Trial (LFST)** during Kharif 2024, revealed that 14 entries were promising in 4-6 tests out of 15 valid field tests. In the first year of testing, RP5490 PTB 1-1-2 and BPT 3284 were promising in 6 out of 15 valid tests, while four entries, viz., ADT 22037, NWGR 18083, NPK 65

and NWGR 18084, were promising in 5 out of 15 valid field tests and at par with W1263.

Stem borer screening trial (SBST) : Evaluation of entries in 13 valid field tests for dead hearts damage and 10 valid tests for white ear damage identified 7 entries *viz.*, 0615-PTB-01-23-21, NLR 5892-21-4-1-1-1-2, NLR 5930-2-1-2-4-1-1, HKP-ISM-M8-9, RP5564 PTB 2-4-1-2, IET 32031 and NLR 5932-3-2-3-5-5-2 as promising in 8 to 9 of the 23 tests in terms of low dead heart (≤10% DH) and white ear damage (≤10% WE). They were also promising in 2 to 7 tests of the 9 valid tests with higher grain yield (≥15.0 g/hill) under infested conditions in reproductive phase suggesting that recovery resistance and tolerance could be the mechanism in these entries as they have good grain yield despite damage.

Multiple resistance screening trial (MRST) was constituted with 25 entries which included breeding lines, germplasm accession and check varieties was evaluated at 28 locations against 8 insect pests. Evaluation of 25 entries in 50 valid tests (9 greenhouse and 41 field tests) against 7 insect pests helped in identification of 5 test entries *viz*, RP6605-40, NND2, CGR15-49, IBTWGL2 and BPT3194 as most promising in 7-11 tests against 3-5 insect pests with a PPR of 7.7 -12.9. Of these NND2 was in the second year of testing. The check lines RP 2068-18-3-5 was promising in 10 tests, against four insect pests with a PPR 11.4. PTB 33 was promising in 12 tests, 5 pests with a PPR of and 17.1.

National Screening Nurseries (NSN): National Screening Nurseries (NSN) comprised of IIRR- NSN for irrigated ecology and CRRI -NSN for rainfed ecology IRRI-National Screening Nurseries (NSN) comprised of 4 trials -National Screening Nursery 1 (NSN1), National Screening Nursery 2 (NSN2), National Screening Nursery – Hills (NSN hills) and National Hybrid Screening Nursery (NHSN).

IIRR-NSN1: Evaluation of 492 entries at 20 locations in 33 valid tests (7 greenhouse and 26 field tests) against 8 insect pests identified 17 entries *viz.*, IET nos. 31515, 31680 and 32831 were promising in 8 tests against field tolerance to Planthoppers, stem borer white ear damage and leaf folder. IET 32062 was resistant to BPH and gall midge at seedling stage, and exhibited low damage to leaf folder and case worm. IET nos 30656*, 31437 (H), 30505, 31509, 31619, 31689, 31714 (H), 31001*, 32835, 32844, 32849, 31120, 31979 had field tolerance to Planthoppers, stem borer white ear and leaf folder. PTB 33 was promising in 10 tests and MO1 in 6 tests.

IIRR-NSN2: Evaluation of 636 entries along with 47 checks in 36 valid tests (6 greenhouse and 30 field tests) against 6 insect pests identified, 32397,32478, IR 64 and Lalat in 6 tests against 2-3 pests. PTB 33 was promising in 10 tests followed by W1263 in 7 tests and Aganni in 6 tests.

IIRR- NSN hills: Evaluation of 90 entries (76 hill entries+14 checks) in 15 valid tests (6 greenhouse and 9 field reactions) against six insect pests identified two entries *viz.,* IET No 32317 and IET No 32347 as promising in 3-4 tests. IET No 32317 was promising against brown planthopper at seedling stage in four tests; IET No 32347 was promising in 3 tests (against BPH, SBDH and field tolerance to planthoppers). PTB 33 was promising in 5 tests and RP2068-18-3-5 in 3 tests

IIRR-NHSN: In this trial, 97 hybrids along with 33 checks were evaluated in 7 greenhouse and 19 field tests against 5 insect pests at 12 locations in 26 valid tests of the 14 locations where the trial was conducted. The results identified IET Nos 31444, 31453 and 31474 as promising in 4 of the 26 valid tests. PTB33 was promising in 7 valid tests; and RP 2068-18-3-5 was promising in 4 tests of the 26 valid tests.

CRRI-NSN1: Evaluation of 63 entries in NSN-1 in 5 greenhouse and 17 field tests against 6 insect pests in 22 valid tests helped in identification of one entry Varshadhan, as promising in 5 tests against 3 insect pest damages. IET32085 was found promising in 4 tests against 3 insect pest damages. Resistant checks PTB 33, CR Dhan 317 and RP 2068-18-3-5 were resistant to BPH in 4-9 valid tests. Aganni and W1263 were promising against gall midge and leaf folder, respectively.

CRRI-NSN2: Evaluation of 202 entries in NSN-2 in 4 greenhouse and 12 field tests against 7 insect pests in 16 valid tests helped in identification of 4 entries as promising in 2-3 tests against 2-3 insect pest damages. Resistant checks PTB33, CR Dhan 317, RP 2068-18-3-5 and CR Dhan 805 were resistant to BPH (DS≤3) in all the 3 valid tests at seedling stage in greenhouse. Aganni and W1263 were promising against gall midge and leaf folder, respectively.

2.2 Insect biotype studies included four trials 1. Planthopper Special Screening Trial (PHSS) 2. Planthopper population monitoring (PHPM) trial 3. Gall midge biotype trial (GMBT) and 4) Gall midge population monitoring trial (GMPM).

Planthopper Special Screening Trial (PHSS): Evaluation of 20 gene differentials in PHSS trial against brown planthopper at 12 locations in Standard Seed box Screening Test (SSST) identified RP 2068-18-3-5 as promising in 10 tests. PTB 33 was promising in 8 tests; Salkathi in 6 tests and T12 in 4 tests each. Honey dew excretion by nymphs fed on RP 2068-18-3-5, PTB33 and Salkathi was significantly low, with significantly more number of days to wilt as compared to the susceptible lines like TN1, Pokkali and IR36.

In **Planthopper population monitoring (PHPM)** trial, assessment of brown planthopper (BPH) virulence through single female progeny test was studied on four gene differentials *viz.*, PTB 33 (with *bph2, Bph3*, and *Bph32*), RP 2068-18-3-5 (with *Bph33*(t)), RP Bio4918-230S (carrying *bph39* and *bph40*), and Salkathi (with *qBph4.3* and *qBph4.4*), and a susceptible variety TN1 at Gangavathi, Pantnagar, IARI, Ludhiana, and Coimbatore. The results revealed that the Gangavathi population was the most virulent among the five tested populations and was characterized by significantly higher fecundity and nymphal hatching with a lower proportion of males.

Gall midge biotype trial (GMBT) was constituted with a set of 20 gene differentials categorized into 6 groups, along with the susceptible check TN1. Of these, four lines with *Gm1*, *gm3, Gm8 and Gm4+ Gm8* genes in the background of Improved Samba Mahsuri were included in the 6th group. The trial was conducted at 20 locations in 10 States of India. Evaluation of the gene differentials in 13 field tests at 12 locations identified Aganni (*Gm8*) and INRC 3021(*Gm8*) as promising in 8 of the 13 valid tests based on per cent plant damage. RP6749-RMS7-17-27-41 (*Gm4+Gm8*) was promising in 6 tests. W1263 (*Gm1*) and Kavya were promising in 4 tests. INRC17470, RP5925-24 and Kavya had <1% silver shoot damage in 5 locations. The results suggest that donors with *Gm8* and *Gm1* genes confer resistance to gall midge across most of the test locations.

Virulence composition of gall midge populations was monitored in **Gall midge population monitoring (GMPM) trial** at seven locations *viz.*, Jagtial, Warangal, Ragolu Gangavathi, Moncompu, Pattambi and Brahmavar spread across four southern states in India through single female progeny tests in a set of three gene differentials with susceptible variety. The results suggest that there is variation in the pattern of virulence. Aganni (*Gm8*) holds promise at Jagtial, and Ragolu with low susceptibility at Brahmavar and Warangal. Low virulence against W1263 (*Gm1*) was observed at Moncompu and promising at Brahmavar. Low virulence was recorded at Jagtial and Brahmavar towards IBTGm2 (with *Gm4* + *Gm8*). However, a close monitoring of the virulence pattern in endemic areas is important.

Seed Treatment for Management of Early season insect Pests of rice (STEP) a replicated field trial was conducted at 11 locations *viz.*, ABP, ADT, CBT, PTB, CHP, GNV, REW, JDP, MTU, RNR and WGL during 2024 Kharif season with Carbosulfan 25% DS, Chlorantraniliprole 50% W/W FS, Thiamethoxam 70% WS, Imidacloprid 48% W/W FS applied as seed treatments with Untreated Control. All the four insecticides tested as seed treatment were effective in minimising yellow stem borer and gall midge damage and reducing the yield losses. However, in gall midge endemic areas, carbosulfan 25% DS and thiamethoxam 70% WS were most effective with 55.5 and 50.7 per cent reduction in silver shoots, respectively. For stem borer damage, chlorantraniliprole 50% W/W FS was the most effective treatment with 65 and 46.7 per cent and reduction in dead hearts and white ears, respectively over the untreated control. Seed treatment with chlorantraniliprole 50% W/W FS resulted in 32.2 per cent increase in grain yield over untreated control followed by carbosulfan 25% DS (26.3 per cent increase) and thiamethoxam 70% WS (21 per cent increase).

Prophylactic management of Planthoppers in rice (PMRH): In this trial for the prophylactic management of hopper insect pests the probable vectors of southern black streak virus disease in rice, a field trial with four treatments *viz.*, spraying of triflumezopyrim 10% SC @236 ml/ha and pymetrozine 50% WG @ 300 g/ha; pymetrozine 50% WG @ 300 g/ha and dinotefuran 20% SG@ 200 g/ha; dinotefuran 20% SG@ 200 g/ha and essential oil @2ml per litre at maximum tillering and booting stages, respectively was tested. The trial was conducted at six locations (Ludhiana, Kaul, Chatha, Pantnagar, Nawagam, and Raipur). Data revealed that spraying of triflumezopyrim 10% SC @236 ml/ha at maximum tillering stage followed by pymetrozine 50 % WG @300 g/ha at the booting stage was most effective in reducing the populations of brown planthopper, white backed planthopper and green leafhopper with 42.2, 38.9 and 27.2 per cent reduction, respectively over the untreated control. However, there was a concomitant reduction in the spider population in pymetrozine 50% WG @ 300 g/ha and dinotefuran 20% SG@ 200 g/ha treatment (10.6 per cent) and mirid population in triflumezopyrim 10% SC @236 ml/ha and pymetrozine 50% WG @ 300 g/ha treatment (17.8 per cent). Grain yield in all the three insecticide treatment combinations was significantly higher as compared to untreated control, highest being 25.4 per cent increase in triflumezopyrim 10% SC @236 ml/ha and pymetrozine 50% WG @ 300 g/ha treatment.

Bio -efficacy of Insecticides against Brown planthoppers (BIBPH) initiated this year assessed the susceptibility of *Nilaparvata lugens* populations from five rice-growing regions in India *viz.*, Ludhiana, New Delhi, Rajendranagar, Gangavathi, and Aduthurai to four insecticides: acephate, dinotefuran, pymetrozine, and triflumezopyrim. Bioassays using the IRAC Susceptibility Test #05 on third instar nymphs determined LC_{50} values, revealed regional variations in the susceptibility of the populations emphasizing the need for region-specific pest management and resistance monitoring. Among the populations tested insects from Gangavathi were less sensitive to all four insecticides. Triflumezopyrim was most effective against all the populations with consistently low LC_{50} values (0.17–2.08 ppm).

Evaluation of drones for spraying of agrochemicals (herbicides, insecticides and fungicides) in rice pest management (EDAPM): The trial was conducted to evaluate the efficacy of method of spraying agrochemicals through drones in comparison with Battery operated knapsack sprayer and untreated control. The trial was conducted at eight locations namely, Ludhiana, Navasari, Nawagam, Chinsurah, Raipur, Gangavathi, Rajendranagar and IIRR. Both the spraying methods, application through drone and battery operated knapsack sprayer minimised the damage caused by stem borers, gall midge, leaf folder and white backed planthopper significantly. However, drone spraying outperformed knapsack spraying with 45.4 per cent reduction in DH, 54.1 per cent reduction in per cent WE, 59.4 per cent reduction in silver shoots ,66.7 per cent reduction in leaf folder damage and 63.4 per cent reduction in WBPH population over the untreated control. Whereas, in knapsack spray the reduction was 31.7, 40.9, 52.4, 61.2 and 52.1 per cent, respectively.

With respect to diseases, drone and knapsack spraying reduced the leaf blast disease by 53.6 and 45.6 per cent, respectively. Similarly, for sheath blight disease, spraying of chemicals with drone recorded the PDI reduction of 48.7 as against 45.7 per cent in the treatment when battery operated Knapsack sprayer was used for spraying the chemicals. In case of grain discolouration disease, the chemicals were sprayed only at booting stage. The percentage of reduction of PDI was 43.91% when chemicals were sprayed with drone and 39.42% reduction of PDI was recorded when chemicals were sprayed with battery operated knapsack sprayer.

Grain yield was significantly higher in drone spray followed by the knapsack spray with 25 and 15 per cent increase over control. However, population of the natural enemies; mirid bugs and spiders were affected by agrochemicals spraying, more so in drone spraying as compared to knapsack spraying. No phytotoxicity symptoms were observed due to drone spraying of test agrochemicals at given doses and as tank mix.

Evaluation of Entomopathogens against Lepidopteran Pests (EELP) of rice was taken up in fourteen locations to test the effectiveness of different strains of the entomopathogens, *Bacillus albus*, *Bacillus thuringiensis*, *two strains of Beauveria bassiana* and two strains of *Metarhizium anisopliae*, in comparison with chemical and untreated control. While chemical control consistently provided the lowest pest damage of stem borer and leaf folder and highest yield across all locations (6433–7567 kg/ha), it significantly reduced natural enemy populations of mirids, spiders and coccinellids. The entomopathogenic treatments consistently reduced lepidopteran pest damage and supported natural enemy abundance compared to the untreated control. *Bacillus thuringiensis* NRRI TB 261 was highly effective at Chiplima and Coimbatore, with the lowest SB damage (2.56 – 5.80 %) and at Cuttack for leafffolder (6.31 %). *Beauveria bassiana* NBAIR-Bb5a and NRRI TF 6 strains and *Metarhizium anisopliae* strains (T3, T5, T6) resulted in moderate pest control and higher yields (up to 6067 kg/ha), with greater natural enemy retention. Control plots showed the highest pest damage and lowest yields (1700–3049 kg/ha). Overall, biopesticides offered sustainable, eco-friendly alternatives with varied but promising efficacy across locations.

Influence of crop establishment methods on pest incidence (IEMP), a collaborative trial with Agronomy, was conducted at 13 locations during Kharif 2024. Across the locations, the incidence of dead hearts (5.7%) and white ears (8.4%) caused by stem borer was relatively low in dry DSR followed by mechanical transplanting while it was high in wet DSR (14.2% DH) than in normal transplanting (9.4% DH). Gall midge incidence was high in normal transplanting (29.6% SS) and mechanical transplanting (26.7% SS) and relatively low in dry DSR (11.3% SS) and wet DSR (14.7% SS). The incidence of leaf folder (11.5% LFDL), thrips (28.3% THDL) and caseworm (15.7% CWDL) was high in the normal transplanting method as compared to the other three methods. The incidence of BPH was low in dry DSR (16/hill) and WBPH was low in all the establishment methods. Overall, the incidence of insect pests was high in normal transplanting and wet DSR methods, followed by the mechanical transplanting method while the incidence was low in the dry DSR method.

Pest Incidence in Natural Farming (PINF), a collaborative trial with Agronomy, was initiated this year during Kharif 2024. The trial was conducted at 12 locations. The incidence of stem borer, gall midge, leaf folder, whorl maggot, hispa, thrips, caseworm, grasshopper, BPH, and WBPH was observed in all the treatments across locations. The thrips damage was observed only at Moncompu and the grasshopper damage was observed only at Khudwani. Overall, the incidence of dead hearts, white ears, leaf folder, whorl maggot, hispa and BPH was observed low in T5-Integrated crop management with 50 % nutrient application through organic manures and 50% nutrient application through inorganic sources with need-based pesticides, followed by T4-Integrated crop management with components of natural farming, and T2-complete natural farming compared to other treatments, T3-treatments from All India – Network Programme on Organic Farming (AI-NPOF) and T1-control (No addition of inputs).

Evaluation of pheromone blends for insect pests of rice (EPBI) trial was conducted at 13 locations during Kharif 2024 and two locations during rabi 2023-24. The field trial was conducted with normal and slow-release sex pheromone formulations of yellow stem borer and rice leaf folder. Across locations, slow-release formulations recorded maximum cumulative catches in a season compared to the normal formulations in the case of the yellow stem borer and the leaf folder in a season. The cumulative catches of yellow stem borer were high in slow-release pheromone formulation at Jagtial (94/trap), followed by Pusa (81/trap) and Pattambi (41/trap) as compared to normal pheromone formulations with 73, 40 and 37 catches, respectively. Similarly, leaf folder catches were high in Raipur (32/trap) followed by Pusa (28/trap). Simultaneously, field population counts were taken through visual count for yellow stem borer, disturb and count method (DCM) for leaf folder, sweep net catches and light trap (LT) catches for both the pests.

A trial on **Integrated Pest Management in Direct Seeded Rice (IPM DSR)** was conducted with zone-wise practices at 9 locations in 16 farmers' fields during Kharif 2024. Across locations, in Zone-II (Northern areas), the incidence of dead hearts caused by stem borer and leaf folder damage was low in both IPM and FP plots. In Zone VI (Western areas), dead hearts were low in IPM plots (4.8% DH) as compared to FP plots (7.0% DH). Leaf folder incidence was high in FP plots (17% LFDL) compared to IPM plots (2.5% LFDL). The WBPH population was low in both FP plots (22/5 hills) and IPM plots (16/5 hills). In Zone VII (Southern areas), gall midge incidence was very high in IPM plots (12.7% SS) compared to FP plots (10.9% SS). Stem borer damage was not significantly different between IPM plots (7.9% DH) and FP plots (7.2% DH). BPH and WBPH incidence was low in both IPM and FP plots. However, the incidence of leaf folder, whorl maggot, hispa and thrips was low in IPM plots as compared to FP plots.

The adoption of IPM practices reduced the disease progression of leaf blast, neck blast, sheath blight and bacterial blight in Zone II. However, with respect to brown spot, AUDPC values were high in IPM-adopted fields compared to farmers' practices. In Zone VI, IPM practices reduced the disease development of sheath blight and sheath rot. In Zone VII, the AUDPC values of leaf blast, neck blast, and bacterial blight were low in IPM plots compared to FP plots, indicating that the IPM practices were effective in managing these diseases. However, in the case of brown spot, AUDPC values were higher in IPM plots than in FP plots. Sheath blight incidence was similar in both IPM and FP plots at Gangavathi.

Weed population and weed dry biomass were significantly lower in IPM plots as compared to FP plots across the locations. IPM implemented plots resulted in mean grain yield advantage of 1.08%, 21.29% and 17.18% respectively in Zone- II, VI and VII over the FP plots. In IPM-adopted fields, the mean weed population reduction across the Zones ranged from 4.23 % in Zone-VII to 76.92% in Zone-VI at the Active Tillering stage and from 10.00 to 82.39% in Zone-VII at the Panicle Initiation stage. The dry weed biomass recorded at both Active Tillering and Panicle Initiation stages were significantly reduced by 9.38 to 82.87% in Zone-VII.
Grain yields were significantly high in IPM-implemented plots, resulting in high gross returns. Overall, BC ratios of IPM plots (1.43 - 3.14) were superior as compared to those of FP (1.31-2.31), mainly due to better yields, lower input costs, and better returns.

Studies on **Population dynamics of insect pests and natural enemies (PDPNE)** in rice ecosystem was carried out at 32 locations in seven agroclimatic zones to study the dynamics of insect pests /their damages in relation to changes in weather parameters, crop phenology, growing season and cropping systems as it is vital for designing ecologically sound and economically viable pest management strategies. Yellow stem borer, Planthoppers, leaf folder and Gall midge were observed as the major pests of rice across the country during Kharif 2024. However, rice hispa and whorl maggot were also recorded as minor pests in rice ecosystem in different locations in India.

In Zone-I at Khudwani, grasshopper incidence was observed from the 27th to the 44th SMW, peaking at 56.91% in the 43rd SMW before declining. Natural enemy populations varied with spiders in 39th SMW and coccinellids in 42nd SMW, while dragonflies and damselflies remained low. Correlation analysis revealed a significant negative relationship between grasshopper damage and both maximum (r = -0.65**) and minimum temperatures (r = -0.64**).

In Zone II, insect pest incidence began from the 32nd SMW, with stem borer damage peaking in the 35th SMW (9.66%) and 46th SMW (22.70%); leaf folder infestation highest in the 34th SMW (7.62%). Whorl maggot and rice hispa were most prevalent in the 34th SMW, while planthopper populations peaked in the 42nd SMW (70.70 number per hill). Natural enemy populations fluctuated, with spiders peaking in the 34th SMW and mirid bugs in the 40th SMW. A significant negative correlation for planthopper populations with rainfall and humidity was observed.

In Zone III, major pests included gall midge, stem borer, leaf folder, whorl maggot and planthoppers. Gall midge incidence peaked in the 37th SMW (23.30%), while stem borer dead heart damage was highest in the 39th SMW (10.82%), white ear incidence peaked in the 40th SMW (18.13%). Leaf folder infestation reached its maximum (4.57%) in the 39th SMW and whorl maggot damage peaked in the 37th SMW (16.34%). Planthopper populations were highest in the 35th SMW (34.54 number per hill). Natural enemy populations varied, with spiders peaking in the 36th SMW and mirid bugs in the 33rd and 42nd SMWs. Correlation analysis showed significant positive relationships for gall midge incidence with minimum temperature and for leaf folder damage with temperature and humidity.

In Zone IV - reported from one location- Titabar. Insect pest incidence began in the 30th SMW. Gall midge infestation in 41st SMW (0.24%). Stem borer dead heart damage peaked in the 39th SMW (9.72%), while leaf folder infestation was highest in the 31st SMW (6.12%). White ear incidence was 7.03 per cent in the 45th SMW. Whorl maggot incidence was recorded from the 30th to 33rd SMW, peaking at 5.91% in the 31st SMW. Natural enemies, including spiders, coccinellids and mirid bugs showed fluctuating populations. Stem borer and leaf folder damage had significant positive correlation with temperature, rainfall and evening humidity, while whorl maggot damage was positively correlated with rainfall but negatively with morning humidity.

In Zone-V, pest incidence was recorded from the 34th to the 47th SMW. Gall midge infestation peaked in the 36th SMW (88%DP) and declined to 16% by the 44th SMW. Stem borer dead heart damage was highest in the 42nd SMW (19.96%) and White ear in the 46th SMW (17.5%). Leaf folder infestation peaked in the 43rd SMW (10.57%DL), while whorl maggot and rice hispa were most prevalent in the 34th SMW. Planthopper populations were highest in the 46th SMW (3.85 number per hill). Significant positive correlation for gall midge and whorl maggot with humidity and rainfall was observed, while sunshine hours negatively affected on whorl maggot and hispa damage.

In Zone VI, only stem borer, leaffolder and white ear damage were recorded. Stem borer infestation began in the 36th SMW, peaking in the 46th SMW (20.95% DH) and 44th SMW (22.9%WE). Leaf folder damage was highest at 28.84% in the 46th SMW. Spider populations remained stable fluctuating between 0.84 and 1.16 numbers per hill. Correlation analysis showed a significant positive relationship between stem borer incidence and maximum temperature.

In Zone VII, major pests included gall midge, stem borer, leaf folder, whorl maggot, rice hispa and planthoppers. Gall midge damage peaked at 48% in the 39th SMW, while stem borer dead heart incidence was highest in the 29th SMW (16.26% DH) and 52nd SMW (18.65% WE). Leaf folder damage reached 15.56% in the 40th SMW and planthopper populations peaked at 24.71 number per hill in the 45th SMW.

Natural enemies, especially spiders and mirid bugs increased with planthopper density suggesting that population is dependent on pest density. Correlation analysis showed varying relationships between pest incidences and weather parameters with temperature and humidity significantly influencing pest populations.

Population dynamics of insect pests through Light trap catches (LT) revealed that yellow stem borer, leaf folder, and hoppers continued to be the most important pests in terms of numbers as well as spread across the locations. Gall midge continues to be an endemic pest. However, case worm, and gundhi bug showed an increase in the spread and intensity of incidence posing concern for future. Patterns in seasonal incidence and population build up based on light trap catches indicates that the key pests are reaching their peak levels in the months of October and November in the *kharif* season and in the late January or early February during post rainy (*rabi*) season. Therefore, strategies are to be timed accordingly for the effective management of insect pests in rice.

ENTOMOLOGY

INTRODUCTION

This year the rice production during *kharif* 2024 is estimated at 1,206.79 lakh tonne while Rabi rice (excluding summer) at 157.58 lakh tonne. The production of paddy, the main Kharif crop, was 5.8 per cent higher than last year. It was boosted by the normal rainfall from the southwest monsoon (June-September) that was 108% of the long-period average (LPA) across India though, there were significant regional variations. Real Time Pest Survey Reports were continued to be generated at fortnightly interval from AICRPR Centres, during *kharif* 2024.

Reports of Incidence of pests was received from Amritsar, Ludhiana, Jalandhar, Kapurthala, Moga, Ferozpur, Sri Muktsar Sahib districts of Punjab and Kaithal, Karnal, Kurukshetra, Ambala and Yamunanagar districts of Haryana where low level of stem borer, leaf folder and planthoppers incidence was reported. Low to moderate level incidence of stem borers and leaf folder was observed in and around UdhamSingh Nagar, Uttarakhand. In Ahmedabad and Vadodara districts of Gujarat, moderate to severe infestation of stem borers, leaf folder and planthoppers with sporadic 'hopper burn' in fields were observed. In Singur Block, Hooghly district of West Bengal severe incidence of brown planthopper and white backed planthopper caused 'hopper burn' symptoms in extensive areas on the cultivars, Jamuna, Swarna, and Pratiksha during second fortnight of November. Extensive hopper burn by planthoppers was reported from Ghaghraghat and Masodha. In Thanjavur, Mayiladuthurai and Nagapattinam districts of Tamil Nadu, at vegetative and panicle initiation stages leaf folder caused extensive damage on CO 51, CR 1009 cultivars. Leaf mite infestation also was severe, up to 50-55 per cent leaf damage. In Thiruneelakudi village, Thiruvidaimaruthur blocks on CO 51 cultivar at the reproductive stage, black bug occurred in severe form (40-50 per cent). On the same cultivar in Thiruvur block, brown planthopper caused severe damage. In early crop growth stages, whorl maggot also was recorded. In Kongad and Pattambi areas of Kerala, stem borer and brown planthopper caused severe damage. In Warangal, Jangoan, Hanamkonda districts of Telangana at active tillering to panicle initiation stages, gall midge, stem borer, leaf folder and whorl maggot occurred at a low level. During November-December, outbreaks of gall midge leading to severe crop loss in nearly 1.5 lakh hectare of paddy in three districts, Raichur, Koppal and Bellary under Tungabhadra command area of Karnataka were reported. RNR15048 and Kaveri Sona were the two predominant varieties grown by the farmers and they were infested with gall midge. Infestation was in both nursery and main field. Random sampling of the fields revealed that gall midge infestation was as high as 18-93% SS across various farmers' fields. In Kampli kottal Hobbili mandal 10% of the affected nurseries were ploughed off and resown.

Nevertheless, severe pest damage was limited to pockets and no widespread pest outbreaks were reported during main *kharif* season of the crop this year.

Coordinated Entomology programme continued its focus on the host plant resistance, with evaluation of breeding material and germplasm against major insect pests in pest specific trials, monitoring of virulence and characterization of both BPH and gall midge populations. Multilocation evaluation for multiple insect pest injury was carried out for all the entries in National Screening Nurseries and germplasm accessions to identify the promising material.

Under chemical control studies three new trials were initiated *viz.*, 'Seed treatment for management of early season insect pests of rice' to address the need for identification of effective molecules for early stage pest control; "Bio-efficacy of insecticides against brown planthoppers' to assess the efficacy of recommended insecticides to brown planthopper" and "Evaluation of drones for spraying of agrochemicals (herbicides, insecticides and fungicides) in rice pest management' to explore the utility of this novel technology for pesticide application. The trial on 'Prophylactic management of Planthoppers in rice' is being continued for the locations in North- Western India where Southern black streak virus was reported earlier.

In order to identify safer and eco-friendly alternatives for pest management a new trial on "Evaluation of entomopathogens against lepidopteran pests of rice (EELP)" was initiated this year under Biocontrol and Biodiversity studies, so as to harness the possible benefits of eco-friendly components of IPM to strengthen organic farming in rice.

Investigations are also being made to study the underlying impact of climate change on shift in cultivation practices and the resultant alterations in pest profile dynamics thereof. Under Ecological studies "Influence of establishment methods on pest incidence" is continued in collaboration with agronomists at different cooperating centres. The trial on "Evaluation of pheromone blends for Insect pests of rice" is continued with emphasis on the formulations for *Scirpophaga incertulas* and *Cnaphalocrocis medinalis*. Keeping pace with the government policies on the emphasis to natural farming, a new trial on "Pest Incidence in natural farming" was taken up this year in collaboration with the agronomists and plant pathologists.

With the imminent climate change and keeping note of the changes in the cultivation practices across the country due to water and labour shortage, a new trial on "Integrated pest management in Direct seeded rice" was taken up. The trial which involved the integration of efforts from the disciplines of Entomology, Pathology and Agronomy for the holistic on farm biotic stress management was initiated through farmers' participatory approach wherein IPM practices were compared with Farmers practice and demonstrated the benefits of IPM adoption in direct seeded rice.

The long term pest surveillance through light trap catches to discern short term fluctuations and long term trends in pest incidence along with assessment of pest and natural enemy dynamics through field incidence is being continued.

This report summarizes the significant findings from the multilocation testing under greenhouse studies, field trials at research stations and farmers' fields carried out at IIRR and its cooperating centres under AICRPR during kharif 2024.

2.1 HOST PLANT RESISTANCE STUDIES

Host plant resistance trials were conducted with the main objective of identifying new sources of resistance to major insect pests from land races and breeding lines. To achieve these objectives, six trials *viz.*, i) Planthopper screening trial (PHS) ii) Gall midge screening trial (GMS), iii) Leaf folder screening trial (LFST), iv) Stem borer screening trial (SBST) v) Multiple resistance screening trial (MRST), and vi) National screening nurseries (NSN) were constituted and conducted. The results are summarized and discussed trial wise. In all 1967 entries were evaluated at 41 locations against 14 insect pests and 136 (6.91%) entries were identified as promising. The reaction of the entries to insect pests in each trial are tabulated in a separate volume **"Screening Nurseries: Vol. II –Diseases & Insect Pests".** The results of the reaction of entries to insect pests are discussed trial wise.

2.1.1 Planthopper Screening Trial (PHS)

The planthopper screening trial was constituted to identify germplasm and breeding lines promising to rice planthoppers *i.e.*, brown planthopper and white-backed planthopper.

The trial was constituted with 150 entries comprising of 10 breeding lines developed at RRU, Bapatla, ANGRAU; 17 breeding lines developed at APRRI, ANGRAU, Maruteru, 12 breeding lines developed at ARS, ANGRAU, Ragolu, 15 breeding lines developed at TNAU, Coimbatore; 10 lines from RARS , Aduthurai; 3 breeding lines from RARS, Jagtial, PJTAU; 16 breeding lines nominated by IIR, Rajendranagar, PJTAU; 16 breeding lines developed at RARS, Warangal, PJTAU, 1 breeding line developed at ARS, UAS, Mugadh; 3 NILs in the genetic background of IR 24, 30 lines from IIRR comprising of advanced breeding lines from various backgrounds (EMS mutant lines derived from BPT 5204, recombinant inbred lines, aromatic lines, gene pyramided lines of Improved Samba Mahsuri) developed at ICAR-IIRR, Hyderabad along with three resistant checks *viz.,* PTB 33 (BPH), RP 2068-18-3-5 (BPH) and MO1 (WBPH) and TN1(susceptible check). Of these, 20 entries were under retesting. The entries were evaluated at 17 locations in 23 valid tests against brown planthopper (BPH), white-backed planthopper (WBPH) and mixed populations of planthoppers under both field and greenhouse conditions.

Brown planthopper: The entries were evaluated under greenhouse conditions in 11 tests. Among the promising entries, MTU 2721-7-1-2-1* and MTU 2721-7-1-2-2* were promising in 6 tests; RP 6740-SP-M-MS-70* and MTU 2720-28-2-1-1* were promising in 5 tests of the 11 valid tests with a DS ≤ 3.0. All these entries were in the second year of testing. RP 6469-364 and MTU 2716-28-2-2-2 were promising in 4 tests.

White- backed planthopper: Reaction to WBPH was studied in two tests at IIRR and Coimbatore and one field test at Nawagam where population counts along with damage score were reported. RP 5977-MS-41* and CB 18586* were promising in greenhouse test (DS≤ 3.0) at IIRR and field test at Nawagam. However, both the entries were moderately susceptible in the greenhouse reaction at Coimbatore.

Mixed population of planthoppers: Mixed populations of brown planthopper and white-backed planthopper were present at Aduthurai, Gangavathi, Maruteru, Sakoli and Warangal. Data on BPH and WBPH populations during the field evaluation at Gangavathi revealed predominance of BPH over WBPH at the later stages though WBPH was more in the initial stages of crop growth. At Aduthurai, throughout the crop season, brown planthopper population was more compared to white-backed planthopper (14 to 37 BPH: 1WBPH). At Sakoli, BPH dominated (1.2 to 3.2 times more) WBPH throughout the crop season. At Warangal, the population of BPH was 17 to 29 times more than WBPH. At Rajendranagar, only BPH population was reared in the glasshouse and augmented in the field. At Nawagam, WBPH was more predominant over BPH. Evaluation of entries to mixed population in 5 valid field tests identified MTU 2716-28-2-1-2* and MTU 2721-7-1-2-1* as promising in four tests exhibiting field tolerance and on par with PTB 33.

Overall reaction*: Evaluation of 150 entries in 11 greenhouse and 3 field tests against brown planthopper; 2 greenhouse and 2 field tests against white-backed planthopper and 5 field tests against mixed populations of planthoppers revealed that 17 entries were promising in 5-12 promising tests of the 23 valid tests (Table 2.1.1). MTU 2721-7-1-2-1* was promising in 12 tests followed by MTU 2720-28-2-1-1* and MTU 2721-7-1-2-2* in 10 tests. RP 6740-SP-M-MS-70*, MTU 2716-28-2-1-2* and MTU 2716-28-2-2-2* were promising in 9 tests. MTU 2760-2-1-1-1 was promising in 7 tests; RP 5977-MS-112*, RP 6469-364, ISM B-8* were promising in 6 tests. AD22011, AD22115, JGL 38935*, RGL 2130, RGL-2037-20-2-1, WGL 2019 and 1536-70-4-2-1-3 were promising in 5 tests. Of the17 promising entries, 9 entries were under retesting. The susceptible check, TN1 recorded a damage score in the range of 6.3 to 9.0 in these valid tests. The universal checks viz., PTB 33 and MO1 performed well in 11 and 5 tests respectively. The breeding line, RP 2068-18-3-5 carrying BPH resistant Bph33t gene and identified as a donor check line for BPH performed better in 9 tests.* **(Table 2.1.1)**.

2.1.2 Gall Midge Screening Trial (GMS)

The objective of this trial was to evaluate the performance of the donors and breeding lines developed from known sources of gall midge resistance against various populations of gall midge. The trial was constituted with 75 entries (67 entries comprising of 66 breeding lines, one variety and 8 insect checks). Of these, 19 entries were under retesting. The nominations included breeding lines that were developed from 40 crosses bred at 9 centres, *viz.,* ICAR- IIRR; IGKVV Raipur, RARS Jagtial; ARS Kunaram; RARS Warangal; IRR Rajendranagar, RARS Maruteru, ARS Ragolu, and ARS Nellore where gall midge is an endemic pest. All the 75 entries were evaluated at 14 locations from 7 states across the country against the prevailing gall midge populations. Reaction was recorded at 30 DAT, 50 DAT and

75 DAT as % DP and %SS. Data from Brahmavar, Ranchi and IIRR was not considered due to low pest pressure. The reaction of the entries to various populations of gall midge from different locations in 11 valid tests is discussed as under:

Reaction at Ambikapur, Chiplima and Jagdalpur: RMS(ISM 26)*, RMS(ISM 24)*, RMS(ISM 26) *, WGL 1909*, Akshayadhan PYL*, NLR 5942-11-2-1-1-1, NLR 5942-11-3-8-1-1, NLR 5942-13-1-1-1-1, NLR 5942-36-3-3-1-5 exhibited nil plant damage at all the three locations.

Sakoli: JGL 41652*, RGL - 294*, RGL 1677, RP 6469-83, RP 6809-47-62-85-89 (ISM-15) (CRP2), RP 5921*, RMS(ISM 11)*, RMS(ISM 18)*, RMS(ISM 24)*, WGL 1837*, WGL 1843*, WGL 1909*, WGL 2013, WGL 2025, NLR 5942-11-2-1-1-1, NLR 5942-11-3-8-1-1, NLR 5942-13-1-1-1-1, NLR 5942-36-3-3-1-5, NLR 5951-66-2-2-1-1, Kavya, Aganni, W 1263, Akshayadhan PYL* recorded nil plant damage at Sakoli.

Jagtial: Field screening at *Jagtial* had identified RGL-294*, WGL 1909*, WGL 2019, Akshayadhan PYL* and IBT-WGL 17 with nil damage along with the resistant check Aganni.

Warangal: Only Aganni and RMS(ISM 24)* recorded nil plant damage.

Nellore: Only two entries *viz.*, RNR 35008 and RNR 41714 recorded nil plant damage.

Maruteru: RGL 294*, RGL7025, Aganni, RGL 2034-56-4-1, RNR 44476, WGL 1822*, WGL 1843*, Akshayadhan PYL*, WGL 2024, NLR 5942-13-1-1-1-1 recorded nil damage at this location.

Gangavathi: RNR 35008 was the only entry with nil plant damage

Pattambi: None of the entries were promising in field screening at this location.

Moncompu: Evaluation at this location identified 29 entries with nil damage where the average damage was 3%SS.

The results revealed that there is a variation in the performance of the lines which could be attributed to the variation in the virulence of the populations as reported in the other gall midge trials.

Overall reaction*:1** *Evaluation of 75 entries in 11 field tests against 11 populations of gall midge helped in identification of 11entries as most promising with nil damage in 3-6 tests of the 11 valid tests. RMS(ISM24) and NLR 5942-13-1-1-1-1 were promising in 5 tests each. WGL 1909, NLR 5942-36-3-3-1-5 and RGL 294 recorded nil damage in 4 tests. Of these, RMS(ISM24), WGL1909, RGL294 and RMS (ISM26) were under second year of testing. Six entries were promising in 3 tests.* ***(Table 2.1.2)*. RNR 35008 was promising at both Nellore and Gangavathi.*

Table 2.1.1Reaction of entries against planthoppers in PHS trial, kharif 2024

Entry No.	Designation	Cross	Greenhouse reaction against BPH												Field Reaction against BPH				Reaction against WBPH					Field Reaction to Mixed populations of Planthoppers					PH	Over all NPT
			IIRR	RNR	WGL	CBT	ADT	MND	CTC	RPR	LDN	IAR	PNT	BPH	JGT	RNR	RNR	BPH	IIRR	CBT	NWG	NWG	WBPH	ADT	GNV	MTU	SKL	WGL		
			GH	GH	GH	GH	GH	GH	GH	GH	GH	GH	GH	GR	80DT	73DT	87DT	FR	GH	GH	71DT	103DT	GR	80DT	105DT	87DT	Pr.h	100DT		
														NPT				NPT					NPT						NPT	
			DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	11	No./10h	No./h	DS	3	DS	DS	No./10h	DS	4	No./10h	DS	DS	%DT	% DT	5	23
85	MTU 2721-7-1-2-1*	(PLA 1100/GM 70)/MTU 1156	2.4	6.1	1.8	5.0	3.0	5.0	1.0	1.5	3.0	5.2	7.0	6	507	26.1	7.0	0	2.0	5.0	72	1.0	2	45	3.0	5.0	3.3	2.9	4	12
84	MTU 2720-28-2-1-1*	MTU 1064/(R 3598-1-4-2-1)//(MTU 1140/RNR 15048)	3.1	5.9	0.2	5.0	3.0	5.0	1.0	1.2	3.0	3.8	7.4	5	557	27.7	7.0	0	2.6	9.0	56	1.0	2	55	5.0	5.0	1.7	2.8	3	10
86	MTU 2721-7-1-2-2*	(PLA 1100/GM 70)/MTU 1156	3.0	4.9	2.6	5.0	3.0	5.0	1.0	1.2	3.0	4.0	9.0	6	562	25.9	7.0	0	1.1	5.0	56	3.0	1	48	5.0	5.0	0.0	0.0	3	10
17	RP 6740-SP-M-MS-70*	BPT5204 mutant	1.1	4.1	5.6	5.0	3.0	5.0	1.0	1.3	3.0	5.0	9.0	5	606	26.0	5.0	0	6.6	5.9	44	1.0	2	79	7.0	9.0	4.2	33.6	2	9
82	MTU 2716-28-2-1-2*	(MTU 1140/RNR 15048)// T12	3.3	5.5	6.2	5.0	3.7	5.0	3.0	1.1	3.0	6.1	4.5	3	537	24.6	5.0	0	3.4	4.0	44	1.0	2	50	5.0	3.0	3.8	1.4	4	9
83	MTU 2716-28-2-2-2*	(MTU 1140/RNR 15048)// T12	3.7	5.5	2.5	5.2	3.0	7.0	7.0	1.5	3.0	4.4	6.5	4	588	24.1	7.0	0	0.8	5.2	58	1.0	2	60	3.0	5.0	17.6	3.2	3	9
69	MTU 2760-2-1-1-1	Samba Sub/Swarna	4.6	5.5	5.5	5.0	4.3	5.0	3.0	1.2	3.0	7.6	7.4	3	588	26.0	7.0	0	6.6	6.6	48	1.0	2	87	7.0	7.0	20.4	3.2	2	7
12	RP 5977-MS-112*	BPT5204 mutant	5.1	9.0	7.8	8.8	3.7	9.0	7.0	1.5	8.0	4.5	6.1	1	588	31.7	7.0	0	2.6	6.0	54	1.0	2	84	3.0	7.0	7.8	4.4	3	6
21	RP 6469-364		2.6	1.8	6.3	5.2	7.7	7.0	1.0	2.4	8.5	6.0	5.0	4	396	22.5	7.0	0	NG	6.8	NG	NG	0	155	3.0	9.0	11.5	2.8	2	6
23	ISM B-8*	Xa21/xa13/Pi2/Pi54/Bph33t	1.6	5.5	4.0	5.0	3.7	7.0	3.0	2.4	8.2	4.6	8.4	3	600	23.6	7.0	0	7.4	5.2	36	3.0	1	85	5.0	9.0	65.1	1.7	2	6
8	AD22011	AD13116 x BPT2270	8.2	9.0	9.0	8.2	9.0	NG	9.0	9.0	NG	6.5	6.0	0	607	47.0	5.0	0	6.4	7.2	10	1.0	2	215	3.0	9.0	2.4	9.8	3	5
9	AD22115	AD13116 x BPT 2270	5.9	8.0	9.0	7.2	9.0	7.0	3.0	9.0	8.2	5.8	7.9	1	619	28.6	3.0	1	9.0	6.0	22	1.0	2	219	5.0	9.0	0.0	15.0	1	5
63	JGL 38935*	JGL 25960 X IRTON 270	5.3	5.0	8.1	5.4	7.7	3.0	9.0	1.0	8.0	4.3	4.3	2	484	24.3	7.0	0	2.7	8.2	58	5.0	1	178	3.0	9.0	51.1	1.7	2	5
91	RGL 2130	Parijatham x RGL 10098	5.2	6.6	7.3	3.0	5.7	5.0	1.0	4.4	3.0	7.4	7.5	3	546	25.5	9.0	0	5.9	5.2	56	3.0	0	138	5.0	5.0	4.9	0.0	2	5
94	RGL-2037-20-2-1	MTU-1290/MTU-1121	4.5	6.7	6.1	5.0	9.0	5.0	3.0	4.0	3.0	8.4	9.0	2	523	24.6	5.0	0	2.0	8.0	42	3.0	2	247	5.0	5.0	12.5	0.0	1	5
132	WGL 2019	NLR 34449/WGL 1191	7.7	6.2	9.0	7.0	3.0	9.0	9.0	9.0	8.0	4.6	8.8	1	528	27.9	7.0	0	7.0	5.0	40	3.0	1	45	3.0	9.0	59.3	0.0	3	5
140	RP 6830-1536-70-4-2-1-	IET 23647/IET 25350	8.6	6.1	9.0	8.8	9.0	3.0	9.0	9.0	8.0	1.7	3.5	2	575	23.9	5.0	0	8.5	7.0	56	1.0	1	235	7.0	9.0	3.8	0.0	2	5
Checks																														
100	PTB33		4.5	6.3	9.0	9.0	3.0	3.0	9.0	1.5	3.0	4.8	5.0	4	561	26.2	5.0	0	2.7	5.0	46	3.0	2	40	3.0	3.0	0.0	0.0	5	11
146	PTB33		2.4	NT	9.0	5.0	3.0	5.0	1.0	1.2	3.0	6.8	4.5	5	581	27.8	7.0	0	1.3	4.2	52	1.0	2	80	3.0	5.0	0.0	9.9	4	11
30	RP2068-18-3-5		6.0	3.9	7.5	2.0	3.0	3.0	1.0	0.0	3.0	8.3	5.0	6	504	44.5	5.0	0	6.2	5.4	54	5.0	0	75	5.0	3.0	19.5	10.0	3	9
70	RP2068-18-3-5		4.6	3.6	6.0	5.0	4.3	3.0	3.0	0.5	3.0	4.5	5.0	4	575	24.7	9.0	0	1.8	5.6	46	3.0	2	80	3.0	9.0	9.5	3.7	3	9
110	RP2068-18-3-5		3.8	3.9	8.6	2.0	3.7	5.0	9.0	2.4	3.0	3.0	3.0	5	559	25.9	7.0	0	5.5	5.0	60	3.0	0	73	3.0	3.0	11.3	1.4	4	9
40	MO1		4.4	9.0	9.0	6.0	3.7	9.0	9.0	0.5	8.0	7.3	7.0	1	613	24.1	7.0	0	3.2	3.0	56	3.0	1	55	3.0	9.0	71.6	1.9	3	5
Total tested			142	138	143	145	141	142	141	144	127	148	150		148	146	146		128	145	134	134		140	145	143	148	146		
Max. damage in the trial			9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.6	13.0	9.0		667	47.0	9.0		9.0	9.0	158	7.0		277	9.0	9.0	86.3	100.0		
Min. damage in the trial			1.1	1.8	0.2	2.0	3.0	3.0	1.0	0.0	3.0	0.0	3.0		230	20.8	3.0		0.5	3.0	10	1.0		40	3.0	3.0	0.0	0.0		
Ave. damage in the trial			6.8	7.0	8.3	7.1	7.3	6.9	7.5	6.0	6.7	6.4	7.4		532	28.0	6.7		6.0	6.7	62.2	3.3		174.4	5.6	8.0	32.2	12.8		
Damage in TN1			7.3	7.7	9.0	8.5	7.5	7.7	9.0	7.5	8.2	6.4	7.4		509	31.3	8.3		8.8	8.1	112.3	6.3		180.5	6.3	9.0	54.4	43.3		
Promising level			3	3	3	3	3	3	3	3	3	3	3		100	10	3		3	3	50	1		100	3	3	5	10		
No. promising			7	2	5	6	12	7	21	42	34	5	2		0	0	2		22	2	39	43		24	23	8	30	27		

*-Entry under Retesting.

Table 2.1.2: Reaction of entries to gall midge population in GMS trial, kharif 2024

GMS No.	Designation	Cross	ABP	JDP	CHP	SKL	JGT	WGL	NLR	MTU	GNV	PTB	MNC	Over all
			GMB1	GMB1	GMB1	GMB4	GMB3	GMB4M	GMB	GMB	GMB	GMB5	GMB5	
			50DT	50DT	50DT	50DT	50DT	50DT	70DT(Rt)	50DT	50DT	50DT	50DT	NPT
			Per cent plant damage										%SS	11
48	RMS(ISM 24)*	ISM*2//Abhaya/Aganni/Swarna	30.0	0.0	0.0	0.0	30.0	0.0	100.0	30.0	95.0	85.7	0.0	5
72	NLR 5942-13-1-1-1-1	NLR 33892 x JGL 17004	10.0	0.0	0.0	0.0	100.0	85.0	80.0	0.0	90.0	71.4	0.0	5
56	WGL 1909*	UPR 3667-2-1-7/WGL 1003	40.0	0.0	0.0	0.0	0.0	50.0	100.0	20.0	90.0	95.2	1.9	4
73	NLR 5942-36-3-3-1-5	NLR 33892 x JGL 17004	0.0	0.0	0.0	0.0	100.0	85.0	40.0	60.0	95.0	71.4	3.6	4
13	RGL - 294*	RGL 232 X RGL 3250	50.0	20.0	0.0	0.0	0.0	30.0	60.0	0.0	90.0	71.4	2.0	4
14	RGL 1677	Lalat x CR-308-408	60.0	0.0	70.0	0.0	100.0	95.0	100.0	NG	95.0	71.4	0.0	3
41	WGL 1859	WGL 810/MTU 1156	0.0	40.0	0.0	85.0	100.0	100.0	100.0	10.0	95.0	81.0	0.0	3
49	RMS(ISM 26)*	ISM*2//Abhaya/Aganni/RP2068	0.0	0.0	10.0	30.0	20.0	55.0	100.0	40.0	100.0	95.2	0.0	3
64	IBT-WGL -17	MTU -IL-1/RMSGM 3	40.0	0.0	10.0	20.0	0.0	33.3	80.0	20.0	100.0	95.2	0.0	3
69	NLR 5942-11-2-1-1-1	NLR 33892 x JGL 17004	0.0	0.0	10.0	0.0	100.0	90.0	40.0	10.0	90.0	85.7	2.1	3
71	NLR 5942-11-3-8-1-1	NLR 33892 x JGL 17004	0.0	0.0	20.0	0.0	100.0	95.0	70.0	10.0	100.0	95.2	2.0	3
	Check													
20	Aganni		10.0	100.0	0.0	0.0	0.0	0.0	40.0	0.0	100.0	66.7	0.0	6
60	Akshayadhan Pyl*		20.0	0.0	0.0	0.0	0.0	100.0	60.0	0.0	90.0	90.5	2.0	5
30	W 1263		30.0	0.0	10.0	0.0	100.0	95.0	90.0	20.0	90.0	47.6	0.0	3
Total Tested			74	71	70	74	73	69	72	68	71	71	75	
Max. damage in the trial			80	100	100	100	100	100	100	90	100	100	15.7	
Min. damage damage in the trial			0	0	0	0	0	0	0	0	0	47.62	0	
Ave. damage in the trial			35.4	52.4	46.7	24.0	82.6	83.1	85.7	30.4	92.9	86.7	3.0	
Damage in TN1			55.0	90.0	65.0	67.5	100.0	100.0	65.0	70.0	91.7	61.9	9.9	
Promising level			0	0	0	0	0	0	0	0	0	0	0	
No. promising			6	16	10	23	6	2	2	10	1	0	29	

*-Entry under Retesting.

2.1.3 Leaf Folder Screening Trial (LFST)

To identify novel sources of resistance to rice leaf folder, *Cnaphalocrocis medinalis,* the Leaf Folder Screening Trial (LFST) was constituted with 35 nominations for field evaluation. The trial comprised 10 nominations from Rice Research Unit, Acharya NG Ranga Agricultural University, Bapatla, 4 nominations from Main Rice Research Station, Anand Agricultural University, Nawagam, 5 nominations from Institute of Rice Research, , PJTAU, Rajendranagar, 8 nominations from Regional Agricultural Research Station (RARS) Pattambi, 2 nominations from Tamil Nadu Rice Research Institute, Aduthurai, 4 back-cross inbred lines (BILs) of Swarna/*Oryza nivara* from IIRR along with a susceptible check (TN1) and resistant check (W 1263) and evaluated at 22 locations in a replicated trial.

The leaf folder damage during *Kharif* season, 2024 was low to moderate at all the locations, with an average damage in the trial ranging between 8.2 and 36.1%DL, while the maximum damage varied from 16.4 to 62.2%DL. Data analysis revealed that 14 out of 33 entries were promising in 4-6 tests out of 15 valid field tests (**Table2.1.3**) at a promising level of 10-15% DL. Two entries, RP5490 PTB 1-1-2 and BPT 3284 were promising in 6 out of 15 valid tests. Four entries, *viz.*, ADT 22037, NWGR 18083, NPK 65 and NWGR 18084 were promising in 5 out of 15 valid field tests. The resistant check, W 1263, was promising in 5 out of 15 tests. Eight entries were promising in 4 out of 15 tests. Of the remaining entries, 12 were promising in 3 tests and 6 entries were promising in 2 tests out of 15 valid field tests.

*Field evaluation of 35 entries, including susceptible and resistant checks replicated twice at 22 locations in the **Leaf Folder Screening Trial (LFST)** during Kharif 2024, revealed that 14 entries were promising in 4-6 tests out of 15 valid field tests. In the first year of testing, RP5490 PTB 1-1-2 and BPT 3284 were promising in 6 out of 15 valid tests, while four entries, viz., ADT 22037, NWGR 18083, NPK 65 and NWGR 18084, were promising in 5 out of 15 valid field tests and at par with W1263. Eight entries were promising in 4 out of 15 tests.*

Table 2.1.3: Performance of promising entries against leaf folder in LFST, ***Kharif*** 2024

S. No	Designation	Parentage	Leaf folder damaged leaves (%)															NPT 15
			ADT	RNR	PTB	KUL	MNC	KJT	CHN	BPT	CHT	MLN	NLR	NVS	NWG	CTC	LDN	
			60 DAT	81 DAT	50 DAT	28 DAT	60 DAT	80 DAT	68 DAT	80 DAT	60 DAT	75 DAT	80 DAT	80 DAT	60 DAT	65 DAT	80 DAT	
LFST 21	RP5490 PTB 1-1-2	Sampada /IRGC 11010 x Sampada	16.7	16.9	21.3	15.1	9.9	9.3	9.6	6.5	18.7	11.3	7.0	8.5	16.7	36.9	44.0	6
LFST 3	BPT 3284	BPT 2270/BPT 2605	5.9	54.4	22.4	16.5	9.8	17.1	9.4	7.2	21.6	13.7	9.5	7.6	22.2	48.1	29.2	6
LFST 16	ADT 22037	CO 51/ ADT 41	4.7	26.8	43.3	20.9	8.0	13.2	9.5	9.3	22.0	16.9	3.6	NG	48.7	23.9	37.0	5
LFST 12	NWGR 18083	Gurjari/Z-31	9.5	46.6	32.5	18.1	8.5	15.2	11.7	8.7	22.1	16.1	6.7	8.2	21.7	34.0	38.5	5
LFST 30	NPK 65	Swarna/ *O nivara* BIL	5.8	25.9	21.4	NG	7.1	12.4	13.5	8.9	18.3	11.4	7.5	8.6	24.1	48.4	33.7	5
LFST 14	NWGR 18084	Gurjari/Z-31	5.8	44.8	24.5	15.1	7.4	15.4	7.0	7.8	20.5	18.4	10.2	5.8	23.2	38.0	33.8	5
LFST 35	W 1263	Resistant check	22.8	11.7	10.8	9.3	7.9	14.4	8.5	5.7	17.1	10.2	9.7	NG	19.6	13.7	36.6	5
LFST 9	BPT 3507	Cult.01120305/Cult. 0910025-7	14.6	39.9	20.5	17.9	13.9	13.5	12.2	4.2	20.5	17.9	6.9	9.3	14.3	27.5	30.1	4
LFST 13	NWGR 17121	GAR 13/IET 2006	3.2	54.2	29.3	17.1	6.8	12.7	10.9	7.9	21.0	16.6	8.5	36.9	26.0	48.8	26.4	4
LFST 10	BPT 3363	BPT 5204/BPT 2841	13.7	28.8	13.3	18.8	10.2	17.1	9.8	9.1	20.9	17.5	8.8	7.2	17.3	32.0	30.1	4
LFST 5	BPT 3354	BPT 3291/BPT 2411	7.4	62.2	22.1	19.6	9.6	15.7	11.9	10.0	21.8	12.3	6.1	29.1	23.4	45.4	24.7	4
LFST 25	RNR 35008	HKR 08-01/MTU 1001	12.3	34.1	24.4	15.4	9.1	11.9	11.8	7.1	22.0	10.7	7.3	9.8	25.7	39.5	34.1	4
LFST 27	RNR 44476	(ISM 390-4/JGL 13595)/(SYE 503-78-34-2/BPT 5204 Pi1, Pi2)	7.4	32.0	16.3	15.7	6.7	11.6	13.5	7.4	22.1	13.3	8.1	12.6	24.4	30.4	29.9	4
LFST 29	RNR 37919	AAGP 9772/NLR 34449	5.1	21.2	16.5	13.1	9.8	11.1	12.1	6.5	20.0	13.8	6.5	NG	21.5	52.1	32.0	4
LFST 33	NPK 8	Swarna/ *O nivara* BIL	23.7	15.5	25.0	14.4	8.6	12.8	9.7	8.6	18.9	11.1	7.6	22.4	19.8	46.4	43.3	4
	Local GR-11	Local check												45.2	17.5			
LFST 34	TN 1	Susceptible check	29.7	22.2	41.8	23.9	8.8	12.5	13.1	9.7	19.8	11.1	13.2	NG	25.1	36.4	43.8	
Minimum damage			3.2	11.7	10.8	9.3	5.9	9.3	7.0	4.2	17.1	5.4	3.6	5.8	14.3	9.8	23.2	
Maximum damage			28.6	62.2	43.3	21.9	18.1	17.8	18.8	16.4	24.2	18.4	23.7	45.2	48.7	60.0	45.8	
Average damage in trial			11.3	36.1	22.9	16.8	9.1	13.8	11.4	8.2	20.6	13.1	9.7	17.1	23.0	34.1	33.9	
Promising level			10	10	10	10	10	10	10	10	10	10	10	10	15	10	10	
Number Promising			19	0	0	1	25	1	8	28	0	1	23	10	1	1	0	
Total entries tested			35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	

Data from Arundhutinagar, Brahmavar, Jagdalpur, Karaikal, Masodha, Rewa and Titabar was not included in the analysis due to low pest pressure; NG = Not germinated.

2.1.4 Stem Borer Screening Trial (SBST)

To identify novel sources of tolerance to stem borer damage in rice, **Stem borer Screening trial (SBST)** was conducted during *kharif* 2024 with 55 entries which included 16 nominations from IIRR; 7 nominations from PTB; two from Nawagam, 3 from TNRRI, Aduthurai, 9 from ARS, Nellore, 8 from IRR, Rajendranagar, three from CCMB along with 7 checks. Of these, 16 entries were under retesting. The entries were evaluated at 21 locations. For effective screening, two staggered sowings were taken up at NVS, PNT, CHN, NWG, TTB, RNR and IIRR. At IIRR, infestation was supplemented through pinning of yellow stem borer egg masses. At each location, observations were recorded on dead heart damage in vegetative phase and white ear damage in reproductive phase, grain yield in the infested plant and the larval survival in the stubbles at harvest. In all the locations tested, damage by yellow stem borer was observed with few exceptions. At Titabar, both yellow stem borer and white stem borer were recorded in the ratio of 40:60. At Navsari *S. incertulas*, white stem borer, *Scirpophaga* sp. and pink stem borer, *Sesamia inferens* were observed. At Chiplima, *S. incertulas*, white stem borer, *Scirpophaga* sp. and pink stem borer, *Sesamia inferens* and *Chil*o sp. were observed. Though YSB was predominant, traces of pink stem borer were observed in stubbles at Rajendranagar. The results of the evaluation from the valid tests are discussed below**.**

Dead heart damage: The dead heart damage in the trial varied from 0.0 to 55.8% with an average damage of 19.5% DH across 10 locations in 13 valid tests. Evaluation of entries for dead heart damage at 30, 50 DAT and at 71-78 DAT in two staggered sowings helped in identification of HKP-ISM-M8-9 as promising in 7 tests; NLR 5932-3-2-3-5-5-2 in 6 tests; IET 32031, RNR 41661, HKP-ISM-M8-29, 0615-PTB-01-28-18 in 5 tests each as the most promising with a damage ≤10% DH (DS1.0).

White ear damage: The white ear damage across 9 locations in 10 valid tests varied from 0.0 to 92.3% with a mean of 19.2% WE in the trial. Evaluation of entries identified, NLR 5892-21-4-1-1-1-2 in 5 tests; NLR 5930-2-1-2-4-1-1, RP5564 PTB 2-4-1-2 and 0615-PTB-01-28-18 in 4 tests; IET 21401, IET 32031, NLR 5960-13-2-2-4 and NLR 5960-14-1-1-2 as promising in 3 tests with ≤10 % WE damage (DS3.0).

The larval survival in the stubble of each entry across 8 locations in 11 tests varied from 0.0 to 5 larvae/hill with a mean of 0.7larvae/hill.

Grain yield: 0615-PTB-01-23-21, BK 49-76*, were promising in 7 of the 9 tests with grain yield of ≥15g/hill despite white ear damage; NWGR-19007*, NLR 5942-11-3-6-1-1, NWGR-19183 and, RNR 38125 in 6 valid tests with grain yield of ≥15g/hill.

Overall reaction: *Evaluation of entries in 13 valid field tests for dead hearts damage and 10 valid tests for white ear damage identified 7 entries viz., 0615-PTB-01-23-21, NLR 5892-21-4-1-1-1-2, NLR 5930-2-1-2-4-1-1, HKP-ISM-M8-9, RP5564 PTB 2-4-1-2, IET 32031 and NLR 5932-3-2-3-5-5-2 as promising in 8 to 9 of the 23 tests in terms of low dead heart (≤10% DH) and white ear damage (≤10% WE). They were also promising in 2 to 7 tests of the 9 valid tests with higher grain yield (≥15.0 g/hill) under infested conditions in reproductive phase suggesting that recovery resistance and tolerance could be the mechanism in these entries as they have good grain yield despite damage. Another 15 entries were promising in 5-7 tests with low damage for stem borer and higher grain yield in 1 to 7 valid tests* ***(Table 2.1.4).***

Table 2.1.4: Reaction of most promising cultures to stem borer in SBST, ***kharif*** 2024.

SBST No.	Designation	No. of promising tests (NPT)				Overall
		SBDH	SBWE	SBDH+SBWE	GY/Hill	SB NPT
		13	10	23	9	32
1	0615-PTB-01-23-21	5	4	9	7	16
7	NLR 5892-21-4-1-1-1-2	4	5	9	4	13
9	NLR 5930-2-1-2-4-1-1	4	4	8	5	13
53	HKP-ISM-M8-9	7	1	8	5	13
37	RP5564 PTB 2-4-1-2	4	4	8	3	11
5	IET 32031	5	3	8	2	10
11	NLR 5932-3-2-3-5-5-2	6	2	8	2	10
4	IET 21401	4	3	7	1	8
26	RNR 41661	5	1	6	5	11
3	0627-PTB-7-8-24	4	2	6	4	10
51	RP6738-42-16-2-2*	4	2	6	4	10
34	RP5517-PTB-1-1-1-1-1	4	2	6	3	9
55	HKP-ISM-M8-29	5	1	6	3	9
2	0627-PTB-2-14-1	4	2	6	2	8
16	NLR 5960-14-1-1-2	3	3	6	2	8
15	NLR 5960-13-2-2-4	3	3	6	1	7
35	W1263*	3	2	5	7	12
21	NWGR-19183	3	2	5	6	11
29	RP4919-NSR24*	4	1	5	5	10
50	RP5977Bio-SB9 (SM92)*	3	2	5	5	10
54	HKP-ISM-M8-24	3	2	5	5	10
27	RNR 41760	4	1	5	3	8

*Entry under retesting

Data on dead heart damage from ADT, AND, CBT, CHN, LDN, MNC, MND, NVS1, RNR1,2, NWG1,2, TTB1,2; white ear damage from ADT, IIRR-2, MNC, NVS1, RNR1,2, TTB-1, 2, AND, RNR, CHN, MND and NLR not considered for analysis due to low pest pressure.

Valid data considered for analysis in SBST, kharif 2024

<table>
<tr><td>Paratmeters</td><td colspan="13">Locations tested</td><td>Total tests</td></tr>
<tr><td>Dead heart (%DH)</td><td>CHN</td><td>CHP</td><td>GGT</td><td>IIRR-2</td><td>NLR</td><td>NVS-2</td><td>PSA</td><td>PTB</td><td>RPR</td><td>PNT-I</td><td rowspan="2">PNT-I</td><td rowspan="2">PNT-II</td><td rowspan="2">PNT-II</td><td>13</td></tr>
<tr><td>White ear damage (%WE)</td><td>ABP</td><td>GGT</td><td>IIRR-1*</td><td>LDN</td><td>NWG</td><td>PSA</td><td>PTB</td><td>RPR</td><td>PNT-I</td><td>PNT-II</td><td>10</td></tr>
<tr><td>Grain yield (g)/hill</td><td></td><td>ABP</td><td>CHP</td><td>IIRR-D7</td><td>NWG</td><td>PSA</td><td>PTB</td><td>RPR</td><td>PNT-I</td><td>PNT-II</td><td></td><td></td><td></td><td>9</td></tr>
<tr><td>Larval survival</td><td>ADT</td><td>CHN-1</td><td>CHP</td><td>IIRR</td><td>PSA</td><td>RNR1</td><td>RNR2</td><td>TTB-1</td><td>TTB-2</td><td>PNT-1</td><td>PNT-2</td><td></td><td></td><td>11</td></tr>
</table>

*Infestation augmented; 1 and 2 refer to the staggered sowings in a location

2.1.5 Multiple Resistance Screening Trial (MRST)

This trial was constituted with a view to identify the reaction of entries that were found promising in pest specific trials to other pests and also to evaluate the reaction of advanced breeding lines to insect pests. The trial was constituted with 25 entries consisting of eight lines promoted from SBST trial promising for stem borers, four entries from GMS trial, two from PHS trial, one from PJTAU and one entry from Nawagam; four entries under retesting from MRST 2023 and with four resistant and one susceptible check. The entries were evaluated against 8 insect pests at 28 locations for their reaction to insect pests. The valid data pertaining to reaction of entries from various locations are discussed pest wise:

BPH: Entries were evaluated in five greenhouse tests at seedling stage and two field reactions against BPH. Field screening was augmented by releasing insects periodically to ensure population build- up at RNR. BPT 3194, RP 6505-40, NND-2*, RP5564 PTB 1-4-1-2, RP5564 PTB 2-4-2-1-2, RP 6505-82, NND6, KNM 14382 and WGL 1792 were promising in 2-4 tests of the 8 valid tests. The resistant checks, PTB33 and RP2068-18-3-5 recorded a DS of ≤5.0 in 4 of the 8 valid tests.

WBPH: Entries were evaluated in greenhouses at IIRR, Coimbatore and Ludhiana. RP 6505-40 was moderately resistant with a DS of ≤5.0 in 2 of the 3 valid tests at IIRR and Coimbatore. PTB33 and RP2068-18-3-5 were also promising in 2 tests. KNM 14382 and BPT 3194 were promising in one test at Ludhiana and WGL 1790 was promising at Coimbatore.

Mixed population of Planthoppers: Field evaluation of entries was carried out at Maruteru and Gangavathi. NND-2*, CGR-15-49, RP5564 PTB 2-4-2-1-1, IBT-WGL-2, NWGR-19064, BPT 3194 and WGL 1792 were promising at Gangavathi with a DS of 3.0 and population below 100 hoppers/10 hills. However, all these seven entries were susceptible at Maruteru.

Gall midge: Entries were evaluated in 6 field tests which identified IBT-WGL-2, APKS 82-75 as promising in 3 tests (<10 % DP and 1% SS at MTU). WGL 1790, WGL1792 and the resistant checks Suraksha and W1263 were promising in 2 tests at Ambikapur and Jagdalpur. RP 6505-82* and WGL 1792 were promising with nil damage in one test at Jagdalpur.

Stem borer: Entries were evaluated against stem borer at vegetative phase for dead heart damage in 9 valid tests with <5% DH damage. IBT-WGL-2, RP 6505-40, RP 6505-82, RPGP-3000-179-3-9-1 and APKS 82-75 were promising in 2 of the 9 valid tests for dead hearts damage at a promising level of 5 % DH. The mean damage in these entries across locations was < 20% DH. At reproductive phase, of the 9 valid tests with ≤5 % WE damage, RP5564 PTB 1-4-1-2 was promising in 3 tests. RP5564 PTB 1-4-2, IBT-WGL-2, BPT 3194, RP 2068-18-03-5 were promising in 2 tests. NND-2* was promising in one test. RP5564 PTB 1-4-1-2, IBT-WGL-2 and APKS 82-75 were promising at both phase for stem borer damage in 3 to 4 tests. **(Table 2.1.5).**

Foliage feeders:

Leaf folder: Field evaluation of entries against leaf folder was carried out at 9 locations. NND-2, CGR-9, CGR-15-49, IBT-WGL-2 were identified as promising in 3 of the 9 valid tests at a promising level of ≤5% DL. IBTWGL 21, RP5564 PTB 1-4-1-2, RP5564 PTB 1-4-2, RP 6505-40, PTB 33 and W1263, were promising in 2 tests.

Case worm: Average damage recorded at 45 DAT in Brahmavar was 10.6% DL and none of the entries were promising at Brahmavar.

Whorl maggot: Damage was recorded at Jagdalpur and Pattambi. NND 2 had less than 5 % DL at Jagdalpur.

Overall reaction: *Evaluation of 25 entries in 50 valid tests (9 greenhouse and 41 field tests) against 7 insect pests helped in identification of 5 test entries viz, RP6605-40, NND2, CGR15-49, IBTWGL2 and BPT3194 as most promising in 7-11 tests against 3-5 insect pests with a PPR of 7.7 -12.9 (**Table 2.1.5**). Of these NND2 was in the second year of testing. The check lines RP 2068-18-3-5 was promising in 10 tests against four insect pests with a PPR 11.4. PTB 33 was promising in 12 tests 5 pests with a PPR of and 17.1.*

Table 2.1.5 Reaction of most promising cultures against insect pests in MRST, kharif 2024

S.No.	Designation	Cross	No. of Promising tests (NPT)										Number of			
			BPH	WBPH	PH	GM	SBDH	SBWE	SBDH+ WE	LF	CW	WM	Tests	Pests	MRI	PPR
			8	3	3	6	9	9	18	9	1	2	50	7	350	
12	RP 6505-40	INRC18108X TN1	3	2	0	1	2	0	2	1	0	0	9	5	45	12.9
1	NND-2*	Land race	2	0	2	0	0	1	1	3	0	1	9	4	36	10.3
3	CGR-15-49	Samba Mahsuri*2/Oryza rufipogon -38-5	1	0	2	1	0	1	1	2	0	0	7	4	28	8.0
11	IBT-WGL-2	MTU1010/RMS GM3// MTU1010/ RP5923	0	0	2	3	2	2	4	2	0	0	11	4	44	12.6
21	BPT 3194	BPT 5204/MTU 1075	4	1	2	0	0	2	2	0	0	0	9	3	27	7.7
Checks																
10	PTB 33		4	2	3	1	1	0	1	1	0	0	12	5	60	17.1
25	RP 2068-18-03-05		4	2	1	1	0	2	2	0	0	0	10	4	40	11.4

*Entry under retesting; MRI- Multiple resistance Index (PX T); Percent promising reaction (PPR)= (MRI of individual entry*100)/Total MRI

Valid reaction to insect pests considered for analysis in MRST, kharif 2024

Insect pests	Reaction	Locations / Tests									Total tests
BPH	GH	IIRR	CBT	MND	PNT	LDN	RNR				6
BPH	FR	RNR*	MSD								2
WBPH	GH	IIRR*	CBT	LDN							3
BPH+ WBPH	FR	MTU	GNV	PNT							3
GM	FR	GNV	PTB	WGL	JDP	ABP	MTU				6
SBDH	FR	IIRR	CHN	GNV	RPR	MSD	NLR	NVS	PNT	PSA	9
SBWE	FR	IIRR*	PTB	CHP	RPR	SKL	LDN	NVS	PNT	PSA	9
LF	FR	IIRR	RPR	MLN	MSD	NLR	NVS	PNT	PSA	PTB	9
WM	FR	PTB	JDP								2
CW	FR	BRH									1
										Total Tests	50

*Augmented Insect infestation

Data on BPH from PNT(FR), ADT,JDP,RPR, WGL; WBPH from PNT, WGL; GLH from ADT, &JDP; GM from, IIRR, CHP,NLR, RGL, SKL; SBDH from ABP, ADT, CHP, JDP,RGL ,RNR ,MTU, NWG, PTB, REW, SKL, WGL; SBWE from GNV, MSD, RNR, NWG, CHN, TTB: LF from GNV, JDP, NVS,NWG CHN , WGL, RGL,RNR, TTB ; data on RH damage from RNR ; WM from NLR & RNR; GLH from ADT& JDP, GB from MSD were not included due to low pest pressure.

2.1.6 National Screening Nurseries (NSN)

National Screening Nurseries (NSN) comprised of IIRR- NSN for irrigated ecology and CRRI -NSN for rainfed ecology.

2.1.6.a IIRR-National Screening Nurseries

IIRR-National Screening Nurseries (NSN) comprised of 4 trials-National Screening Nursery-1(NSN1), National Screening Nursery-2(NSN2), National Screening Nursery–Hills (NSN hills) and National Hybrid Screening Nursery (NHSN). **IIRR-NSN1** was constituted with 492 entries (446 AVT entries along with 10 insect checks and 12 disease checks replicated thrice) was evaluated at 20 locations. **IIRR-NSN 2** trial comprised of 683 entries (629 entries from IVT trials, 12 disease checks replicated thrice and 10 insect checks) was evaluated at 18 locations against 6 insect pests. **IIRR NSN-Hills** trial was constituted with 76 entries for hill location along with 4 local checks and 10 insect checks and evaluated at 8 locations against eight insect pests in 6 greenhouse and 9 field reactions. **IIRR-NHSN** trial constituted 147 entries (100 hybrids+11 insect checks+25 disease checks+11varietal checks) was evaluated at 15 locations against 7 insect pests. The valid reactions from the evaluations in each trial are discussed pest wise:

Brown planthopper:

IIRR-NSN1: IET Nos. 32062 exhibited resistant reaction (DS of ≤3.0) in SSST in 4 of the 5 valid tests. IET Nos.31437 (H), 30686, 31479 (H), 31496 (H), 31986, recorded a Damage Score (DS) of ≤3.0 in 2 of the 5 tests in greenhouse evaluations. PTB33 and RP 2068-18-3-5 were resistant at seedling stage in one of the 5 tests with a DS of ≤3.0.

IIRR-NSN2: Greenhouse evaluations were carried out at 5 locations. IET Nos. 32378, 32381, 32386, 32582, Shatabdi, MTU 1121recorded a DS of ≤3.0 in 2 of the 5 valid tests and at par with PTB 33. Field incidence was recorded at 132 DAS at Ghaghraghat and the average BPH population in the trial was as high as 1578 hoppers /10 hills.

IIRR-NSN hills: Evaluation of entries in SSST against BPH at IIRR, CBT, PNT and LDN identified IET No 32317 as MR (DS≤5.0) at all the 4 locations.

IIRR-NHSN: IET Nos 33048, 33057, 33058 and 33075 were resistant in two to three of the five valid tests at seedling stage with a DS ≤ 3.0. PTB 33 was resistant in 2 tests of the 5 valid tests against BPH in greenhouse reaction.

White-backed planthopper:

IIRR-NSN1: Entries were evaluated in greenhouse conditions against WBPH at both IIRR and Coimbatore. At IIRR, IET Nos 30505, 31509, 31510, 31550, 31553, 30681, 30674, 30640, 31063, 31877 and 30577* were found resistant with a DS≤ 3.0. None of the test entries were observed to be promising for WBPH at Coimbatore.

IIRR-NSN2: Entries were evaluated at seedling stage in pro-trays in greenhouse conditions at CBT. All the entries were susceptible to WBPH except MO1. IET Nos 32445, 32819, 32930, 32954 recorded DS ≤ 5.0 at Coimbatore where MO1 recorded a DS of 3.0 to 8.0.

*IIRR-NSN hills***:** Entries were evaluated under greenhouse conditions at IIRR and CBT at seedling stage. MO1 recorded resistant reaction (DS ≤ 3.0) at IIRR and DS 5.0 at Coimbatore. However, none of them were promising at both the locations.

IIRR-NHSN: Entries were evaluated in greenhouse conditions against WBPH at both IIRR and Coimbatore. IET Nos 33071, 33077, Abhaya and MO1 were promising at both the locations with a DS of ≤5.0. The reaction of MO1 at IIRR was DS 1.8 and DS 3.0 at Coimbatore.

Mixed population of Planthoppers:

IIRR-NSN1: IET Nos.31641, 31619, 31714 (H), 32848,32849, 31004(R), 32005, 31120, 29549, 31979, PTB 33, RP2068-18-3-5 and MO1were identified as resistant to mixed populations of planthoppers in the field at Maruteru and Gangavathi in 3 valid tests in zone 7. All these entries recorded DS ≤ 3.0 at Gangavathi and Maruteru. These entries also supported less than 100 planthoppers per 10 hills at Gangavathi at 105 DAT when the average infestation was 273.6 planthoppers/10hills and 525.4 planthoppers/10 hills on TN1. The ratio of BPH to WBPH was 9: 1 at Maruteru. At Gangavathi, initially WBPH incidence was observed but at later stages of crop growth it was dominated by BPH.

IIRR-NSN2: All the entries were evaluated in field against a mixed population of BPH and WBPH at Gangavathi and Maruteru (zone7) and Kaul (zone2). In the initial phase of crop growth WBPH was present but later stages it was taken over by BPH at Gangavathi. The ratio of BPH to WBPH was 10:1 at Maruteru and 5:1 at Kaul at 82DAT. The infestation was recorded as No./10 hills at Gangavathi and Kaul; as damage score at Gangavathi and Maruteru. The average planthopper population was 397 hoppers/10 hills at Gangavathi and 163 hoppers/10 hills at Kaul. Evaluation of the entries identified IET Nos 32442, 32585, 32599, 32600, 32603, 32607, 32681, 32890, Kalachampa, CR Dhan 315, IR 64, Bahadur Sub-1, Lalat and PKV HMT as promising only at Gangavathi location with a DS ≤ 1.0 and low populations (50 no's/ 10 hills) and on par with PTB33.

IIRR-NSN hills: Field evaluation of the entries against mixed population of planthoppers at Maruteru identified IET Nos 32339, 32345, 32347, 32349, VL Dhan 68, MO1 and PTB 33 as promising with a DS of 5.0. The population was in the ratio of 10BPH: 1WBPH.

IIRR-NHSN: None of the test entries were promising in field reaction at Maruteru against planthoppers except PTB33 (DS 1.0) and RP2068-18-3-5 (DS1.0)

Gall midge:

*IIRR-NSN1***:** Valid data pertaining to reaction of entries to rice gall midge was recorded from two locations in zone 5 (Ambikapur and Jagdalpur), one from zone 1 (Chiplima) and two from zone 7 (Warangal and Gangavathi). At Chiplima, 58 entries recorded nil damage. Sugandha samba, PTB 33 and MO1 recorded nil damage at both Ambikapur and Jagdalpur. Entry no 5109 (RNR 35109) and IET 32836 recorded nil damage at, chiplima, Ambikapur and Jagdalpur. In zone 7, at Gangavathi, IET Nos 32832,32836,31989, 31096, 31986 recorded nil damage at 50 DAT. WGL 1720 MTU 1153 (Southern—Zonal Check), NDR 359, CR3745-3-2-1-2-1-1, and IET 31901(KAUPTB-TRV-EBC-14) recorded 5% DP at this location. However, all these entries were susceptible at Warangal. Aganni, Kavya, RP2068-18-3-5 and Suraksha were promising in 2 of the 5 valid tests.

IIRR-NSN2: Valid reactions for gall midge damage were recorded from Chiplima (zone3), Jagdalpur (zone 5) and Gangavathi (zone7). In field reaction at Gangavathi, seven entries *viz.,* IET Nos 32430, 31635 (R), 32606, 32666, 32770, 32864 and Shatabdi recorded nil damage. IET Nos 32635, 32697 and 32723 recorded nil damage at Jagdalpur. IET 32864 recorded nil damage at Chiplima and Gangavathi. IET No 32705, MTU 1121, Aganni and W1263 recorded nil damage at both Chiplima and Jagdalpur.

IIRR- NHSN: None of the test entries were promising in a field test at Pattambi.

Stem borer (SB):

IIRR NSN1: Valid data for stem borer dead heart damage was recorded from 4 tests in 3 zones *viz.,* in zone 2 (Pantnagar), zone 3 (Pusa) and zone 6 (Navsari). 73 entries recorded nil damage at Navsari and none of entries were promising across locations for dead heart damage. IET nos 30690 and 30668 were promising in 3 tests of the 6 valid tests with ≤ 5% WE damage. IET Nos 31871, 31633, 31637, 31680, 31689 and 32835 and Swarnadhan were promising at both phases in zone 5 (Raipur, Ambikapur, Navsari) and zone 6 (Navsari and Nawagam) for white ear damage and at Navsari for dead heart damage in 3 to 4 tests.

IIRR NSN2: Valid data for stem borer dead heart damage was reported from Chiplima, Pusa, Chinsurah, Ghaghraghat in zone3; Pantnagar and Kaul (zone2): Jagdalpur (zone5); Navsari (zone6) and Aduthurai (zone7). IET No 32569 and 32662 were promising in 5 of the 9 valid tests. IET nos 32510, 32544,32558, 32622, 32676, 32691, 32373, Tetep, Pushyami-Zonal check were promising in 4 tests with ≤ 5% DH damage. None of the entries were promising at Pantnagar where the average damage in the trial was 23.8% DH. IET Nos 32393 and the check DRR H4 were promising at Pantnagar with ≤ 10% WE damage

*IIRR NSN hills***:** Entries were evaluated under field conditions at Pantnagar and Ludhiana against stem borer. IET nos 32364 and 32347 recorded ≤10 % DH at Pantnagar. IET 32349 had low WE damage (<11%WE) at both Ludhiana and Pantnagar. However, it should be further confirmed through artificial inoculation.

IIRR NHSN: IET Nos 33059 recorded nil damage at Raipur and Pattambi of the 5 valid tests. Ajaya and PTB 33 also were promising in 2 tests each in the field evaluations at Chinsurah and Pattambi. In the field evaluation against SB white ear damage, IET nos 32995, 33015,33053 and PTB 33 were promising in 2 of the 6 valid tests with <5% WE damage. But these lines need to be further tested under greenhouse conditions for validation of the reactions and to check that they are not escapes as it is more common in very short and long duration varieties.

Leaf folder:

*IIRR-NSN1***:** Valid data for leaf folder damage was recorded from 6 locations in zone3 (Pusa), 6 (Navsari and Nawagam) and 7 (Rajendranagar, Brahmavar and Gangavathi). IET nos 30555*(H) and 31515, 31519, 32826, 32830, 32831, 32844 recorded < 10 % DL in 3 of the 6 valid tests exhibiting tolerance to leaf folder.

IIRR NSN2: Leaf folder damage was reported from Kaul and Malan (zone2); Pusa and Ghaghraghat (zone3); and Gangavathi (zone7). Valid data from 5 tests identified IET Nos 32373, 32374, 32375, 32376, 32378, 32397, 32804, 32586, 32588, 32593 as promising in 2 tests with a promising level of <5%DL. Nil damage in PTB 33 at 2 locations could be due to asynchrony in the crop stage with pest occurrence.

IIRR NSN Hills: Field evaluation against leaf folder damage was reported from Malan with an average damage of 12.0%DL at 86 DAT and from Chatha with an average damage of 35 %DL at 91 DT. None of the entries had <10% DL.

IIRR NHSN: Field evaluation of entries in 5 valid tests identified 8 entries., IET nos. 32995, 32996, IR-64 as promising in 4 tests. IET nos. 33060, 33039, HR12, 27P37 and AZ8433DT with ≤10% DL in 3 tests.

Other pests

IIRR-NSN Hills: Gundhi bug damage was recorded at Chatha (57% DG) in the trial at 91 DT and none of the entries were found promising.

Grasshopper

*IIRR NSN Hills***:** Grasshoppers (*Oxya nitidula, Hieroglyphus* spp. *Attractomorpha pscittacina* & Long-horned grasshopper) caused an average of 22.2% leaf damage at Khudwani. Incidence of rice skipper (*Paranara guttata*) at Khudwani was observed. At Chatha, damage by grasshoppers was 14.5%DL at 45 DT.

Case worm

IIRR-NSN 1: At Brahmavar, case worm damage varied from 0.9-26.8% DL at 45 DAT. The average damage in the trial was 9.7% DL. 43 entries recorded <5% DL.

Whorl maggot:

IIRR- NSN1: At Jagdalpur, whorl maggot damage was recorded at 90 DAT. The damage varied from 0-19.6% DL with an average damage of 3.7% DL. Six entries viz., IET nos. 30565* (H), 31434 (H), 31436 (H), 31501, 31515, 31519 recorded nil damage.
IIRR- NSN2: IET no 32393 recoded nil damage by whorl maggot at Jagdalpur at 60 DAT
IIRR-NHSN: DRR dhan 51 recorded 4.6% DL at Pattambi at 30DAT when the average damage in the trial was 12.9 %.

Overall reaction

IIRR-NSN1: Evaluation of 492 entries at 20 locations in 33 valid tests (7 greenhouse and 26 field tests) against 8 insect pests identified 17 entries viz., IET nos. 31515, 31680 and 32831 were promising in 8 tests against field tolerance to Planthoppers, stem borer white ear, leaf folder. IET 32062 was resistant to BPH and gall midge at seedling stage and exhibited low damage to leaf folder and case worm. IET nos 30656*, 31437 (H), 30505, 31509, 31619, 31689, 31714 (H), 31001*, 32835, 32844, 32849, 31120, 31979 had field tolerance to Planthoppers, stemborer white ear and leaf folder. PTB 33 was promising in 10 tests and MO1 in 6 tests **(Table 2.1.6.1)**.

IIRR-NSN2: Evaluation of 636 entries along with 47 checks in 36 valid tests (6 greenhouse and 30 field tests) against 6 insect pests identified, 32397,32478, IR 64 and Lalat in 6 tests against 2-3 pests. PTB 33 was promising in 10 tests followed by W1263 in 7 tests and Aganni in 6 tests **(Table 2.1.6.2)**.

IIRR- NSN hills*:* Evaluation of 90 entries (76 hill entries+14 checks) in 15 valid tests (6 greenhouse and 9 field reactions) against six insect pests identified two entries *viz.,* IET No 32317 and IET No 32347 as promising in 3-4 tests. IET No 32317 was promising against brown planthopper at seedling stage in four tests; IET No 32347 was promising in 3 tests (against BPH, SBDH and field tolerance to planthoppers). PTB 33 was promising in 5 tests and RP2068-18-3-5 in 3 tests **(Table 2.1.6.3)**

IIRR-NHSN: In this trial,100 hybrids along with 47 checks were evaluated in 8 greenhouse and 20 field tests against 5 insect pests at 12 locations in 28 valid tests of the 15 locations where the trial was conducted. The results identified 10 entries IET Nos. 32995, 32996, 33048, 33057, 33058, 33059, 33060, AZ8433DT, 33071, 33075 as promising in 5-8 tests of the 28 valid tests. PTB 33 was promising in 10 valid tests; and RP 2068-18-3-5 were promising in 5 tests and W1263 in 3 tests. **(Table 2.1.6.4)**.

It is pertinent to note that, since the breeding lines in these nurseries were not specifically bred for insect resistance, the number of promising tests is very low in all the identified promising entries in the nurseries. So, these entries need to be further tested, verified and validated for one or two seasons under suitable pest pressure situations for utilization in pest resistance breeding programs. The nil damage recorded for white ear damage should be noted with caution as we need to confirm that there is sufficient pest pressure at booting phase of the crop, and it is not an escape.

Table 2.1.6.1: Performance of most promising cultures against insect pests in NSN1, kharif 2024

Entry No.	IET No.	Z- II	Z- II	Z- VII	Z- VII	Z- VII	BPH	Z- III	BPH	Z- VII	Z- VII	WBPH	Z- VII	Z- VII	Z- III	PH	Z- III	Z- V	Z- V	Z- VII	Z- VII		Z- II	Z- VI	Z- III	SBDH	Z- II	Z- III	Z- III	Z- V	Z- V	Z- VI	SBWE	Z-VI	Z-VI	Z-III	Z- VII	Z- VII	Z- VII	LF	Z- VII	CW	Z- V	WM	Over all
		LDN	PNT	CBT	IIRR	MND	NPT	MSD	NPT	IIRR	CBT	NPT	MTU	GNV	GNV	NPT	CHP	ABP	JDP	WGL	GNV	GM	PNT	NVS	PSA	NPT	PNT	MSD	PSA	ABP	RPR	NWG	NPT	NVS	NWG	PSA	RNR	BRH	GNV	NPT	BRH	NPT	JDP	NPT	
		BPH	BPH	BPH	BPH	BPH	GH	BPH	FR	WBPH	WBPH		PH	PH	PH		GM	GM	GM	GM	GM	NPT	SBDH	SBDH	SBDH		SBWE	SBWE	SBWE	SBWE	SBWE	SBWE		LF	LF	LF	LF	LF	LF		CW		WM		NPT
		GH	GH	GH	GH	GH	5	65DT	1	GH	GH	2	95DT	75DT	105DT	3	30DT	66DT	90DT	33-48DT	50DT	5	50DT	50DT	30DT	3	128DT	85DT	90DT	Pr.h	92DT	Pr. H	**6**	45DT	68DT	50DT	88DT	45DT	50DT	**6**	45DT	1	90DT	1	33
		DS	DS	DS	DS	DS		No./10h		DS	DS		DS	No./10h	DS		%DP	%DP	%DP	%DP	%DP		%DH	%DH	%DH		%WE	%WE	%WE	%WE	%WE	%WE		%DL	%DL	%DL	%DL	%DL	%DL		%DL		%DL		
28	31515	8.0	6.0	5.8	9.0	9.0	0	1890	0	5.9	6.0	0	5.0	89	3.0	2	10.0	60.0	100.0	85.0	30.0	0	20.2	6.3	12.4	0	0.0	12.1	17.4	35.6	26.8	3.7	2	0.0	10.8	13.0	31.1	4.0	0.8	3	9.5	0	0.0	1	8
209	31680	8.2	6.8	5.0	5.4	7.0	0	2440	0	NT	6.0	0	5.0	95	3.0	2	40.0	80.0	100.0	95.0	90.0	0	23.9	0.0	19.7	1	30.2	10.3	14.8	4.6	0.0	4.1	3	8.3	8.8	14.3	9.2	9.5	10.1	2	7.7	0	3.7	0	8
270	32831	8.2	9.0	6.0	9.0	7.0	0	2200	0	NT	7.0	0	9.0	97	3.0	2	0.0	40.0	70.0	60.0	80.0	1	31.9	13.3	9.9	0	0.0	10.3	17.4	34.4	22.2	2.0	2	6.6	8.7	11.8	9.5	12.4	0.9	3	10.3	0	0.9	0	8
419	32062	3.0	7.0	2.0	1.0	3.0	4	2560	0	NT	5.2	0	9.0	235	5.0	0	0.0	100.0	0.0	55.0	75.0	2	27.8	20.0	15.5	0	16.1	7.6	19.1	17.2	20.4	12.5	0	9.2	7.7	15.1	25.1	9.3	8.3	1	4.0	1	1.7	0	8
8	30656*	8.4	7.0	5.0	RT	9.0	0	1910	0	NT	5.8	0	9.0	85	3.0	2	30.0	NT	90.0	95.0	25.0	0	20.4	6.3	13.0	0	8.0	10.1	17.2	NT	10.7	2.0	1	0.0	10.4	10.2	12.8	10.0	3.3	2	3.6	1	0.9	0	6
19	31437 (H)	3.0	8.8	8.4	RT	3.0	2	1780	0	NT	9.0	0	9.0	59	3.0	2	30.0	NT	90.0	90.0	40.0	0	22.4	17.6	17.9	0	44.2	11.3	14.9	NT	13.0	2.0	1	0.0	12.4	13.0	27.7	7.3	12.8	1	8.5	0	1.0	0	6
24	30505	3.7	7.5	4.0	6.5	5.0	0	1600	0	2.4	5.2	1	9.0	89	3.0	2	30.0	NT	100.0	75.0	30.0	0	26.4	6.7	14.8	0	33.3	6.2	14.1	NT	22.0	1.8	1	19.0	6.1	14.0	32.9	8.5	3.7	2	8.7	0	1.2	0	6
25	31509	8.0	7.2	5.0	8.7	7.0	0	1660	0	2.7	5.6	1	5.0	98	3.0	2	40.0	NT	100.0	95.0	35.0	0	26.3	18.8	12.5	0	20.6	8.9	11.3	NT	1.8	1.9	2	16.0	26.3	4.0	29.2	5.5	21.5	1	9.6	0	5.0	0	6
199	31619	8.0	5.0	5.0	5.9	9.0	0	2310	0	NT	7.0	0	3.0	20	1.0	3	50.0	90.0	90.0	85.0	95.0	0	25.8	11.8	17.4	0	15.4	6.8	13.9	41.7	10.0	3.7	1	8.3	10.4	4.5	9.4	13.7	9.7	2	14.5	0	3.3	0	6
212	31689	5.0	9.0	9.0	7.8	7.0	0	2100	0	NT	9.0	0	7.0	10	1.0	2	40.0	90.0	100.0	100.0	100.0	0	29.8	0.0	21.6	1	32.8	10.3	14.5	8.5	0.0	1.9	2	9.1	18.1	14.6	23.1	8.6	2.5	1	8.6	0	2.8	0	6
216	31714 (H)	3.0	4.5	5.8	5.5	5.0	1	1880	0	NT	6.0	0	3.0	72	3.0	3	0.0	10.0	90.0	95.0	80.0	1	24.9	6.7	18.5	0	17.8	11.6	11.8	5.7	5.9	8.5	0	8.9	17.9	11.4	24.4	10.3	3.6	1	8.7	0	4.2	0	6
241	31001*	8.0	7.0	9.0	8.9	5.0	0	1880	0	NT	9.0	0	9.0	85	3.0	2	0.0	50.0	10.0	80.0	80.0	1	28.3	0.0	17.9	1	20.6	7.7	14.5	23.9	3.8	7.3	1	0.0	32.1	16.2	26.4	10.6	8.8	1	11.1	0	2.7	0	6
276	32835	8.4	5.0	6.0	9.0	7.0	0	2130	0	NT	6.2	0	9.0	84	3.0	2	30.0	50.0	80.0	70.0	90.0	0	37.2	6.7	12.1	0	18.6	4.6	15.6	8.6	0.0	3.4	3	9.5	34.8	8.6	15.5	15.1	10.5	1	8.6	0	1.7	0	6
289	32844	NG	6.4	9.0	9.0	9.0	0	1880	0	NT	9.0	0	9.0	84	3.0	2	0.0	10.0	40.0	65.0	45.0	1	28.9	20.0	15.7	0	9.8	13.6	12.1	34.9	5.1	5.9	0	0.0	15.2	16.4	8.8	12.9	4.7	3	8.3	0	0.9	0	6
294	32849	8.6	5.0	7.0	9.0	9.0	0	2200	0	NT	7.0	0	1.0	73	3.0	3	0.0	80.0	100.0	90.0	100.0	1	39.3	13.3	15.2	0	21.0	9.8	8.8	26.0	0.0	8.9	1	18.9	11.2	7.2	18.6	17.4	8.5	1	5.4	0	1.1	0	6
323	31120	8.0	7.5	5.0	5.6	7.0	0	2180	0	NT	6.0	0	3.0	68	3.0	3	20.0	70.0	100.0	100.0	65.0	0	20.7	18.8	15.5	0	3.6	14.0	15.1	31.6	4.0	5.1	2	0.0	17.1	13.2	28.7	9.3	16.6	1	12.2	0	1.2	0	6
370	31979	3.0	9.0	8.2	NG	7.0	1	1880	0	NT	9.0	0	3.0	76	3.0	3	30.0	40.0	80.0	95.0	65.0	0	27.2	0.0	14.1	1	0.0	10.3	13.2	22.4	8.8	5.4	1	19.7	21.7	17.5	38.2	13.7	8.1	0	12.1	0	0.9	0	6
Checks																																													
486	PTB 33	NG	7.0	5.2	7.4	3.0	1	2840	0	NT	5.8	0	1.0	86	3.0	3	0.0	0.0	0.0	55.0	65.0	3	24.8	0.0	12.9	1	57.5	10.0	20.0	29.0	0.0	20.4	1	15.7	18.5	12.8	19.7	17.4	13.1	0	4.3	1	3.6	0	10
471	HR-12	NG	7.2	5.1	NG	7.0	0	1910	0	NT	5.5	0	9.0	84	3.0	2	10.0	80.0	0.0	100.0	90.0	1	40.8	0.0	14.6	1	48.9	8.6	12.1	15.2	28.8	1.7	1	9.7	8.8	12.5	84.6	17.0	8.4	1	10.3	0	4.0	0	6
485	MO1	NG	3.0	6.0	9.0	5.0	1	1880	0	NT	7.0	0	3.0	74	3.0	3	10.0	0.0	0.0	75.0	75.0	2	23.5	13.3	20.5	0	11.1	7.7	16.1	84.9	27.3	8.3	0	9.6	14.6	13.6	11.5	13.7	26.1	0	5.3	0	2.1	0	6
Total Tested		366	484	465	384	454	0	492		61	465		457	480	480		485	424	479	469	480		477	454	495		477	492	495	423	487	484		454	484	495	483	493	480	0	493		479		
Max. damage in the trial		9.0	9.0	9.0	9.0	9.0	0	2960		9.0	9.0		9.0	703.0	9.0		90.0	100.0	100.0	100.0	100.0		64.9	64.3	24.7		100.0	23.1	23.4	91.3	54.0	37.7		44.6	44.7	18.9	84.6	23.3	40.8	0	26.8		19.6		
Min. damage in the trial		3.0	3.0	2.0	1.0	1.0	5	220		1.0	5.0		1.0	10.0	1.0		0.0	0.0	0.0	25.0	0.0		13.0	0.0	3.1		0.0	4.5	3.8	0.0	0.0	1.7		0.0	3.1	4.0	0.8	1.1	0.4	0	0.9		0.0		
Ave. damage in the trial		7.5	7.1	7.3	7.9	6.8	0	2079		5.0	7.5		7.6	273.6	5.0		30.2	60.7	76.4	84.5	74.4		28.2	12.8	15.3		27.3	10.6	14.3	28.0	19.3	11.5		13.9	18.6	12.6	28.8	11.6	10.3	0	9.7		3.7		
Damage in TN1		7.6	5.6	6.8	8.8	6.0	0	1622		NT	6.8		7.2	525.4	7.4		34.0	46.0	72.0	91.0	85.0		24.0	22.7	14.7		39.8	8.6	15.2	29.8	23.5	10.1		23.6	17.7	12.2	27.2	7.8	13.2	0	8.2		4.1		
Promising level		3	3	3	3	3	5	500		3	3		3	100	3.0		0	0	0	0	0		10	0	5		5	5	5	5	5	5		0	10	10	10	5	5	0	5		0		
No. promising		25	2	3	3	25	3	0		11	0		32	113	139		58	14	32	0	5		0	73	2		30	3	3	11	78	78		30	74	32	22	26	91	0	43		6		

Data from WGL, PNT (FR) WGL for PH; MNC for GM; ABP, CHP, JDP GNV, MSD, MNC, LDN, NVS, NWG, RNR, TTB, WGL, RPR for SBDH; TTB, WGL, RPR, CHP, GNV, MNC, NVS, RNR for SBWE; WGL, NVS, RNR, RPR, MSD, JDP, BRH, TTB for LF; RNR for WM; BRH for CW, JDP for GLH not considered for analysis due to low pest pressure.

Valid NSN1 data considered for analysis, ***kharif*** 2024

Insect pests	Locations							NPT
BPH	GH	LDN	PNT	CBT	IIRR	MND		5
BPH	FR	MSD						1
WBPH	GH	IIRR	CBT					2
PH (BPH+WBPH)	FR/ counts	MTU	GNV	GNV				3
GM	FR	CHP	ABP	JDP	WGL	GNV		5
SBDH	PNT	NVS	PSA					3
SBWE	PNT	MSD	PSA	ABP	RPR	NWG		6
LF	NVS	NWG	PSA	RNR	BRH	GNV		6
CW	BRH							1
WM	JDP							1

Table2.1.6.2 Performance of most promising cultures against planthoppers and Gall midge in NSN2, kharif 2024.

Entry No	IET No.	Z-VII	Z-VII	Z-VII	Z-II	Z-II	Z-III		Z-VII		Z-VII	Z-VII	Z-VII	Z-II		Z-III	Z-V	Z-VII	
		IIRR	CBT	MND	LDN	PNT	GGT	BPH	CBT	WBPH	GNV	GNV	MTU	KUL	PH	CHP	JDP	GNV	GM
		GH	GH	GH	GH	GH	132DAS	NPT	GH	NPT	75DT	90DT	FR	82DT	NPT	50DT	60DT	50DT	NPT
		BPH	BPH	BPH	BPH	BPH	BPH	6	WBPH	1	PH	PH	PH	PH	4	GM	GM	GM	3
		DS	DS	DS	DS	DS	No./10h		DS		No./10h	DS	DS	No./10h		%DP	%DP	%DP	
26	32397	6.8	9.0	5.0	7.8	3.0	1765	1	9.0	0	465	7.0	9.0	130	0	0.0	100.0	55.0	1
111	32478	5.7	9.0	5.0	NG	3.0	1874	1	9.0	0	80	3.0	9.0	134	0	30.0	70.0	40.0	0
592	IR 64	9.0	6.0	9.0	NG	9.0	1665	0	7.9	0	32	1.0	7.0	165	2	30.0	90.0	65.0	0
601	Lalat	RT	6.2	3.0	3.7	9.0	1543	1	7.9	0	25	1.0	9.0	150	2	40.0	90.0	55.0	0
Checks																			
677	PTB 33	7.6	9.0	3.0	3.0	9.0	1612	2	8.2	0	25	1.0	1.0	160	3	10.0	0.0	60.0	1
682	W1263	NT	4.0	7.0	3.0	3.0	1734	2	5.6	0	230	5.0	9.0	161	0	0.0	0.0	70.0	2
674	Aganni	NG	7.2	3.0	NG	5.0	1765	1	7.5	0	85	3.0	9.0	164	0	0.0	0.0	80.0	2
Total Tested		420	621	650	346	677	683		621		676	676	650	669		661	672	676	
Max. damage in the trial		9.0	9.0	9.0	9.0	9.0	1876		9.6		865	9.0	9.0	202		90.0	100.0	100.0	
Min. damage in the trial		1.7	2.2	1.0	3.0	1.0	1100		3.0		0.0	1.0	1.0	107		0.0	0.0	0.0	
Ave. damage in the trial		7.7	7.7	6.8	7.2	6.3	1577.5		8.0		282.5	5.1	7.3	149.1		32.1	77.7	77.7	
Damage in TN1		8.9	7.9	7.0	7.6	7.6	1635.2		7.8		397.4	6.2	8.2	163.2		43.3	71.7	58.3	
Promising level		3	3	3	3	3.0	100		5.0		50	1.0	1	50		0	0	0	
No. promising		5	2	21	30	66	0		4		16	15	12	0		82	9	7	

Table2.1.6.2 Performance of most promising cultures against Stem borer and other pests in NSN2, kharif 2024.

Entry No	IET No.	Z-VII	Z-II	Z-III	Z-III	Z-III	Z-III	Z-V	Z-II	VI	SBDH NPT	Z-II	Z-II	Z-II	Z-III	Z-III	Z-III	Z-VI		Z-III	Z-III	Z-II	Z-VII	Z-VII		Z-V		Over all
		ADT	PNT	CHP	CHN	GGT	PSA	JDP	KUL	NVS		PNT	PNT	KUL	CHN	GGT	PSA	KJT	SBWE	GGT	PSA	KUL	GNV	MLN	LF	JDP	WM	
		30DT	47DT	50DT	54DT	71DAS	30DT	60DT	52DT	50DT		78DT	132DT	82DT	102DT	108DAS	80DT	Pr. H	NPT	93DAS	50DT	30DT	50DT	86DT	NPT	60DT	NPT	NPT
		SBDH	SBDH	SBDH	SBDH	SBDH	SBDH	SBDH	SBDH	SBDH	9	SBDH/WE	SBWE	SBWE	SBWE	SBWE	SBWE	SBWE	7	LF	LF	LF	LF	LF	5	WM	1	36
		%DH	%DH	%DH	DH%	%DH	%DH	%DH	%DT	%DH		%DH/WE	%WE	%WE	%WE	%WE	%WE	%WE		%DL	%DL	%DL	%DL	%DL		%DL		
26	32397	0.8	19.7	11.3	8.7	11.1	14.6	6.9	3.0	28.6	1	4.1	12.7	19.1	6.0	66.7	16.4	13.6	1	29.1	2.9	22.5	2.6	14.9	2	2.5	0	6
111	32478	4.9	20.6	4.3	5.6	13.6	13.3	0.0	2.8	0.0	4	7.3	7.9	11.7	5.0	24.2	11.0	13.2	1	36.1	11.5	19.5	11.2	13.8	0	2.8	0	6
592	IR 64	5.6	25.4	5.3	10.3	4.5	12.8	7.4	4.7	0.0	3	**64.5**	22.7	7.2	10.8	14.1	17.1	10.7	0	7.8	13.1	24.1	17.8	12.6	1	2.7	0	6
601	Lalat	2.9	20.8	1.8	3.7	8.3	16.7	0.0	27.0	6.7	2	5.2	12.9	18.0	8.3	28.3	16.2	11.5	1	30.3	13.6	22.2	9.7	15.1	0	4.2	0	6
Checks																												
677	PTB 33	NG	22.2	10.2	7.0	6.9	12.1	0.0	6.8	0.0	2	**39.3**	1.8	8.8	2.2	28.6	14.5	10.0	1	5.2	11.9	18.2	22.0	NG	1	1.6	0	10
682	W1263	1.5	27.1	8.2	2.3	14.3	17.1	1.4	1.6	0.0	3	**47.9**	14.5	2.9	2.6	24.1	13.2	10.4	0	41.3	11.5	18.4	15.8	NG	0	0.3	0	7
674	Aganni	0.0	NG	9.7	3.6	15.8	15.6	2.9	11.8	25.0	2	NG	NG	5.9	14.4	23.0	16.4	20.6	0	7.7	13.3	31.7	20.8	NG	1	0.4	0	6
Total Tested		628	640	662	680	683	685	672	669	657		640	640	583	680	683	685	671		683	686	669	676	670		672		
Max. damage in the trial		50.0	57.7	61.0	70.7	66.7	28.2	53.8	33.2	57.1		91.8	100.0	39.6	53.8	170.0	23.3	23.6		67.6	23.4	71.9	31.7	100.0		9.6		
Min. damage in the trial		0.0	10.7	0.0	0.0	0.0	3.2	0.0	0.0	0.0		1.7	0.0	1.0	0.0	5.2	2.5	4.2		1.0	2.6	11.0	0.5	0.0		0.0		
Ave. damage in the trial		4.2	23.8	10.0	6.8	12.8	15.5	7.5	6.5	15.3		33.6	26.0	9.6	13.6	25.7	14.4	11.9		22.3	12.3	21.8	11.7	16.5		3.6		
Damage in TN1		3.6	24.8	10.5	5.0	11.0	11.8	8.1	8.2	29.4		31.6	23.4	18.4	11.7	21.8	11.9	13.3		18.1	9.5	21.8	10.3	15.7		2.6		
Promising level		0.0	10.0	5.0	0.0	5.0	5.0	5.0	5.0	0.0		10.0	5.0	0.0	0.0	5.0	5.0	5.0		10	5	5	5	5		0		
No. promising		10	0	83	5	1	3	38	10	131		15	12	0	1	0	5	2		6	11	0	62	4		1		

The stem borer damage shaded& bold at 78DAT at Pantnagar is deadheart damage

PH- Mixed population of BPH & WBPH; GNV- Predominantly BPH at later stages of crop growth; Kaul- Ratio of 5 BPH: 1WBPH: MTU-10 BPH: 1 WBPH. Data JDP for GLH, PNT(FR) for BPH; PNT (FR for WBPH; JDP, ADT, MNC, NVS for LF; CHP, KJT, NVS, GNV, MNC, NVS, MLN-SBDH: ADT, GNV;MNC;NVS;CHP for SBWE; - not considered for analysis due to low pest pressure.

Table 2.1.6.3: Reaction of entries against major insect pests in National Screening Nursery-Hills (NSN-H), kharif 2024

Entry No.	IET No.	Z-VII	Z-VII	Z-II	Z-II	BPH NPT	Z-VII	PH NPT	ZVII	Z-VII	WBPH NPT	Z-II	SBDH NPT	Z-II	Z-II	SBWE NPT	Z-I	Z-I	LFDL NPT	Z-I	GB NPT	Z-I	Z-I	Gr H NPT	Over all NPT
		IIRR	CBT	LDN	PNT		MTU		IIRR	CBT		PNT		LDN	PNT		CHT	MLN		CHT		CHT	KHD		
		BPH	BPH	BPH	BPH		PH		WBPH	WBPH		SBDH		SBWE	SBWE		LF	LF		GB		GrH	GrH		
		GH	GH	GH	GH	GH	FR	FR	GH	GH		40DT		82DT	128DT		91DT	86DT		91DT		45DT	60DT		
		DS	DS	DS	DS	4	DS	1	DS	DS	2	%DH	1	%WE	%WE	2	%DL	%DL	2	%DG	1	%DL	%DL	2	15
23	32317	4.8	4.8	3.7	5.0	4	9.0	0	NT	6.0	0	NT	0	6.8	NT	0	29.5	10.4	0	64.0	0	15.8	24.6	0	4
70	32347	9.0	5.0	7.9	7.0	1	5.0	1	5.9	6.2	0	9.9	1	13.3	13.1	0	40.6	11.1	0	62.0	0	18.6	25.2	0	3
checks																									
85	PTB 33	2.6	3.0	3.0	9.0	3	5.0	1	5.9	5.2	0	17.3	0	7.7	4.3	1	32.5	13.8	0	NF	0	11.0	24.4	0	5
87	RP 2068-18-3-5	3.6	2.3	3.0	7.2	3	9.0	0	6.2	5.0	0	23.1	0	10.2	10.3	0	29.7	11.6	0	NF	0	12.9	27.4	0	3
Total Tested		91	92	90	90		90		50	92		86		90	86		90	88		79		90	90		
Max. damage in the trial		3.5	5.2	8.1	8.4		9.0		9.0	4.0		25.9		13.3	36.5		35.5	11.6		52.0		14.7	17.8		
Min. damage in the trial		1.8	2.3	3.0	3.0		5.0		3.6	3.0		9.5		3.9	2.8		20.5	9.3		28.0		9.8	17.8		
Ave. damage in the trial		7.0	7.0	7.5	7.1		8.6		6.5	7.6		18.9		8.7	20.1		35.0	12.0		57.0		14.5	22.2		
Damage in TN1		8.5	8.6	8.4	7.7		9.0		6.7	9.0		20.9		10.2	22.4		36.4	13.3		54.0		14.6	21.8		
Promising level		5	5	5	5		5		3	3		10		3	5		10	5		3		10	10		
No. promising		12	16	11	13		7		0	0		3		0	2		0	0		0		1	0		

Valid data considered for analysis, NSN Hills, kharif 2024

Insect pests	Reaction	Locations				Total tests
BPH	GH	IIRR	CBT	LDN	PNT	4
WBPH	GH	IIRR	CBT			2
PH (BPH+WBPH)	FR	MTU				1
SBDH	FR	PNT				1
SBWE	FR	LDN	PNT			2
LFDL	FR	CHT	MLN			2
GB	FR		CHT			1
Gr H	FR	CHT	KHD			2

Data on SB from Malan, rice skipper counts from Khudwani and GLH incidence from Chatha were not considered for analysis due to low pest pressure.

Table 2.1.6.4: Performance of hybrid cultures against major insect pests in NHSN, kharif 2024

Entry No.	IET No.	Z-II	Z-II	Z-VII	Z-VII	Z-VII	Z-III	BPH NPT	Z-VII	Z-VII	WBPH NPT	Z-VII	PH NPT	Z-VII		Z-III	Z-III	Z-II	Z-V	Z-VII		Z-II	Z-II	Z-III	Z-III	Z-V	Z-VII		Z-III	Z-VI	Z-V	Z-VII	Z-VII		Z-VII		over
		LDN	PNT	IIRR	CBT	MND	GGT		IIRR	CBT		MTU		PTB	GMB	CHN	GGT	PNT	RPR	PTB	SBDH	LDN	PNT	CHN	GGT	RPR	PTB	SBWE	GGT	NWG	RPR	RNR	PTB	LFDL	PTB	WM	all
		BPH	BPH	BPH	BPH	BPH	BPH		WBPH	WBPH		PH		GMB5	NPT	SBDH	SBDH	SBDH	SBDH	SBDH	NPT	SBWE	SBWE	SBWE	SBWE	SBWE	SBWE	NPT	LF	LF	LF	LF	LF	NPT	WM	NPT	NPT
		GH	GH	GH	GH	GH	156DS	6	GH	GH	2	FR	1	50DT	1	65DT	65DAS	45DT	65DT	30DT	5	109DT	111DT	92DT	134DS	105DT	Pre.h	6	107DS	72DT	65DT	69DT	75DT	5	30DT	1	27
		DS	DS	DS	DS	DS	No./10h		DS	DS		DS		%SS		DH%	%DH	%DH	%DH	%DH		%WE	%WE	%WE	%WE	%WE	%WE		%DL	%DL	%DL	%DL	%DL		%DL		
1	32995	8.4	7.1	8.7	9.0	5.0	1546	0	3.9	8.5	1	9.0	0	21.9	0	10.2	11.1	23.0	0.0	2.2	1	3.8	26.3	6.6	13.6	1.9	17.7	2	8.9	9.0	7.9	2.5	9.1	4	18.1	0	8
2	32996	8.4	7.0	6.7	8.0	9.0	1765	0	6.7	9.0	0	9.0	0	25.5	0	21.1	6.1	26.7	3.0	1.3	0	6.3	22.9	14.5	29.6	1.8	22.7	1	6.2	12.1	8.7	2.7	7.1	4	12.1	0	5
65	33048	8.4	3.0	3.3	2.0	5.0	1346	3	2.7	6.8	1	9.0	0	18.7	0	11.1	12.5	15.3	27.1	6.7	0	17.6	30.8	20.8	31.0	33.8	25.8	0	17.9	10.6	8.2	4.7	24.3	1	11.5	0	5
79	33057	3.0	2.5	6.3	2.0	5.0	1874	5	1.3	5.8	1	7.0	0	25.0	0	12.1	8.8	22.7	21.6	5.1	0	15.7	40.0	20.2	28.4	26.8	23.4	0	4.6	9.1	10.7	2.4	15.4	2	14.9	0	8
80	33058	3.0	3.0	7.0	2.0	5.0	1457	5	2.4	7.0	1	7.0	0	24.0	0	2.6	9.1	29.4	10.9	4.6	0	13.8	55.0	5.8	19.8	19.2	27.0	0	14.7	10.4	6.7	2.0	12.9	1	19.0	0	7
81	33059	9.0	6.5	6.1	9.0	7.0	1654	0	3.1	8.2	1	9.0	0	22.2	0	14.9	13.6	24.3	0.0	0.0	2	8.0	19.1	32.6	17.4	30.4	19.1	0	7.0	12.9	4.2	2.1	25.0	2	11.0	0	5
83	33060	3.6	7.0	3.6	9.0	1.0	1786	1	1.6	8.2	1	7.0	0	20.6	0	15.6	9.1	26.6	6.5	7.4	0	10.4	3.7	18.5	45.2	22.6	16.7	1	9.9	8.3	6.1	2.7	13.5	3	15.3	0	6
88	AZ8433DT	8.2	7.0	5.9	5.0	5.0	1876	0	4.9	9.0	1	7.0	0	17.7	0	8.8	10.9	22.0	17.5	0.0	1	13.5	26.8	12.4	20.9	19.7	27.6	0	8.7	8.9	7.6	2.8	17.8	3	14.4	0	5
96	33071	8.2	7.2	7.2	5.8	7.0	1100	0	3.5	5.0	2	7.0	0	24.7	0	9.1	9.9	30.4	20.9	0.0	1	9.8	45.5	17.9	27.3	23.1	28.4	0	15.5	9.7	8.6	3.7	19.8	2	12.2	0	5
100	33075	8.2	4.5	2.6	3.0	3.0	1786	3	4.5	5.4	1	7.0	0	9.4	0	13.4	11.1	17.5	10.6	0.0	1	12.5	19.1	13.9	21.8	20.3	20.2	0	14.3	13.8	11.1	2.9	16.3	0	8.8	0	5
Checks																																					
141	PTB 33	3.0	8.4	4.1	3.0	7.0	1600	3	4.4	5.2	1	1.0	1	22.2	0	0.0	7.0	15.9	18.0	0.0	2	7.5	33.6	0.0	33.3	0.0	27.6	2	35.2	6.1	10.8	10.8	22.4	1	8.0	0	10
143	RP 2068-18-3-5	3.0	4.5	5.2	5.0	7.0	1623	2	4.3	5.2	1	3.0	1	12.2	0	8.0	12.7	26.3	14.1	4.1	0	9.5	76.6	9.2	23.1	6.6	18.3	0	24.4	8.5	27.4	16.3	17.6	1	7.5	0	5
146	W 1263	8.4	3.0	8.4	5.4	7.0	1543	2	4.6	9.0	1	9.0	0	16.4	0	11.3	14.9	14.8	19.0	1.5	0	4.0	42.3	6.7	34.0	16.9	25.4	1	47.8	11.4	11.6	9.0	19.4	0	10.2	0	4
147	BM 71	3.0	7.2	NT	5.2	5.0	1276	2	3.0	9.0	1	5.0	0	18.3	0	12.1	9.3	17.1	25.0	1.4	0	16.0	21.1	2.4	61.1	17.2	17.2	0	37.3	12.1	27.5	7.2	14.1	0	8.9	0	3
	MO1								1.8	3.0	2																										
Total tested		147	146	140	142	145	147		138	142		145		145		146	147	145	147	145		147	145	146	147	147	145		147	145	147	147	145		145		
Max. damage in the trial		9.0	9.0	9.0	9.0	9.0	1876		9.0	9.0		9.0		80.0		28.1	40.9	30.8	60.9	31.1		18.8	91.3	44.1	82.4	72.7	59.4		49.6	22.9	41.0	58.6	27.1		20.5		
Min. damage in the trial		3.0	2.5	2.6	2.0	1.0	1100		0.5	5.0		1.0		4.2		0.0	4.2	7.4	0.0	0.0		3.8	0.0	0.0	5.0	0.0	14.8		4.6	3.1	0.6	0.0	7.0		4.6		
Ave. damage in the trial		8.0	7.1	7.8	7.4	6.6	1569		5.4	7.6		8.4		19.4		10.1	11.7	19.8	15.4	6.2		11.5	32.8	12.0	26.6	27.2	25.4		19.6	10.7	10.3	6.5	16.9		12.4		
damage in TN1		8.1	6.6	8.3	8.8	6.6	1604		7.3	8.7		9.0		14.0		12.2	12.3	17.8	12.1	7.5		12.3	39.8	10.9	43.3	35.7	36.0		23.2	12.1	14.6	12.4	16.1		12.9		
Promising level		3	3	3	3	3	500		5	5		3		0		0	5	10	0	0		5	5	0	5	5	5		10	5	10	0	10.0		5.0		
No.promising		5	6	1	6	6	0		61	5		2		0		6	3	2	5	19		6	2	13	1	5	0		22	1	0	2	4		1.0		

Field reaction of BPH& WBPH from PNT; GM from MNC; SBDH from MNC, LDN, RNR, PTB; SBWE from RNR; LF damage from CHN, RNR, RPR; WM damage from PTB, RNR, CHN, RPR were not considered due to low pest pressure.

Valid insect pest reaction considered for analysis in NHSN, ***kharif*** 2024

Insect pest	Reaction	Locations						Total
BPH	GH	LDN	PNT	IIRR	CBT	MND	GGT	6
WBPH	GH	IIRR	CBT					2
GM	FR	PTB						1
PH(BPH+WBPH)	FR	MTU						1
SBDH	FR	PNT	CHN	GGT	RPR	PTB		5
SBWE	FR	PTB	RPR	CHN	GGT	LDN	PNT	6
LF	FR	NWG	PTB	GGT	RPR	PTB	NWG	5
GB	FR	GGT						1
WM	FR	PTB						1

2.1.6.b CRRI-National Screening Nurseries

AT CRRI Cuttack, National Screening Nurseries (NSN) consisting of two trials *viz*., National Screening Nursery-1 (NSN1) and National Screening Nursery-2 (NSN2) were constituted this year with entries from Early Direct Seeded, Rainfed Shallow Lowland, Semi Deep Water, Deep water. NSN1 trial constituted with 63 entries (51 AVT entries along with 12 insect checks) was evaluated at 20 locations. NSN2 trial comprised of 202 entries (190 IVT entries plus 12 insect checks) and was evaluated at 18 locations. The valid data of the reaction of entries in the above said trials to various insect pests are presented insect pest-wise:

Brown Planthopper:
CRRI-NSN1: The IET lines 32121, and 31220 were found promising (SES≤3) in 2 tests in greenhouse reaction of the 4 valid tests. PTB 33 and CR Dhan 317 exhibited resistant reaction (damage score ≤3 on SES scale) in 4 tests in SSST.

CRRI-NSN2: The following IET lines 33194, 33181, and 33183 were promising in 1 greenhouse reaction out of the 3 tests. PTB 33, RP2068-19-3-5 and CR Dhan 317 and CR Dhan 805 exhibited resistant reactions (damage score ≤3 on SES scale) in all 3 tests in SSST.

White-backed Planthopper:
CRRI-NSN1: IET lines 31258, 32121 were found promising at CBT. against the resistant check PTB 33, and CR Dhan 805 (damage score ≤5 on SES scale).

CRRI-NSN2: IET line 33221 was found promising at CBT against PTB 33 and CR Dhan 317 exhibiting resistant reaction (damage score ≤5 on SES scale).

Mixed population of Planthoppers:
CRRI-NSN2: The following IET lines 33194, 33195, 33252, 33220, 33224, 33172, 33183, 33125, 33127, 33132, 33136, and 33137 were found promising (damage score ≤1 on SES scale) in field evaluation including the resistant check PTB-33 tested at MTU location.

Gall Midge:
CRRI-NSN1: IET32087 recorded nil damage against gall midge at Ambikapur. The resistant check Aganni, W1263, PTB 33 showed a nil damage in one location out of 3 valid tests.

CRRI-NSN2: IET entries 32223 and 33098, Aganni and Suraksha recorded nil damage against gall midge at Jagdalpur.

Stem borer:
CRRI-NSN1: IET32085 was promising against stem borer during vegetative and reproductive phases in 2 out of the 10 tests where damage level ranged from 10 to 30.77%.

CRRI-NSN2: IET33129 had nil dead heart damage at Navsari and Pantnagar during the vegetative phase; however, it requires a glass house study for confirmation.

Leaf folder:

CRRI-NSN1: IET lines 31237, 31204, 32175, 32176, 32147, 32121, 33264, 33262 recorded nil damage against leaf folder at Navsari location. The Check PTB 33 and Aganni showed resistant reactions in 2 out of 3 valid locations, while W1263 showed resistance reaction at Navsari.

CRRI-NSN2: The following IET lines 33194, 33227, 33179, 33188, 33092, IR 64, 33099, 33103, 33138, 33141 were found promising in field evaluation including the resistant check W1263 at Aduthurai. Check W1263 showed resistant reaction in 3 out of 4 valid locations

Case worm:

CRRI-NSN1: In the field evaluation at Brahmavar, CW incidence was recorded and the average damage in the trial was 7.9% DL at 30DAT and 15.38% DL at 45 DAT.

CRRI-NSN2: In the field evaluation at Brahmavar, CW incidence was recorded and the average damage in the trial was 17.27% DL at 30DAT and 24.19% DL at 45 DAT.

Whorl Maggot:

CRRI-NSN2: In the field evaluation at Aduthurai, WM incidence at 50 DAT was recorded and the average damage in the trial was 4.5% DL.

Overall reaction:

CRRI-NSN1: Evaluation of 63 entries in NSN-1 in 5 greenhouse and 17 field tests against 6 insect pests in 22 valid tests helped in identification of one entry Varshadhan, as promising in 5 tests against 3 insect pest damages. IET32085 was found promising in 4 tests against 3 insect pest damages. Resistant checks PTB 33, CR Dhan 317 and RP 2068-18-3-5 were resistant to BPH in 4-9 valid tests. Aganni and W1263 were promising against gall midge and leaf folder, respectively. **(Table 2.1.6.5).**

CRRI- NSN2: Evaluation of 202 entries in NSN-2 in 4 greenhouse and 12 field tests against 7 insect pests in 16 valid tests helped in identification of 4 entries as promising in 2-3 tests against 2-3 insect pest damages. Resistant checks PTB33, CR Dhan 317, RP 2068-18-3-5 and CR Dhan 805 were resistant to BPH (DS<3) in all the 3 valid tests at seedling stage in greenhouse. Aganni and W1263 were promising against gall midge and leaf folder, respectively **(Table 2.1.6.6).**

Note: Since all these breeding lines have not been specifically developed for insect pest resistance, all these identified promising entries need to be further tested and validated for their resistance against individual pests in specific screening program under suitable pest pressure for further use in the resistant breeding program.

Table 2.1.6.5: Performance of most promising culture against insect pests in CRRI-NSN1, ***Kharif*** 2024

Sl. No	IET No.	Number of promising tests (NPT)							
		BPH	WBPH	GM	LF	SBDH	SBWE	CW	Overall NPT
		4	1	3	3	4	6	1	22
1	32121	2	1	0	0	0	0	0	3
2	31258	0	1	0	1	0	1	0	3
3	32085	0	0	0	1	1	1	1	4
4	Varshadhan	2	0	0	0	1	2	0	5
Resistant checks									
PTB-33		4	1	1	2	0	1	0	9
CR Dhan 317		4	1	0	0	1	0	1	7
RP2068-18-3-5		3	0	1	0	0	1	0	5
Aganni		1	0	1	2	0	0	0	4
W-1263		0	0	1	1	0	0	0	2

* JDP, PNT, WGL for BPH & WBPH; CHP, and TTB for GM; JDP, MNC, TTB, WGL for LF; JDP for GLH; ABP, JDP, CHP, NAS, NWG, RNR, TTB, WGL, SKL for SBDH & SBWE not considered for analysis due to low insect pest pressure.

Valid NSN1 data from locations considered for analysis

Insect pest	Locations					
BPH	CBT	MND	LDN	MTU	-	-
WBPH	CBT	-	-	-	-	-
Gall midge	ABP	JDL	SKL	-	-	-
LF	NVS	RPR	RNR	-	-	-
SBDH	NVS	RPR	MNC	CHP	-	-
SBWE	ABR	RPR	MNC	SKL	NWG	PNT
Case worm	BRH	-	-	-	-	-

Table 2.1.6.6: Performance of most promising culture against insect pests in CRRI-NSN2, ***Kharif*** 2024

Sl. No	IET No.	Number of promising tests (NPT)								
		BPH	WBPH	PH	GM	LF	SBDH	SBWE	CW	Overall NPT
		3	1	1	1	4	3	2	1	16
1	33194	1	0	1	0	1	0	0	0	3
2	33181	1	0	0	0	1	1	0	0	3
3	33183	1	0	1	0	1	0	0	0	3
4	33129	0	0	0	0	0	2	0	0	2
Resistant checks										
PTB33		3	1	1	0	0	0	0	0	5
CR Dhan 317		3	1	0	0	0	1	0	0	5
CR Dhan 805		3	0	0	0	0	0	1	0	4
RP2068-18-3-5		3	0	0	0	1	0	0	0	4
W-1263		0	0	0	0	3	0	0	0	3
Aganni		0	0	0	1	1	0	0	0	2

*JDP, KUL, PNT for BPH; PNT for WBPH; CHP for GM; JDP for GLH; ADT, JDP, KJT, CHN, MNC for SBDH; ADT, CHP, MNC for SBWE; MNC, and JDP for LF; ADT, CHN for WM not considered for analysis due to low insect pest pressure

Valid NSN2 data from locations considered for analysis

Insect pest	Locations			
BPH	CBT	MND	LDN	-
WBPH	CBT	-	-	-
Planthopper	MTU	-	-	-
Gall midge	JDP	-	-	-
LF	ADT	BRH	KUL	PSA
SBDH	CHP	NVS	PNT	
SBWE	PUSA	-	PNT	-
CW	BRH	-	-	-

2.2. INSECT BIOTYPE STUDIES

Variation in the response of host plant/gene differentials to different pest populations in endemic areas are monitored for two major insect pests *viz.,* planthoppers and gall midge through insect biotype studies comprising of four trials 1) Planthopper Special Screening trial (PHSS) 2) Planthopper population Monitoring trial (PHPM) 3) Gall midge biotype monitoring trial (GMBT) and 4) Gall midge population monitoring (GMPM) trial.

The results of the observed virulence pattern of planthopper populations during *kharif* 2024 in PHSS trial are discussed below:

2.2.1 Planthopper Special Screening trial (PHSS)

A set of 20 primary sources of BPH resistance with some sources having known resistance gene(s) were evaluated in the greenhouse through Standard Seedbox Screening Test (SSST) at 12 locations *viz.*, IIRR, Aduthurai, Coimbatore, Cuttack, Ludhiana, Mandya, Maruteru, New Delhi, Pantnagar, Raipur, Rajendranagar and Warangal. At IIRR and Coimbatore, the sources were also screened for white-backed planthopper reaction. The special screening tests such as days to wilt to know the tolerance mechanism was studied at Pantnagar and Maruteru; feeding preference test by measuring honeydew excretion(mm^2) at Coimbatore, Maruteru and Pantnagar and nymphal survival (%) was observed at Coimbatore, Maruteru and Pantnagar.

Reaction to BPH: Based on SSST results presented in **Table 2.2.1**, the gene differential RP 2068-18-3-5 (with *Bph*33(t) gene) was promising in 10 tests with DS≤5.0. PTB 33 (with *bph2*+*Bph3*+*Bph32*+unknown factors) was promising in 8 tests; Salkathi (qBPH4.3 and qBPH4.4) in 6 tests and T12 in 4 tests of the 12 valid tests. Swarnalatha (with Bph6 gene) and ARC10550 (*bph*5 gene) were promising in 3 tests. Chinasaba with *bph*8 gene and ASD7 (with *bph*2), were promising in 2 tests. IR-71033-121-15 with Bph20/21 genes, Babawee (with *bph* 4 gene), Pokkali, Rathu Heenati (with *Bph*3+*Bph*17 genes), MUT NS1, IR 36 (with *bph2* gene), IR 64 (with *Bph1, BPh37 + other unknown* genes) and Milyang 63 with unknown genetics performed better at one location each. Two gene differentials *viz.*, OM 4498 with unknown genetics and IR-65482-7-2-216-1-2-B with *Bph18(t)*) gene and TN1 showed susceptible reaction at all test locations.

In the current study at Pantnagar, Coimbatore and Maruteru, no significant difference in mean nymphal survival (%) was observed on the differentials. Honeydew excretion was studied at Coimbatore, Maruteru and Pantnagar. The mean honey dew excretion was significantly low on PTB33, RP-2068-18, Salkati (57.1-87.3 mm^2) and statistically at par. It was significantly high in TN1, OM4498, Mut NS-1 and IR-64 (268.80 -238.43mm^2). Studies at Pantnagar on days to wilt at seedling stage identified that PTB33 had taken significantly more number of days (24.5 days) to wilt followed by Chinsaba (20.8 days), T12 (20.2 days), RP2068-18-3-5 (18.2 days) unlike TN1 and Pokkali which wilted in 8.2 and 7.8 days, respectively (**Table 2.2.1**)

At Maruteru, BPH nymphs were released on 30day old plants, and it was recorded that the number of days to wilt was significantly more in Rathu Heenati, PTB33, Salkati(58.7- 57.7days) as compared to Chinsaba (30.7 days) and IR36(32.3 days). *Reaction to WBPH:* PTB33, RP2068-18-3-5, ASD7, Babawee and Chinsaba were promising in one test against WBPH of the two valid tests.

Overall reaction*: Evaluation of 20 gene differentials in PHSS trial against brown planthopper at 12 locations in Standard Seed box Screening Test (SSST) identified RP 2068-18-3-5 as promising in 10 tests. PTB 33 was promising in 8 tests: Salkathi in 6 tests and T12 in 4 tests each. Honey dew excretion by nymphs fed on RP 2068-18-3-5, PTB33 and Salkathi was significantly low, with significantly more number of days to wilt as compared to the susceptible lines like TN1, Pokkali and IR36* (**Table 2.2.1**).

Table 2.2.1 Reaction of differentials to planthoppers in PHSS trial, kharif 2024

		Reaction to Brown planthopper (BPH)																	Reaction to WBPH		
		Brown planthopper (BPH) (Damage Score)												BPH NPT	Nymphal survival (%)	Honey dew excretion(mm^2)	Days to wilt		Damage Score		WBPHNPT
PHSS No	Differentials	ADT	CBT	CTC	NDL	IIRR	LDN	MND*	MTU	PNT	RNR	RPR	WGL	12			PNT	MTU	CBT	IIRR	2
																	seedlings	30 DAS			
1	ASD7 (ACC6303)	9.0	5.0	9.0	8.8	8.4	8.3	5.0	5.1	5.6	9.0	9.0	8.9	2	32.3	128.20 abcd	12.167 efgh	40.3 bcd	6.1	4.9	1
2	Babawee	9.0	4.0	9.0	8.0	7.5	7.4	9.0	6.5	6.0	9.0	9.0	8.8	1	29.3	146.90 abcd	13.667 def	47 b	5.4	5.0	1
3	Chinnasaba (ACC33016)	8.3	5.8	9.0	5.8	8.3	8.1	5.0	7.9	5.0	9.0	9.0	8.8	2	25.2	115.90 abcd	20.833 b	30.667 f	6.0	4.8	1
4	IR36	7.7	3.0	9.0	5.5	8.4	8.0	7.0	6.0	8.2	9.0	9.0	8.7	1	35.0	198.43 abc	11.000 ghi	32.333 ef	5.5	5.8	0
5	ARC10550	7.0	2.0	9.0	6.5	7.3	7.9	9.0	5.6	5.0	9.0	3.3	6.9	3	31.4	116.27 abcd	10.667 hij	40.667 bcd	5.2	6.4	0
6	IR-64	8.3	5.0	9.0	7.8	8.6	6.9	7.0	7.9	7.3	9.0	9.0	9.0	1	32.3	238.43 a	9.3333 ijk	36.333def	6.2	6.2	0
7	IR-65482-7-2-216-1-2-B	8.3	5.2	9.0	5.7	7.3	7.1	7.0	7.8	7.0	9.0	9.0	8.7	0	28.8	218.10 ab	14.000 de	36.333 def	6.8	5.6	0
8	IR71033-121-15	8.3	6.4	9.0	4.6	8.3	7.2	7.0	9.0	8.5	9.0	9.0	8.8	1	30.0	162.57 abcd	10.000 hijk	34.333 def	9.0	5.1	0
9	Miliang63	9.0	6.6	9.0	5.9	7.9	9.0	5.0	9.0	7.0	9.0	9.0	9.0	1	37.5	121.63 abcd	13.167defg	41 bcd	8.8	7.8	0
11	Mut NS-1	9.0	6.1	9.0	6.0	8.4	8.7	7.0	9.0	5.0	9.0	9.0	8.9	1	27.8	241.67 a	15.000 d	35def	7.6	8.2	0
12	OM4498	8.3	5.4	9.0	5.9	8.3	8.9	9.0	9.0	9.0	9.0	9.0	9.0	0	37.2	268.20 a	8.6667 jk	35 def	6.0	6.9	0
13	Pokkali	9.0	3.3	9.0	9.0	6.8	7.7	9.0	8.9	7.2	9.0	9.0	9.0	1	35.8	203.93 abc	8.1667 k	39 cde	5.4	6.1	0
15	Salkathi	3.0	1.3	9.0	5.1	4.7	8.9	5.0	4.4	9.0	3.9	9.0	7.3	6	28.7	82.267 d	8.3333 k	57.667 a	5.2	5.3	0
16	RatuHeenati	NG	5.3	9.0	4.5	6.8	5.9	9.0	6.2	9.0	9.0	NA	8.6	1	33.8	153.83 abcd	13.667 def	58.667 a	5.8	6.0	0
17	RP-2068-18-3-5	3.0	1.6	5.0	4.8	4.1	2.9	3.0	4.5	7.0	3.5	2.7	8.1	10	27.8	70.500 d	18.167 c	55 a	5.0	5.4	1
18	Swarnalatha (ACC33964)	5.0	2.9	9.0	4.4	5.7	5.7	7.0	8.6	7.0	8.7	9.0	8.3	3	35.8	152.20 abcd	11.667 fgh	44.333 bc	5.6	5.3	0
19	T12(ACC56989)	5.0	3.3	9.0	5.8	5.3	5.3	7.0	5.0	5.0	9.0	9.0	7.5	4	26.1	96.733 cd	20.167 bc	40 cd	5.4	6.0	0
	PTB33	5.7	1.5	5.0	5.5	2.3	2.4	3.0	3.9	2.0	7.1	1.1	5.4	8	39.9	57.078 d	24.500 a	58.17 a	4.8	NG	1
	TN1	9.0	NG	9.0	5.4	8.6	8.9	NG	NG	8.2	NG	9.0	9.0	0	48.0	268.80 a	8.1667 k	NT	NG	NG	0
	Promising level	5	5	5	5	5	5	5	5	5	5	5	5		NS				5	5	
	No. promising	4	11	2	4	3	2	6	4	5	2	3	0						2	3	

Means followed by same letter within a column are not significantly different**;** * visual scoring

2.2.2 Planthopper population Monitoring trial (PHPM).

The Planthopper Population Monitoring (PHPM) study was conducted at five locations namely, Gangavathi, Pantnagar, IARI, Ludhiana, and Coimbatore to evaluate the virulence profiles of brown planthopper (BPH) populations in response to selected resistant donor lines. A single BPH female was introduced, and its progeny were subsequently assessed. Four gene differential lines were tested namely, PTB 33 (harboring *bph2, Bph3*, and *Bph32*), RP 2068-18-3-5 (with *Bph33*(t)), RP Bio4918-230S (carrying *bph39* and *bph40*), and Salkathi (with *qBph4.3* and *qBph4.4*), alongside the susceptible variety TN1. Parameters recorded included the number of nymphs hatched, the emergence of adults, their sex ratio, and the proportion of brachypterous and macropterous individuals in each line. The findings from these observations given in **Table 2.2.2** and are detailed in the following report.

Gangavathi: Females laid eggs on all the gene differentials, with the highest nymphal hatching on TN1 and the lowest on PTB33. The incubation period lasted 9 days. Nymphal survival was longest on Salkathi and lowest on TN1. TN1 also had the lowest proportion of males, and across all differentials, the sex ratio favoured females. Macropterous (winged) adults made up 54.28% of the population, outnumbering wingless forms and were most abundant on TN1.

Pantnagar: Egg-laying was found on all gene differentials, with nymphal hatching remaining consistent among them. The incubation period was 10 days. The highest nymphal survival was recorded on TN1, while the lowest was on PTB33. TN1 had the lowest percentage of males, and a female-biased sex ratio was observed only in TN1. Brachypterous (short-winged) adults accounted for 55.42 % of the population, outnumbering winged adults and were most abundant on TN1.

IARI: Oviposition was observed across all gene differentials, with the highest nymphal emergence recorded on TN1 and the lowest on Salkathi. The incubation period for eggs was 8 days. Nymphal survival rates were highest on TN1, RP Bio 4918-230S and Salkathi. A female-biased sex ratio was consistently observed on all the differentials. Macropterous (fully winged) adults predominated over brachypterous (short-winged) forms in all differentials, comprising 85.43% of the adult population. The lowest proportion of macropterous individuals was found on PTB33, while the highest was recorded on RP Bio 4918-230S.

Ludhiana: All female individuals oviposited on all the tested gene differentials, with uniform nymphal hatching. The egg incubation period lasted 6 days. The highest nymphal survival was recorded on TN1, and the nymphal duration was 12 days. Male proportions peaked in Salkathi, while a female-dominant sex ratio was exclusive to TN1. Macropterous adults constituted 66.12% of the population, exceeding the number of wingless forms, with the greatest proportion found on TN1.

Coimbatore: All the females laid eggs the gene differentials tested, and the nymphs hatched were highest on TN1 and lowest on PTB 33. The egg incubation period was 9 days, the nymphal survival ranged from 3.5-32% and was highest on TN1. Sex ratio was in favour of females in TN1 and RP2068-18-3-5.

Overall reaction: Assessment of brown planthopper (BPH) virulence through single female progeny test on four gene differentials *viz.*, PTB 33 (harboring *bph2, Bph3*, and *Bph32*), RP 2068-18-3-5 (with *Bph33*(t)), RP Bio4918-230S (carrying *bph39* and *bph40*), and Salkathi (with *qBph4.3* and *qBph4.4*), and a susceptible variety TN1 was studied at Gangavathi, Pantnagar, IARI, Ludhiana, and Coimbatore. The results revealed that the Gangavathi population was the most virulent among the five tested populations and was characterized by significantly higher fecundity and nymphal hatching with a lower proportion of males.

Table 2.2.2: Virulence monitoring of brown planthopper population in PHPM trial, kharif 2024

Location	Gangavathi					Pantnagar					IARI, NewDelhi					Ludhiana					Coimbatore				
Gene Differential	TN-1	PTB-33	RP2068-18-3-5	RPbio 4918-230S	Salkathi	TN-1	PTB-33	RP2068-18-3-5	RPbio 4918-230S	Salkathi	TN-1	PTB-33	RP2068-18-3-5	RPBio 4918-230S	Salkathi	TN-1	PTB-33	RP2068-18-3-5	RPBio 4918-230S	Salkathi	TN-1	PTB-33	RP2068-18-3-5	RPBio 4918-230S	Salkathi
No. females released	25	25	25	25	25	25	25	25	25	25	12	12	12	12	12	20	20	20	20	20	10	10	10	10	10
Virulent females (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
No nymphs hatched /F	73.2	32.7	43.4	53.5	35.9	39.5	15	22.9	20.5	27.9	57.5	23.4	25.1	34.8	23.3	69.1	24.1	25.8	28.1	27.4	21.2	6.2	8.4	14	9.7
Total nymphs/female	238.7	238.7	238.7	238.7	238.7	125.8	125.8	125.8	125.8	125.8	164.1	164.1	164.1	164.1	164.1	174.4	174.4	174.4	174.4	174.4	59.5	59.5	59.5	59.5	59.5
Egg period	9	9	9	9	9	10	10	10	10	10	8	8	8	8	8	6	6	6	6	6	9	9	9	9	9
Nymphal survival %	67	71.6	76.1	73.5	86.7	11.5	6.4	7.2	7	8.1	20.3	11.6	18.6	20.3	20.3	29	20.3	21.3	23	22	32	8	19.5	17	3.5
Nymphal duration	12	12	12	12	12	13	13	13	13	13	12	12	12	12	12	12	12	12	12	12	NR	NR	NR	NR	NR
Males (%)	32.4	36.6	36.9	37.2	36.8	47.5	58.7	55.6	60.7	61.7	42.3	46.8	44.5	44.6	40.8	42.5	59	57.8	58	60.6	39.1	62.5	48.7	52.9	71.4
Females -F	3.3	1.5	2.1	2.4	1.9	1.2	0.5	0.6	0.6	0.6	2.3	1.2	2.2	2.4	2.3	3.3	1.7	1.8	1.9	1.7	3.9	0.6	2	1.6	0.2
Males-M	1.6	0.9	1.2	1.4	1.1	1.1	0.8	0.8	0.9	1	1.7	1.1	1.7	1.8	1.7	2.5	2.4	2.5	2.7	2.7	2.5	1	1.9	1.8	0.5
No.Winged females	1.5	0.6	1.1	1.3	1	1.2	0.5	0.7	0.6	0.6	1.7	1.1	1.6	1.7	1.7	1.4	1	1.2	1.3	1.2	NR	NR	NR	NR	NR
No.wingless females	1.8	0.9	1	1.2	1	1.1	0.8	0.8	0.8	1	0.7	0.1	0.7	0.6	0.6	1.9	0.7	0.6	0.7	0.5	NR	NR	NR	NR	NR
No.Winged males	1.1	0.5	0.8	0.9	0.7	0	0	0	0	0	1.7	1	1.6	1.8	1.6	1.9	2	1.8	1.9	1.7	NR	NR	NR	NR	NR
No.Wingless males	0.5	0.4	0.4	0.5	0.4	0	0	0	0	0	0	0	0	0	0	0.5	0.4	0.7	0.8	1	NR	NR	NR	NR	NR
Total adults (F+M)	4.9	2.3	3.3	3.9	3.1	2.3	1.3	1.4	1.4	1.6	4.1	2.3	3.7	4.1	4.1	5.8	4.1	4.3	4.6	4.4	6.4	1.6	3.9	3.4	0.7
SR F:M	2.1	1.7	1.7	1.7	1.7	1.1	0.7	0.8	0.6	0.6	1.3	1.1	1.3	1.3	1.4	1.4	0.7	0.7	0.7	0.7	1.6	0.6	1.1	0.9	0.4

2.2.3 Gall midge biotype monitoring trial (GMBT)

Gall midge biotype trial was constituted with a set of 20 gene differentials categorized into 6 groups, along with the susceptible check TN1. Of these, four lines with *Gm1*, *gm3, Gm8 and Gm4+ Gm8* genes in the background of Improved Samba Mahsuri were included in the 6^{th} group. The trial was conducted at 20 locations in 10 States of India. The reaction of the differentials was observed at both 30DAT, 50DAT and/or 75DAT in terms of percent plant damage and silver shoot (%). Data with >50 % plant damage/ ≥15% SS in TN1 at a location was considered as valid. Differentials with nil plant damage or <1% SS damage were considered as resistant. Though gall midge incidence was recorded at IIRR, Titabar (Assam), Aduthurai (Tamil Nadu), Brahmavar (Karnataka), and Maruteru (Andhra Pradesh) but the severity was low. No data received from NRRI, Cuttack (Odisha). The results of the evaluation from the valid data from research stations at 12 locations in 13 valid tests are summarized in **Table 2.2.3** and discussed as under.

Jharkhand

Ranchi: Differentials from Group 1(Kavya, W1263, ARC6605), Group II (Dukong1, Madhuri L9 and BG380-2), Group 3(CR-MR 1523), Group 4 (Abhaya, Aganni and INRC3021) and RP5922-21 recorded nil plant damage.

Chattishgarh

Ambikapur: Gene differentials Kavya (*Gm1*) and INRC 17470(*Gm8*) and RP 6749-RMS7-17-27-41 *(Gm4 + Gm8)* recorded nil plant damage. Aganni, INRC3021, INRC15888 and RP 5925-24 *(Gm8)* recorded <10%DP and <1 % SS in the field reaction at this location.

Jagdalpur: Reaction of differentials at Jagdalpur were categorized as R-S-S-R-S-S with exceptions of ARC6605 in Group 1 being susceptible. In group IV, INRC3021 and Aganni recorded nil damage where as INRC 17470 recorded low damage of 10%DP. In Group V1, RP5925-24 and RP 6749-RMS7-17-27-41 recorded nil damage.

Odisha

Chiplima: Gene differentials W1263 (*Gm1*), Aganni, INRC3021 (*Gm8*) and RP 6749-RMS7-17-27-41 *(Gm4 + Gm8)* recorded nil plant damage *at this location.*

Maharashtra

Sakoli: This year Kavya and W1263 (*Gm1*); Aganni, INRC 3021, INRC 17470 and RP5925-24 (with *Gm8*); RP5923 (*gm3*), and RP 6749-RMS7-17-27-41 (*Gm4 + Gm8*) recorded nil damage at this location.

Telangana

Jagtial: Earlier the populations at Jagtial conformed to the typical pattern of R-S-R-R-S for biotype 3 but this year all the differentials were highly susceptible.
Warangal: Aganni and INRC 3021(with *Gm8*), exhibited nil damage at Warangal research station and evaluation in the farmer's field which is 30 km away from research farm. However, INRC 17470 had low silver shoot damage in the research farm (5%DP and 0.3%SS)

Andhra Pradesh

Ragolu: Differentials of group 2 (DUKONG 1, RP 2333-156-8), group 3 and 4 conferred resistance to gall midge at this location which is typical reaction(S-S-R-R-S) pattern of biotype 4. RP5925-24, and RP6749-RMS7-17-27-41also recorded nil damage.
Nellore: All the gene differentials were susceptible to this population as in the earlier years.

Karnataka

Gangavathi: Only ARC 6605 (Group I differentials) recorded nil damage while, all the other differentials were susceptible.

Kerala

Moncompu: Kavya and RP 5922-21 (*Gm1*), ABHAYA (*Gm4*), RP 5923 (*gm3*) and RP 6749-RMS7-17-27-41 recorded nil damage.
Pattambi: All the differentials were susceptible

Overall reaction: *Evaluation of the gene differentials in 13 field tests at 12 locations identified Aganni (Gm8) and INRC 3021(Gm8) as promising in 8 of the 13 valid tests based on per cent plant damage.* RP6749-RMS7-17-27-41 (*Gm4+Gm8*) *was promising in 6 tests. W1263 (Gm1) and Kavya were promising in 4 tests. INRC17470, RP5925-24 and Kavya had <1% silver shoot damage in 5 locations. The results suggest that donors with Gm8 and Gm1 genes confer resistance to gall midge across most of the test locations.*

2.2.4 Gall midge population monitoring (GMPM)

This trial has been designed to complement the study on characterization of gall midge biotypes. Reaction of single gall midge female collected from a light source to a set of three gene differentials *viz.*, W1263 (*Gm1*), Aganni (*Gm8*), IBT*Gm2* (*Gm4 + Gm8*) and Purple variety (no resistance gene but highly susceptible) raised in a single pot would generate information on the virulence pattern of the gall midge population at a given location. This year the trial was conducted at seven locations *viz.*, Jagtial, Warangal, Moncompu, Pattambi, Gangavathi, Brahmavar, and Ragolu. But at Ragolu, Akshayadan PYL was used instead of IBTWGL2.The results are presented in **Table 2.2.4** and discussed location wise.

Table 2.2.3 Reaction of gene differentials against gall midge populations in GMBT, ***kharif*** 2024

Group	Entry No.	Differential	Gene	ABP	JDP	CHP	RNC	SKL	JGT	WGL	WGL$	RGL	NLR	GNV	PTB	MNC	Over all NPT
				50DT	50DT	50DT	50DT	50DT	50DT	50DT	50DT	50DT	63DT(Rt)	50DT	50DT	50DT	
				GMB1	GMB1	GMB1	GMB1	GMB4	GMB3	GMB4M	GMB4M	GMB4	GMB	GMB	GMB5	GMB5	13
				Per cent plant damage													
I	1	KAVYA	*Gm 1*	0.0	0.0	20.0	0.0	5.0	100.0	100.0	95.0	70.0	20.0	100.0	47.6	0.0	4
	2	W 1263	*Gm 1*	20.0	0.0	0.0	0.0	0.0	100.0	95.0	90.0	30.0	40.0	100.0	47.6	40.0	4
	3	ARC 6605	*(?)*	60.0	70.0	80.0	0.0	35.0	90.0	90.0	70.0	50.0	30.0	0.0	95.2	40.0	2
II	4	PHALGUNA	*Gm 2*	70.0	90.0	80.0	30.0	30.0	100.0	90.0	85.0	60.0	30.0	90.0	81.0	50.0	0
	5	ARC 5984	*Gm 5*	60.0	60.0	70.0	40.0	60.0	100.0	95.0	85.0	70.0	30.0	95.0	76.2	60.0	0
	6	DUKONG 1	*Gm 6t*	40.0	90.0	90.0	0.0	60.0	100.0	100.0	95.0	0.0	100.0	100.0	90.5	50.0	2
	7	RP 2333-156-8	*Gm 7*	20.0	60.0	50.0	40.0	25.0	100.0	100.0	90.0	0.0	80.0	90.0	90.5	50.0	1
	8	MADHURI L 9	*Gm 9*	10.0	0.0	30.0	0.0	15.0	100.0	100.0	100.0	40.0	70.0	100.0	90.5	30.0	2
	9	BG 380-2	*Gm 10*	40.0	100.0	50.0	0.0	30.0	100.0	90.0	95.0	10.0	70.0	90.0	95.2	40.0	1
III	10	MR 1523	*Gm 11*	20.0	30.0	70.0	0.0	55.0	75.0	85.0	80.0	0.0	100.0	95.0	95.2	30.0	2
IV	11	RP 2068-18-3-5	*gm 3*	30.0	90.0	30.0	40.0	45.0	85.0	70.0	75.0	30.0	90.0	90.0	90.5	60.0	0
	12	ABHAYA	*Gm 4*	40.0	80.0	50.0	0.0	35.0	55.0	60.0	85.0	0.0	100.0	85.0	71.4	0.0	3
	13	INRC 3021	*Gm 8*	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	15.0	47.6	60.0	8
	14	AGANNI	*Gm 8*	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	20.0	47.6	20.0	8
	15	INRC 15888	*Gm 8*	10.0	20.0	30.0	20.0	0.0	100.0	85.0	100.0	0.0	50.0	100.0	71.4	40.0	2
	16	INRC17470	*Gm8*	0.0	10.0	10.0	40.0	0.0	20.0	5.0	15.0	0.0	40.0	90.0	52.4	30.0	3
V	17	TN1	*None*	60.0	90.0	90.0	60.0	35.0	100.0	95.0	100.0	80.0	80.0	90.0	90.5	60.0	0
V1	18	RP 5922-21	*Gm 1*	60.0	80.0	60.0	0.0	40.0	100.0	100.0	100.0	50.0	100.0	95.0	85.7	0.0	2
	19	RP 5923	*gm 3*	20.0	20.0	30.0	40.0	0.0	10.0	45.0	20.0	50.0	100.0	100.0	85.7	0.0	2
	20	RP 5925-24	*Gm 8*	10.0	0.0	10.0	30.0	5.0	55.0	65.0	25.0	0.0	100.0	90.0	85.7	10.0	2
	21	RP 6749-RMS7-17-27-41	*Gm4+ Gm8*	0.0	0.0	0.0	60.0	0.0	100.0	35.0	5.0	0.0	100.0	90.0	100.0	0.0	6
V	22	TN1	*none*	70.0	70.0	100.0	60.0	75.0	100.0	100.0	95.0	40.0	90.0	100.0	81.0	100.0	0
Total Tested				22	22	22	22	22	22	22	22	22	22	22	22	22	
Max. damage in the trail				70.0	100.0	100.0	60.0	75.0	100.0	100.0	100.0	80.0	100.0	100.0	100.0	100.0	
Min. damage damage in the trial				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	47.6	0.0	
Ave. damage in the trial				30.0	43.6	43.2	20.9	25.0	76.8	73.0	68.4	26.4	69.5	83.0	78.1	35.0	
Damage in TN1				65.0	80.0	95.0	60.0	55.0	100.0	97.5	97.5	60.0	85.0	95.0	85.7	80.0	
Promising level				0	0	0	0	0	0	0	0	0	0	0	0	0	
No. promising				3	7	4	11	7	2	2	2	10	0	1	0	5	
$Farmers Field																	

Jagtial: Of the 220 single female insects tested, 157 insects were virulent at this location. Only 84% were virulent on Purple (no resistance gene), 29.0% on W1263 (*Gm1*), 8% were virulent on IBT Gm2 (*Gm4+ Gm8*) and none were virulent on Aganni (*Gm8*). The sex ratio was favorable in all the differentials. Male progeny was 41.3 % on W1263 as compared to 38.2% on purple. The results support the reaction of these differentials at Jagtial in GMBT trial suggesting Aganni as a promising donor at this location.

Warangal: At this location, 250 insects were tested but only 194 were virulent. Low virulence of tested females was recorded on Aganni (3.09%) and IBTGm2 (6.7%) with <10% SS damage. The virulence on W1263 (*Gm1*) was at par with purple variety. Male progeny (%) was very high in all the gene differentials tested (40.7-50.0%). The results suggest that the population has very low level of virulence to Aganni at this location.

Moncompu: Single female progeny test was done with 250 females of which 248 (99.2 %) were virulent. Of the virulent insects, only 75.8% females were virulent on purple (no gene), 10.1% on W1263 (*Gm1*) with 2.8%SS, 70.2% on Aganni (*Gm8*) and 70.6 % on IBTGm2 (*Gm4+Gm8*). The results suggest a low level of virulence to *Gm1* gene. Though the severity of pest was low in GMBT trial, it can be deduced that under favourable conditions there can be an upsurge in the gall midge infestation at this location.

Pattambi: At this location, 87 insects were tested and all were virulent and the virulent females per cent varied from 24.7% in purple to 70.1% in IBTGm2. The silver shoot damage ranged from 24.7% SS in W1263 to 61.9% in IBTGm2. There was no variation in the reaction of the insect to gene differentials in terms of virulence, and sex ratio and per cent male progeny. This is in line with the results of the GMBT trial where all the gene differentials recorded susceptibility.

Brahmavar: Of the 52 females tested, only 49 were virulent. None were virulent on W1263; 8.2% were virulent on Aganni and 12.2 % on IBTGm2. In Aganni, the sex ratio optimum, but in IBTGM2 and purple it was more towards females. Though the incidence *per se* was low in the GMBT trial, the results in this trial indicate that if the favourable conditions persist, the infestation is bound to increase.

Gangavathi: Of the 100 female insects tested, 97% were virulent. Of these, 90% were virulent on Purple (no gene), 34.0% on W1263 (*Gm1*), 97.0% on Aganni (*Gm8*) and 56% on IBTGm2 (*Gm4 + Gm8*). However, the damage was low in Aganni (4.2%SS) and W1263 (7.4%SS). Sex ratio was favourable towards females in all the test entries with high progeny numbers. Male progeny (%) was very high in W1263 as compared to other entries. These results support the reaction of these differentials at Gangavathi in GMBT trial except for recording of high virulence on Aganni in this test.

Ragolu: At this location, 250 single females were tested of which 243 were virulent. The gene differentials tested were Aganni, Akshayadhan (*Gm4+Gm8*) and W1263 along with purple. The results suggest that the population was highly virulent 60.8% on the purple variety and the two gene differentials, W1263 (60.4%) and Akshyadhan (*Gm4+Gm8*) (62.8%). None were virulent on Aganni. In all the test entries, the sex ratio was favourable towards females though male progeny(%) was more (45.3%) on Akshyadhan (*Gm4 + Gm8*) .

Overall reaction: *Studies on virulence composition of gall midge populations in GMPM trial conducted at seven locations across four southern states in India suggest that Aganni (Gm8) holds promise at Jagtial, and Ragolu with low susceptibility at Brahmavar and Warangal. Low virulence against W1263 (Gm1) was observed at Moncompu and promising at Brahmavar. Low virulence was recorded at Jagtial and Brahmavar towards IBTGm2 (with Gm4 + Gm8). However, a close monitoring of the virulence pattern in endemic areas is important.*

Table 2.2.4: Virulence composition of gall midge populations at seven locations, GMPM, Kharif 2024

Locations	Total females tested	No of virulent females	Differentials	virulent females (%)	%SS	Sex ratio (M:F)	Total progeny	% Male progeny
Jagtial	220	157	Aganni	0.0	0.0	-	0	0.0
			IBT WGL2	8.0	15.6	1M: 1F	12	50.0
			W1263	29.0	7.4	1M:1.42 F	46	41.3
			Purple	84.0	32.2	1M:1.62 F	131	38.2
Warangal	250	194	Aganni	3.0	1.40	1M:1F	12	50.0
			IBT WGL2	6.7	3.2	1M:1.2F	28	46.4
			W1263	32.0	24.3	1M1.3F	207	40.7
			Purple	36.6	27.6	1M:1.3F	246	43.5
Moncompu	250	248	Aganni	70.2	36.3	1M:1.2F	260	61.5
			IBT WGL2	70.6	39.7	1M:0.9F	268	69.4
			W1263	10.1	2.8	1M:0.8F	30	63.3
			Purple	75.8	40.2	1M:1.4F	293	54.3
Pattambi	87	87	Aganni	52.9	40.7	1M:3.4F	70	22.9
			IBTWGL-2	70.1	61.9	1M:2.7F	114	27.2
			W1263	36.8	24.7	1M:3.6F	41	22.0
			Purple	24.7	59.1	1M:3.0F	97	24.7
Brahmavar	52	49	Aganni	8.2	NA	1M:1F	4	50.0
			IBTWGL-2	12.2	NA	1M:2F	6	33.0
			W1263	0.0	NA	0	0	0.0
			Purple	95.2	NA	1M:1.6F	47	38.3
Gangavathi	100	97	Aganni	97.0	4.20	1M:2.3F	21	28.6
			IBT WGL2	56.0	15.6	1M:4F	75	20.0
			W1263	34.0	7.4	1M:2.2F	35	31.4
			Purple	90.0	32.2	1M:2.9 F	90	25.4
Ragolu	250	243	Aganni	0.0	0.0	Nil	Nil	Nil
			Akshayadhan	62.8	43.6	1M:1.2F	278	45.3
			W1263	60.4	29.4	1M:2.9F	284	25.4
			Purple	60.8	26.9	1M:2.9F	280	25.7

NA- not available

2.3 CHEMICAL CONTROL STUDIES

2.3.1 Seed Treatment for management of early season insect pests of rice (STEP)

Early season pests namely, hispa, whorl maggot, caseworm, thrips, gall midge and stem borer cause considerable damage in rice. Of late, there is an uptrend in their incidence at many of the rice growing areas leading to severe yield losses. In order to identify the effective insecticides by seed treatment for the management of gall midge, this year a new trial was constituted and conducted. A replicated field trial was conducted at 11 locations *viz.*, ABP, ADT, CBT, PTB, CHP, GNV, REW, JDP, MTU, RNR and WGL during 2024 *Kharif* season.

Treatments:

T. No.	Insecticide	Dosage (formulation)
T_1	Carbosulfan 25% DS	10 g/kg seed
T_2	Chlorantraniliprole 50% W/W FS	6 ml/kg seed
T_3	Thiamethoxam 70% WS	7.5 g/kg seed
T_4	Imidacloprid 48% W/W FS	2.5 ml/kg seed
T_5	Untreated Control	

Statistical analysis: Data were subjected to appropriate transformations and to two-way ANOVA. Treatment effects across the locations (treatment*location interaction) were estimated to draw overall conclusions. Means were separated by LSD at five per cent level of significance.

Results: Across locations gall midge and stem borer were recorded. The results of the efficacy of the insecticide seed treatments are discussed pest wise:

Effect of seed treatment on gall midge damage at different locations:

Trial was conducted at eight centres (ABP, ADT, CHP, GNV, JDP, MTU, WGL and PTB) and data from seven centres were analysed. Percent silver shoots (% SS) in the untreated control plot ranged from 5.1 (MTU) to 31.1 (GNV) and is above the ETL (5%). At all the locations, the treatment effects were significant in comparison to the untreated control. Results are given in terms of mean of % SS location wise and overall mean of treatment*location interaction along with percent reduction over control (% ROC) in Table 2.3.1.1.

ABP: All the treatments were significantly effective as compared to untreated control T5- Untreated Control (7.9 % SS) with T1- carbosulfan (3.4 % SS) being the most effective treatment followed by T2- chlorantraniliprole (3.7 % SS), T3- Thiamethoxam 70% WS (4.3 % SS) and T4- Imidacloprid 48% FS (4.6 % SS).

ADT: All the treatments were significantly effective as compared to untreated control T5 (5.2 % SS) with T4 (1 % SS) being the most effective treatment followed by T2 (1.3 % SS), T1 (1.5 % SS) and T3 (1.9 % SS).

CHP: All the treatments were significantly effective as compared to the untreated control T5 (7.9 % SS) with T3 (1.4 % SS) being the most effective treatment followed by T2 (3.5 % SS), T1 (4.8 % SS) and T4 (6.2 % SS).

GNV: Gall midge incidence was highest at this centre. All the treatments were significantly effective as compared to the untreated control T5 (31.1 % SS) with T1 (10.1 % SS) being the most effective treatment followed by T3 (12.6 % SS), T2 (22.2 % SS) and T4 (25.8 % SS).

JDP: All the treatments were significantly effective as compared to the untreated control T5 (27.5 % SS) with T1 (11.4 % SS) being the most effective treatment followed by T2, T3 and T4 (14.8%SS, 16.9%SS and 19.3 % SS, respectively) which were statistically at par.

MTU: Gall midge incidence was lowest at this centre with 8.1 % SS in untreated control. Effect of treatments on silver shoot damage (4.3-6.1%SS) were not significantly different.

WGL: All the treatments were significantly effective as compared to untreated control T5 (8.4 % SS) with T3 (2.2 % SS) being the most effective treatment followed by T4 (2.3 % SS), T1 (4.1 % SS) and T2 (4.2 % SS).

Effect on the gall midge damage across the locations (treatment*locations):

In order to arrive at treatment effects across the locations (treatment*locations), interaction effects were analysed. T1 (Carbosulfan 25% DS) and T3 (Thiamethoxam 70% WS) were most effective with significantly lower SS (5.9 and 6.5 %) resulting in 55.5 and 50.7 per cent reduction in silver shoots, respectively (Table 2.3.1.1).

Effect of seed treatment on stem borer damage at different locations:

Data from ten locations (ABP, ADT, CHP, PTB, GNV, JDP, MTU, RNR WGL and CBT) was considered for analysis. Only at ADT, GNV and JDP damage has crossed the ETL of 10% dead hearts (DH). Dead hearts ranged from 0.5% (MTU) to 18.3% (ADT) in the untreated control. The white ear (WE) damage ranged from 8.1% (MTU) to 34.1% (ABP) (Table 2.3.1.2 and 2.3.1.3). But dead heart was from 7 locations in the table.

ABP: T2 was the most effective treatment with significantly lower DH (3.0%) followed by T4 (3.2 %), T1 (4.0 %) and T3 (4.1 %). With respect to WE, T1, T2 and T3 were on par and significantly different from untreated control (34.1%WE) with T2 recording comparatively lower WE (23.2%WE).

ADT: Lowest number of DH were recorded in T3 (4.2 %) followed by T1 (4.2 %), T4 (4.2 %) and T2 (5.3 %). With respect to WE all the treatments were at par but significantly differed from damage in untreated control (16.6%).

CHP: The per cent DH was significantly lower in all the treatments as compared to untreated control with T2 (1.3 %) recording lower DH. With respect to WE, treatment effects were significantly different from untreated control with T2 (4.9 %) recording lowest number of WE.

GNV: Among the treatments, T2 was the most effective with significantly lower DH (5.8 %) and WE (8.6 %) as compared to untreated control T5 (16.4% DH and 24.9% WE).

JDP: All the treatments were effective with significantly lower per cent DH (2.5-5.7%) as compared to untreated control T5 (12.2 %). T4 (2.5 %) recorded per cent DH. With respect to WE all the treatments were at par and significantly differed from untreated control with T1 (12.6 %) recording lower white ear damage.

MTU: Stem borer incidence was lowest at this location. The per cent DH ranged from 0.2 to 0.6 %. The data on per cent WE ranged from 4.3 to 8.1 % and was not significantly different.

WGL: Dead heart damage varied from 0.4-4.4% across the treatments and statistically non-significant. All the treatments were significantly superior to untreated control (4.4 % DH) and T2 was the most effective (0.4 % DH). With respect to WE, T1 has recorded lowest number of WE (4.6 %).

CBT: All the insecticide treatments were not significantly different from the untreated control with per cent WE are ranging from 9.5 to 12.6.

RNR: DH incidence was low. Whereas WE ranged from 13.7 to 16.8 per cent and treatment means were insignificant.

PTB: With respect to WE, T2 was most effective (5.2%) followed by T3 (9.3%) and significantly different from the damage in untreated control 19.1 % WE.

Effect on stem borer damage across the locations (treatment*locations):

For dead hearts (DH) T2 (3.1 % DH) (Chlorantraniliprole 50% W/W FS) was the most effective treatment with 65 % reduction over the untreated control. In case of WE also, T2 (9.5 % WE) (Chlorantraniliprole 50% W/W FS) was the most effective treatment with 46.7 % reduction over the untreated control.

Effect of seed treatment on grain yield at different locations:

The seed treatment with insecticides has resulted in higher grain yields as compared to untreated control **(Table 2.3.1.4)**.

ABP: All the insecticidal seed treatments have resulted in significantly increased yields as compared to the untreated control T5 (1984 kg/ha) with T1 (2677 kg/ha) recording highest yield.

ADT: T2 resulted in better yield (2673 kg/ha) as compared to the untreated control T5 (1366 kg/ha) and T4 (1500 kg/ha) which were at par

CHP: All the insecticidal seed treatments had resulted in significantly increased yields as compared to the untreated control T5 (2045 kg/ha) with T2 (3548 kg/ha) recording highest yield.

GNV: All the insecticidal seed treatments had resulted in significantly increased yields as compared to the untreated control T5 (3347 kg/ha) with T2 (6867 kg/ha) recording highest yield.

JDP: All the insecticidal seed treatments have resulted in significantly increased yields as compared to the untreated control T5 (4751 kg/ha) with T1 (5373 kg/ha) recording highest yield.

MTU: T1 (8349kg/ha) and T2 (8312 kg/ha) recorded significantly higher grain yields. The lowest yield was recorded in untreated control (7494 kg/ha) and was at par with T3 (7671 kg/ha).

WGL: There was no significant difference in the yields of insecticide treatment as compared to untreated control.

PTB: Except T1 in all the treatments, grain yield was significantly higher. T4 was the best treatment with a yield of 2075 kg/ha. Whereas the mean yield in the untreated control was 1281 kg/ha.

Effect on grain yield across the locations (location*treatment):

Treatment effects were significant with all the treatments recording higher yield as compared to the untreated control T5 (3676 kg/ha). T2 (Chlorantraniliprole 50% W/W FS) was the best treatment with significantly higher yield (4859 kg/ha) resulting in 32.2 per cent increase in yield as compared to untreated control, followed by T1 (Carbosulfan 25% DS) and T3 (Thiamethoxam 70% WS) recording 4642 and 4447 kg/ha yield, respectively (Table 4).

***Summary**: All the four insecticides tested as seed treatment were effective in minimising yellow stem borer and gall midge damage and reducing the yield losses. However, in gall midge endemic areas, carbosulfan 25% DS and thiamethoxam 70% WS were most effective with 55.5 and 50.7 per cent reduction in silver shoots, respectively. For stem borer damage, chlorantraniliprole 50% W/W FS was the most effective treatment with 65 and 46.7 per cent and reduction in dead hearts and white ears, respectively over the untreated control. Seed treatment with chlorantraniliprole 50% W/W FS resulted in 32.2 per cent increase in grain yield over untreated control followed by carbosulfan 25% DS (26.3 per cent increase) and thiamethoxam 70% WS (21 per cent increase).*

Table 2.3.1.1 Effect of seed treatment with insecticides on rice gall midge damage

Treatment		Per cent silver shoots per hill								
		Location#							Treatment*location@	
		ABP	ADT	CHP	GNV	JDP	MTU	WGL	Mean	% ROC
T_1	Carbosulfan 25% DS	3.4^{b} (2.0)	1.5^{b} (0.9)	4.8^{bc} (2.8)	10.1^{e} (5.8)	11.4^{c} (6.7)	5.7^{a} (3.3)	4.1^{b} (2.4)	5.9^{d} (3.3)	55.5
T_2	Chlorantraniliprole 50% W/W FS	3.7^{b} (2.1)	1.3^{b} (0.7)	3.5^{c} (2.0)	22.2^{c} (12.8)	14.8^{bc} (8.9)	8.0^{a} (4.6)	4.2^{b} (2.4)	8.2^{c} (5.2)	37.6
T_3	Thiamethoxam 70% WS	4.3^{b} (2.5)	1.9^{b} (1.1)	1.4^{d} (0.8)	12.6^{d} (7.3)	16.9^{b} (9.9)	6.0^{a} (3.5)	2.2^{c} (1.3)	6.5^{d} (3.5)	50.7
T_4	Imidacloprid 48% W/W FS	4.6^{b} (2.6)	1.0^{b} (0.6)	6.2^{b} (3.6)	25.8^{b} (15.0)	19.3^{b} (11.3)	7.6^{a} (4.4)	2.3^{c} (1.3)	9.5^{b} (6.0)	27.6
T_5	Untreated Control	7.9^{a} (4.5)	5.2^{a} (3.0)	7.9^{a} (4.5)	31.1^{a} (18.3)	27.5^{a} (16.2)	5.1^{a} (2.9)	7.5^{a} (4.3)	13.2^{a} (8.3)	-
LSD (P=0.05)		0.8821	1.2202	0.9162	0.5858	2.7398	2.1668	0.7714	0.37	

* Percent reduction over untreated control. Figures in the parentheses are #arc sine and @Atkinson transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Table 2.3.1.2: Effect of seed treatment with insecticides on rice stem borer (dead hearts)

Treatment		Per cent dead hearts per hill								
		Location#							Treatment*location@	
		ABP	ADT	CHP	GNV	JDP	MTU	WGL	Mean	% ROC*
T_1	Carbosulfan 25% DS	4.0^{b} (2.3)	4.6^{b} (2.7)	2.2^{b} (1.2)	10.2^{d} (5.9)	4.4^{bc} (2.6)	0.6^{ab} (0.3)	2.1^{b} (1.2)	4.0^{c} (3.9)	55.4
T_2	Chlorantraniliprole 50% W/W FS	3.0^{b} (1.7)	5.3^{b} (3.1)	1.3^{b} (1.1)	5.8^{e} (3.3)	5.7^{b} (3.3)	0.4^{a} (0.6)	0.4^{b} (0.6)	3.1^{d} (2.7)	65.0
T_3	Thiamethoxam 70% WS	4.1^{b} (2.4)	4.2^{b} (2.4)	1.6^{b} (0.9)	14.1^{b} (8.1)	3.5^{bc} (2.1)	0.2^{b} (0.1)	1.2^{b} (0.7)	4.2^{b} (4.6)	53.7
T_4	Imidacloprid 48% W/W FS	3.2^{b} (1.8)	4.6^{b} (3.1)	1.9^{b} (1.1)	12.7^{c} (7.3)	2.5^{c} (1.5)	0.2^{b} (0.1)	1.3^{b} (0.8)	3.8^{c} (4.2)	57.9
T_5	Untreated Control	6.2^{a} (3.5)	18.3^{a} (10.7)	4.9^{a} (2.8)	16.4^{a} (9.4)	12.2^{a} (7.1)	0.5^{ab} (0.3)	4.4^{a} (2.5)	9.0^{a} (7.1)	-
LSD (P=0.05)		0.7603	2.7459	0.8894	0.3435	1.5231	0.4278	0.6413	0.37	

* Percent reduction over untreated control. Figures in the parentheses are #arc sine and @Atkinson transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Table 2.3.1.3: Effect of seed treatment with insecticides on stem borer (white ears)

Treatment		Per cent white ears per hill											
		Location#										Treatment*location@	
		ABP	ADT	CBT	CHP	GNV	JDP	MTU	WGL	RNR	PTB	Mean	% ROC*
T_1	Carbosulfan 25% DS	24.4^{b} (14.5)	5.5^{b} (3.2)	11.2^{a} (6.5)	8.0^{b} (4.6)	14.8^{d} (8.6)	12.6^{b} (7.3)	6.1^{a} (3.5)	4.6^{b} (2.6)	15.3^{a} (8.8)	9.3^{c} (5.4)	11.2^{c} (5.57)	37.3
T_2	Chlorantraniliprole 50% W/W FS	23.2^{b} (13.5)	5.7^{b} (3.3)	9.5^{a} (5.5)	4.9^{c} (2.8)	8.6^{e} (4.9)	13.7^{b} (7.9)	4.3^{a} (2.5)	5.2^{b} (3.0)	14.8^{a} (8.5)	5.2^{c} (3.0)	9.5^{d} (4.35)	46.7
T_3	Thiamethoxam 70% WS	23.9^{b} (13.9)	6.0^{b} (3.4)	11.1^{a} (6.4)	7.3^{bc} (4.2)	20.0^{b} (11.6)	13.4^{b} (7.7)	6.0^{a} (3.5)	5.9^{b} (3.4)	16.8^{a} (9.7)	17^{b} (9.8)	12.7^{b} (6.55)	28.6
T_4	Imidacloprid 48% W/W FS	27.5^{ab} (16.2)	6.2^{b} (3.6)	11.2^{a} (6.4)	6.3^{bc} (3.6)	17.4^{c} (10.1)	14.9^{b} (8.7)	4.7^{a} (2.7)	6.5^{ab} (3.7)	13.9^{a} (8.0)	19.1^{ab} (11.0)	12.8^{b} (6.27)	28.4
T_5	Untreated Control	34.1^{a} (20.2)	16.6^{a} (9.7)	12.6^{a} (7.3)	13.1^{a} (7.6)	24.9^{a} (14.5)	22.4^{a} (13.1)	8.1^{a} (4.8)	10.5^{a} (6.0)	13.7^{a} (7.9)	22.3^{a} (12.9)	17.8^{a} (9.45)	-
LSD (P=0.05)		5.372	1.061	2.10	1.49	0.845	2.016	2.44	2.333	2.7378	2.4824	0.466	

* Percent reduction over untreated control. Figures in the parentheses are #arc sine and @Atkinson transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Table 2.3.1.4: Effect of seed treatment with insecticides on grain yield

Treatment		GrainYield Kg/ha									
		Location								Treatment* location	
		ABP	ADT	CHP	GNV	JDP	MTU	PTB	WGL	Mean	% IOC*
T_1	Carbosulfan 25% DS	2677^{a}	1910^{ab}	3268^{c}	5996^{b}	5373^{a}	8349^{a}	1202.7b	4920^{a}	4642^{b}	26.3
T_2	Chlorantraniliprole 50% W/W FS	2524^{a}	2673^{a}	3548^{a}	6867^{a}	5181^{a}	8312^{a}	1879a	4907^{a}	4859^{a}	32.2
T_3	Thiamethoxam 70% WS	2514^{a}	1974^{ab}	3449^{b}	5307^{c}	5306^{a}	7671^{b}	1952a	4907^{a}	4447^{b}	21.0
T_4	Imidacloprid 48% W/W FS	2405^{a}	1500^{b}	3286^{c}	5224^{c}	5079^{ab}	8089^{ab}	2074.7a	4969^{a}	4365^{c}	18.7
T_5	Untreated Control	1984^{b}	1366^{b}	2045^{d}	3347^{d}	4751^{b}	7494^{b}	1281.3b	4745^{a}	3676^{d}	-
LSD (P=0.05)		336.30	862.60	73.80	327.50	384.60	609.80	532.22	389.30	167.03	-

* IOC-Percent Increase over untreated control. Figures in the parentheses are square root transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

2.3.2. Prophylactic management of Planthoppers in rice (PMRH)

To standardize a protocol for prophylactic management of hopper pests, the probable vectors of southern black streak virus disease, the trial was conducted with the following treatments at Ludhiana, Kaul, Chatha, Pantnagar, Nawagam, and Raipur during kharif 2024.

Treatment number	Treatment details	Crop stage at application
Treatment 1	Triflumezopyrim 10% SC @236 ml/ha	Maximum tillering
	Pymetrozine 50% WG @ 300 g/ha	Booting
Treatment 2	Pymetrozine 50% WG @ 300 g/ha	Maximum tillering
	Dinotefuran 20% SG@ 200 g/ha	Booting
Treatment 3	Triflumezopyrim 10% SC @ 236 ml/ha	Maximum tillering
	Essential oil @ 2ml per litre	Booting
Treatment 4	Water Spray	Untreated

Incidence of WBPH was low at Chatha and Kaul. Observations on population counts of brown planthopper, white backed planthopper, green leafhopper, spiders and mirid bugs were recorded on the crop at one, two and three weeks after spraying. The following is the account of results of the experiment.

Brown planthopper

Data from PNT and RPR considered for analysis. All the three treatment combinations significantly reduced the brown planthopper population as compared to the untreated control. At PNT, application of triflumezopyrim followed by pymetrozine was significantly superior as compared to all the other treatments. Whereas, at RPR all the three treatments had similar effect. On pooled mean basis also, sequential application of triflumezopyrim-pymetrozine, pymetrozine-dinotefuran, triflumezopyrim-essential oil was at par and significantly effective over the untreated control. Reduction of brown planthopper population (42.2 per cent) was higher in triflumezopyrim-pymetrozine treatment (**Table 2.3.2.1**) as compared to other treatments.

White- backed planthopper

Data from NWG, PNT and RPR considered for analysis. All the three treatments with sequential application of insecticides reduced the WBPH population significantly. Based on the pooled mean, triflumezopyrin-pymetrozine application was most effective with 38.9 per cent reduction in white backed planthopper population (**Table 2.3.2.2**).

Table 2.3.2.1. Efficacy of insecticides against brown planthopper

Treatment	No. of BPH per hill			
	Location#		Treatment*location@	
	PNT	RPR	Mean	% ROC
Triflumezopyrim-Pymetrozine	32.2[c] (5.7)	55.0[b] (7.4)	43.6[b] (6.5)	42.2
Pymetrozine-Dinotefuran	37.8[b] (6.1)	53.6[b] (7.3)	45.7[b] (6.7)	39.5
Triflumezopyrim-Essential oil	38.8[b] (6.2)	53.3[b] (7.3)	46.1[b] (6.8)	39.0
Untreated control	70.6[a] (8.4)	80.5[a] (9.0)	75.5[a] (8.7)	-
LSD (P=0.05)	0.3	0.4	0.3	-

Figures in the parentheses are #square root @Atkinson transformed values. Means within a column followed by same alphabet are not significantly different (LSD, P=0.05).

Table 2.3.2.2. Efficacy of insecticides against white backed planthopper

Treatment	No. of WBPH per hill				
	Location#			Treatment*location@	
	NWG	PNT	RPR	Mean	% ROC
Triflumezopyrim-Pymetrozine	2.0[c] (1.4)	3.4[c] (1.8)	9.8[b] (3.1)	5.1[c] (15.5)	38.9
Pymetrozine-Dinotefuran	2.2[cb] (1.5)	5.6[b] (2.3)	9.0[b] (3.0)	5.6[bc] (16.2)	32.7
Triflumezopyrim-Essential oil	2.5[b] (1.6)	5.1[b] (2.3)	8.5[b] (2.9)	5.4[b] (16.3)	34.9
Untreated control	4.8[a] (2.2)	7.9[a] (2.8)	12.2[a] (3.5)	8.3[a] (20.9)	-
LSD (P=0.05)	0.1	0.3	0.2	0.7	-

Figures in the parentheses are #square root @Atkinson transformed values. Means within a column followed by same alphabet are not significantly different (LSD, P=0.05).

Green leafhopper:

Data from PNT and RPR was considered for analysis. At PNT, treatment means were significantly different and green leafhopper population was higher in the untreated control, as compared to all the other treatments that were at par. Whereas, at RPR treatment mean differences were not significant. Based on the pooled mean, application of triflumezopyrim-pymetrozine was most effective with 27.2 per cent reduction in the green leafhopper population (**Table 2.3.2.3**).

Spiders

Impact of the treatments on the spider population had a slight negative bias. At NWG in triflumezopyrim- pymetrozine spray, the spider population was significantly lower as compared to all the treatments that were at par. At PNT, all the treatment means were at par except, triplumezopyrim- pymetrozine which was more effective to pymetrozine-dinotefuran application. At RPR, there were no significant differences between the treatment effects. Pooled mean data revealed that the spider population in the untreated control was significantly higher as compared to rest of the insecticide treatments and the reduction was higher (10.6 %) in pymetrozine-dinotefuran treatment (**Table 2.3.2.4**).

Table 2.3.2.3. Efficacy of insecticides against green leafhopper

Treatment	No of GLH per hill			
	Location#		Treatment*location@	
	PNT	RPR	Mean	% ROC
Triflumezopyrim-Pymetrozine	5.0[b] (2.2)	1.4[a] (1.2)	3.2[b] (1.7)	27.2
Pymetrozine- Dinotefuran	5.2[b] (2.3)	1.7[a] (1.3)	3.5[b] (1.8)	21.5
Triflumezopyrim-Essential oil	5.8[b] (2.4)	1.2[a] (1.1)	3.5[b] (1.8)	20.2
Untreated control	7.3[a] (2.7)	1.5[a] (1.2)	4.4[a] (2.0)	-
LSD (P=0.05)	0.3	0.3	0.2	-

Figures in the parentheses are #square root @Atkinson transformed values. Means within a column followed by same alphabet are not significantly different (LSD, P=0.05).

Table 2.3.2.4. Effect of insecticides on spider population

Treatment	No of spiders per hill				
	Location#			Treatment*location@	
	NWG	PNT	RPR	Mean	% ROC
Triflumezopyrim-Pymetrozine	0.5[c] (0.7)	4.5[a] (2.1)	4.7[a] (2.2)	3.2[b] (18.9)	2.8
Pymetrozine-Dinotefuran	0.7[b] (0.8)	4.0[b] (2.0)	4.3[a] (2.1)	3.0[b] (18.6)	10.6
Triflumezopyrim-Essential oil	0.7[ab] (0.8)	4.2[ab] (2.0)	4.2[a] (2.0)	3.0[b] (19.0)	8.8
Untreated control	0.8[ab] (0.9)	4.3[ab] (2.1)	4.9[a] (2.2)	3.3[a] (19.9)	-
LSD (P=0.05)	0.1	0.1		0.7	-

Figures in the parentheses are #square root @Atkinson transformed values. Means within a column followed by same alphabet are not significantly different (LSD, P=0.05).

Mirids

At PNT, mirid population was significantly higher in the untreated control as compared to all the insecticide treatments except for pymetrozine-dinotefuran treatment. Whereas, at RPR no significant effect of insecticide treatment was observed. With respect to pooled mean, though the treatment mean differences were not significant, mirid population was lower in triflumezopyrim-pymetrozine treatment with 17.8 per cent reduction over control (**Table 2.3.2.5**).

Yield

In all the three locations grain yield was significantly higher in the three tested insecticide treatments as compared to the untreated control. At NWG, triflumezopyrim-pymetrozine application resulted in significantly higher grain yield and was at par with pymetrozine-dinotefuran as compared other treatments. Similar results were observed at RPR. At PNT, in triflumezopyrim-essential oil treatment grain yield was significantly higher. Whereas pooled mean revealed that the grain yield in triflumezopyrim-pymetrozine, pymetrozine-dinotefuran and triflumezopyrim-essential oil treatments was at par but significantly higher as compared to the untreated control. Higher increase was recorded in triflumezopyrim-essential oil treatment (25.4 per cent) (**Table 2.3.2.6**).

Table 2.3.2.5: Effect of insecticide treatments on mirid population

Treatment	No of mirids per hill			
	Location#		Treatment*location@	
	PNT	RPR	Mean	% ROC
Triflumezopyrim-Pymetrozine	2.1[b] (1.4)	2.5[a] (1.6)	2.3[a] (13.1)	17.8
Pymetrozine-Dinotefuran	2.7[ab] (1.6)	2.4[a] (1.5)	2.6[a] (13.3)	8.5
Triflumezopyrim-Essential oil	2.0[b] (1.4)	2.7[a] (1.6)	2.4[a] (13.4)	16.0
Untreated control	3.1[a] (1.8)	2.5[a] (1.6)	2.8[a] (13.8)	-
LSD (P=0.05)	0.3	0.1	0.9	-

Figures in the parentheses are #square root @Atkinson transformed values. Means within a column followed by same alphabet are not significantly different (LSD, P=0.05).

Table 2.3.2.6: Impact of insecticides on the grain yield of rice

Treatment	Yield per ha				
	Location			Treatment*location	
	NWG	PNT	RPR	Mean	%IOC
Triflumezopyrim-Pymetrozine	4961.8[a]	4520.8[b]	5825.0[a]	5102.5[a]	23.5
Pymetrozine-Dinotefuran	4455.0[ab]	4421.6[b]	5700.0[ab]	4858.9[a]	17.6
Triflumezopyrim-Essential oil	4289.8[b]	5674.4[a]	5575.0[b]	5179.7[a]	25.4
Untreated control	3449.8[c]	4082.4[b]	4862.6[c]	4131.6[b]	-
LSD (P=0.05)	509.3	883.0	218.5	323.5	-

Means within a column followed by same alphabet are not significantly different (LSD, P=0.05).

Summary

For the prophylactic management of hopper insect pests the probable vectors of southern black streak virus disease in rice, a field trial with four treatments *viz.*, spraying of triflumezopyrim 10% SC @236 ml/ha and pymetrozine 50% WG @ 300 g/ha; pymetrozine 50% WG @ 300 g/ha and dinotefuran 20% SG@ 200 g/ha; dinotefuron 20% SG@ 200 g/ha and essential oil @2ml per litre at maximum tillering and booting stages, respectively was tested. The trial was conducted at six locations (Ludhiana, Kaul, Chatha, Pantnagar, Nawagam, and Raipur). Data revealed that spraying of triflumezopyrim 10% SC @236 ml/ha at maximum tillering stage and followed by pymetrozine 50 % WG @300 g/ha at the booting stage was most effective in reducing the populations of brown planthopper, white backed planthopper and green leafhopper with 42.2, 38.9 and 27.2 per cent reduction, respectively over the untreated control. However, there was a concomitant reduction in the spider population in pymetrozine 50% WG @ 300 g/ha and dinotefuran 20% SG@ 200 g/ha treatment (10.6 per cent) and mirid population in triflumezopyrim 10% SC @236 ml/ha and pymetrozine 50% WG @ 300 g/ha treatment (17.8 per cent). Grain yield in all the three insecticide treatment combinations was significantly higher as compared to untreated control, highest being 25.4 per cent increase in triflumezopyrim 10% SC @236 ml/ha and pymetrozine 50% WG @ 300 g/ha treatment.

2.3.3. Bio-efficacy of Insecticides against Brown Planthoppers (BIBPH)

The brown planthopper *(Nilaparvata lugens)* is a major insect pest in rice-growing regions, causing severe yield losses through direct feeding and as a vector of grassy stunt virus. Insecticides remain the primary control method. However, excessive and indiscriminate use has led to control failures in many field populations. Understanding the dose – mortality response to commonly used and newly introduced insecticides is essential for effective pest management. This year a new trial on Bio-efficacy of Insecticides against Brown Planthoppers (BIBPH) was constituted to monitor the response of brown planthoppers to commonly used insecticide in rice. This study examined the dose mortaliy response in *N. lugens* populations from different rice-growing regions of India to four insecticides *viz.,* acephate, dinotefuran, pymetrozine and triflumezopyrim that are recommended for management of this insect. The trial was conducted at ICAR-IIRR, Rajendranagar, Gangavathi, Aduthurai, Ludhiana and New Delhi.
Field populations of *N. lugens* were collected from the above five rice-growing regions in India. Nymphs and adults were collected using polythene covers and aspirators and then transported to the laboratory, where they were reared up to the F_1 generation and then subjected to bioassays. The IRAC Susceptibility Test #05 method was used to assess susceptibility slightly modified with third-instar nymphs exposed to rice seedlings treated with different insecticide concentrations, each concentration replicated three times. Mortality was recorded at 72 hours and corrected using Abbott's formula. Mortality data was subjected to Probit analysis to determine LC_{50} values, providing insights into dose response of different populations to insecticide treatments. The results of the study are discussed as under.

Acephate (Organophosphate group)*:* The toxicity of Acephate varied across locations, with LC_{50} values ranging from 38.3 ppm in New Delhi to 130.7 ppm in Gangavathi populations. The highest LC_{50} in Gangavathi suggests that the brown planthopper population is less susceptible as compared to New Delhi population. Populations from Aduthurai and Rajendranagar showed intermediate levels of susceptibility, with LC_{50} values of 63.1 ppm and 57.1 ppm, respectively. These variations indicate a location-specific response to Acephate, highlighting the need for targeted pest management strategies.

Dinotefuran (Neonicotinoid group): For Dinotefuran, LC_{50} values ranged from 4.25 ppm in New Delhi population to 19.35 ppm in population from Gangavathi, showing that the insecticide was more effective on populations from New Delhi than those from Gangavathi, the other locations, including IIRR, Rajendranagar (9.97 ppm), Aduthurai (11.22 ppm) and Ludhiana (11.65 ppm), exhibited moderate levels of susceptibility. These findings suggest that while Dinotefuran remains effective in some areas, there is a varying degree of susceptibility, necessitating careful monitoring and rotation with other insecticides.

Pymetrozine (Pyridine-azomethine group) exhibited a significant variation in LC_{50} values, ranging from 7.832 ppm in Ludhiana to 99.15 ppm in Gangavathi. The high LC_{50} in Gangavathi population suggests it is less sensitive, while the low LC_{50} in Ludhiana indicates a more susceptible population. Intermediate susceptibility levels were recorded in populations from Aduthurai (36.15 ppm), Rajendranagar (55.64 ppm) and New Delhi (10.47 ppm). These results indicate that while Pymetrozine is still effective in some locations, decrease in susceptibility is evident, particularly in populations from Gangavathi.

Triflumezopyrim (Mesoionic group) was the most effective insecticide across locations, with LC_{50} values ranging from 0.17 ppm in Aduthurai to 2.08 ppm in Gangavathi. The low LC_{50} values suggest that brown planthopper populations are more susceptible to this insecticide compared to the other tested insecticides. Gangavathi population exhibited the highest LC_{50}, indicating low susceptibility, while the lowest LC_{50} values in Aduthurai (0.17 ppm) and Rajendranagar (0.18 ppm) suggest high susceptibility. These results highlight Triflumezopyrim as a promising option for brown planthopper management.

Overall, the results show that Gangavathi populations exhibited lowest sensitivity to all the four test, while New Delhi and Ludhiana had populations that are more susceptible. Among the insecticides, Triflumezopyrim was the most effective, showing the lowest LC_{50} values, whereas Acephate and Pymetrozine exhibited higher LC_{50} values, indicating reduced effectiveness. These findings emphasize the need for localized pest management strategies and continuous monitoring of insecticide susceptibility to ensure effective control of brown planthoppers (**Fig: 2.3.3.1**).

Summary**:** The trial on Bio -efficacy of Insecticides against planthoppers (BIBPH) initiated this year assessed the susceptibility of *Nilaparvata lugens* populations from five rice-growing regions in India to four insecticides: acephate, dinotefuran, pymetrozine, and triflumezopyrim. Bioassays using the IRAC Susceptibility Test #05 on third instar nymphs determined LC_{50} values, revealing regional variations in the susceptibility of the populations emphasizing the need for region-specific pest management and resistance monitoring. The response to test insecticides is as follows:

- **Acephate:** Based on LC_{50} values the order of toxicity of populations was New Delhi <Rajendranagar<Aduthurai < Gangavathi (LC_{50}: 130.7 ppm).
- **Dinotefuran:** Based on LC_{50} values the order of toxicity of populations was NewDelhi<Rajendranagar<Aduthurai<Ludhiana<Gangavathi(LC_{50}: 9.35ppm).
- **Pymetrozine:** Based on LC_{50} values the order of toxicity of populations was Ludhiana (7.832 ppm) < New Delhi <Aduthurai<Rajendranagar<Gangavathi (99.15 ppm)

- **Triflumezopyrim:** Most effective, with consistently low LC_{50} values (0.17–2.08 ppm). Gangavathi populations showed a lower susceptibility as compared to New Delhi and Ludhiana populations. Triflumezopyrim remains the best option for control.

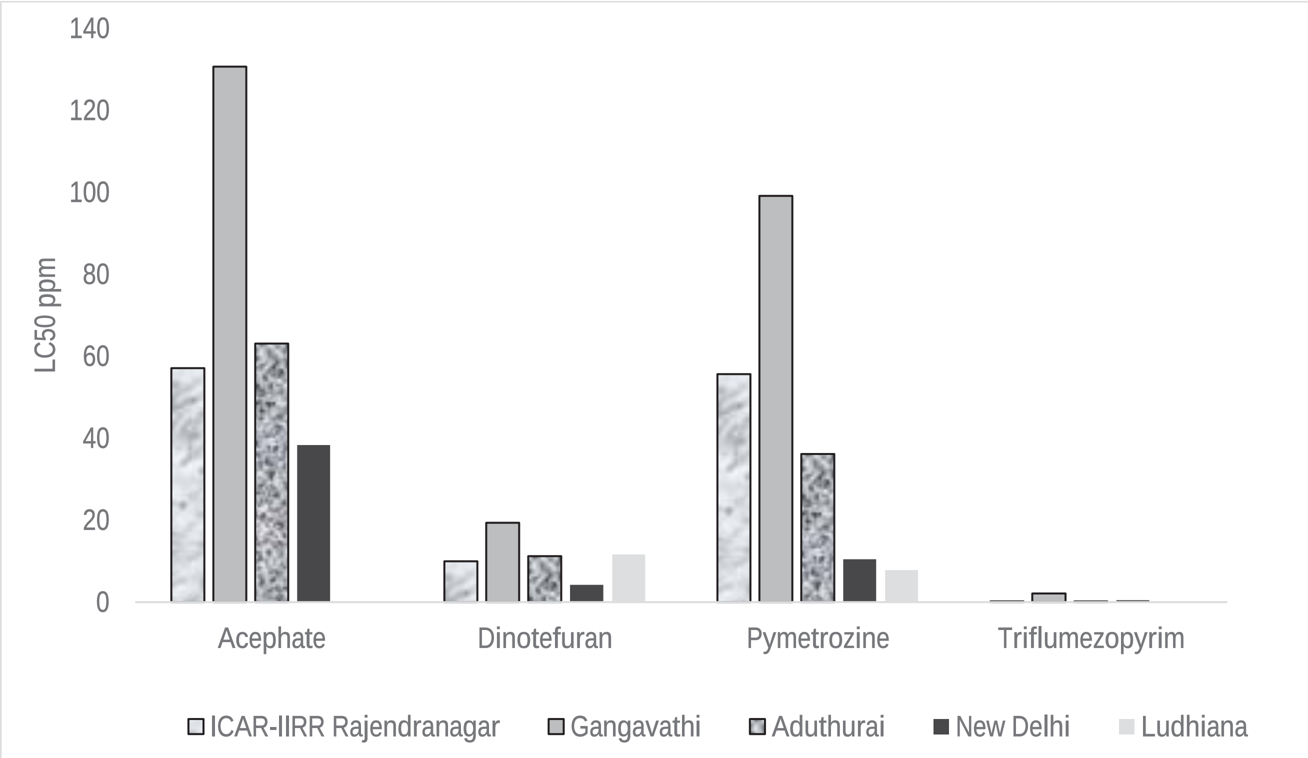


Fig 2.3.3.1 Dose – mortality response of third instar nymphs of BPH populations to insecticides

2.3.4. Evaluation of drones for spraying of agrochemicals (herbicides, insecticides and fungicides) in rice pest management (EDAPM)

To evaluate the efficacy of drone-based spraying of agrochemicals for the management of major insect pests, diseases and weeds a collaborative trial with entomologists, agronomists and pathologists was initiated this year. A replicated trial was conducted at eight locations namely, Ludhiana, Navasari, Nawagam, Chinsurah, Raipur, Gangavathi, Rajendranagar and IIRR. Stem borer; leaf blast, sheath blight, grain discolouration and weeds were the target biotic stresses. Treatment details are given below.

Treat-ment	Spraying Method	Crop Stage		Insecticide (formulation per acre)	Dilution per acre
T1	By Drone	Within 5 DAT	Herbicide	Pretilachlor @600 - 750 l/acre	10 litres of water at maximum tillering stage, 16 liters at PI to booting stage
		Maximum tillering stage	Herbicide	Triafamone 20%+ethoxy-sulfuron l0% WG @90 g/acre	
			Fungicide +insecticide (Tank mix)	+Tebuconazole 50% +trifloxystrobin 25% WG @ 80 g/acre	
				+Isocycloseram 18.1% W/W SC @ 120 ml/acre	
		Booting stage	Fungicide +insecticide (Tank mix)	Picoxystrobin 7.05% +propiconazole 11.7% SC @400 ml/acre	
				Chlorantraniliprole 18.50 %SC @60ml/acre	
T2	Battery operated Knapsack sprayer	Within 5 DAT	Herbicide	Pretilachlor @600 - 750 l/acre	500 litres of water depending on the crop canopy
		Maximum tillering stage	Herbicide	Triafamone 20% + ethoxysulfuron l0% WG @90 g/acre	
			Fungicide +insecticide (Tank mix)	+Tebuconazole 50% + trifloxystrobin 25% WG @ 80g/acre	
				+Isocycloseram 18.1% W/W SC @ 120 ml/acre	
		Booting stage	Fungicide +insecticide (Tank mix)	Picoxystrobin 7.05% + propiconazole 11.7% SC @400ml/acre /ha	
				+Chlorantraniliprole 18.50 % SC @60 ml/acre	
T3	Untreated control			Untreated control (water spray with drone)	10 litres of water at maximum tillering stage, 16 liters at PI to booting stage

Data were recorded at one and two weeks after each spray. Besides data on stem borer damage, data on gall midge, leaf folder, planthoppers, spiders and mirid bugs also was recorded. An account of the results obtained is given hereunder.

Stem borer:

Dead hearts: Dead hearts (DH) data from four locations, CHN, GNV, NWG, and RPR were analysed. Drone spraying was significantly superior to knapsack spray and the untreated control at CHN and GNV with lower percentage of DH. At NWG, efficacy of drone spray was comparable to knapsack spray. At RPR, knapsack spray was significantly superior to drone spray, which was at par with the untreated control. Pooled mean across the four locations revealed that drone spray was significantly superior to knapsack spray with 45.4 per cent reduction in DH over control. Whereas knapsack spray achieved 31.7 % reduction over control. **(Table 2.3.4.1)**.

Table 2.3.4.1. Evaluation of insecticide spraying with drones against stem borer dead heart damage

Treatment	Per cent dead hearts per hill					
	Locations#				Treatment*location@	
	CHN	GNV	NWG	RPR	Mean	%ROC
By Drones	0.6 c (0.3)	4.9 c (2.8)	2.8 b (1.6)	18.6 b (10.7)	6.7 c (2.7)	45.4
Knapsack sprayer	1.1 b (0.6)	5.8 b (3.3)	4.0 b (2.3)	22.7 a (13.1)	8.4 b (3.4)	31.7
Untreated control	7.4 a (4.3)	12.2 a (7.0)	11.6 a (6.7)	17.8 b (10.3)	12.3 a (7.8)	
LSD (P=0.05)	0.216	0.1882	0.8603	1.803	0.2198	

* Percent reduction over untreated control. Figures in the parentheses are #arc sine and @Atkinson transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

White Ears:

Both the spray methods were significantly effective in minimising the white ear (WE) formation as compared to the untreated control from the white ear incidence at 7 locations. However, efficacy of drone spray was significantly superior to knapsack spray at CHN, GNV, RNR, and RPR. At IIRR and NWG both the spraying methods were at par. Only at LDN, knapsack spray was found better than drone spray. Pooled mean across the locations clearly demonstrated significantly superior performance of drone spray (54.1 per cent ROC) over the knapsack spray (40.9 per cent ROC) and untreated control **(Table 2.3.4.2)**.

Table 2.3.4.2. Evaluation of insecticide spraying with drones against white ear damage

Treatment	Per cent white ears per hill								
	Locations#							Treatment*location@	
	CHN	GNV	IIRR	LDN	NWG	RNR	RPR	Mean	%ROC
Drone spray	1.8 c (1.0)	5.7 c (3.3)	12.6 b (7.3)	4.1 b (2.4)	5.2 b (3.0)	4.5 c (2.6)	12.8 c (7.3)	6.7 c (8.6)	54.1
Knapsack spray	4.2 b (2.4)	8.2 b (4.7)	15.2 b (8.8)	3.9 c (2.3)	6.7b (3.8)	7.7 b (4.4)	14.3b (8.2)	8.6 b (10.0)	40.9
Untreated control	10.4 a (5.9)	14.0 a (8.0)	24.1 a (14.1)	8.1 a (4.6)	12.8 a (7.3)	16.2 a (9.3)	16.4 a (9.5)	14.6 a (17.9)	
LSD (P=0.05)	1.2317	0.2667	5.014	0.071	1.9074	0.6938	0.678	0.3345	

* Percent reduction over untreated control. Figures in the parentheses are #arc sine and @Atkinson transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Leaf folder:

Both the spraying methods, drone and knapsack prevented the leaf folder damage significantly as compared to the untreated control. Drone spray outperformed knapsack spray at GNV and RPR; was at par at CHN, NWG and RPR. Whereas the pooled data across the five locations clearly demonstrated the outperformance of drone spray with 66.7 per cent reduction over the untreated control as compared to knapsack spray that resulted in 61.2 per cent reduction over untreated control **(Table 2.3.4.3)**.

Table 2.3.4.3. Effect of insecticide spraying of agrochemical with drones on leaf folder

Treatment	Per cent damaged leaves per hill						
	Location#					Treatment*location@	
	CHN	GNV	NWG	RNR	RPR	Mean	%ROC
Drone spray	0.2 b (0.1)	6.4 c (3.7)	7.6 b (4.4)	0.2 b (0.1)	1.8 c (1.1)	3.3 c (2.9)	66.7
Knapsack spray	0.3 b (0.2)	7.3 b (4.2)	8.3 b (4.8)	0.3 b (0.2)	2.7 b (1.6)	3.8 b (3.5)	61.2
Untreated control	4.1 a (2.4)	15.3 a (8.8)	20.1 a (11.6)	5.3 a (3.1)	4.1 a (2.3)	9.8 a (10.0)	
LSD (P=0.05)	0.0855	0.1619	0.8962	0.3322	0.2766	0.1965	

* Percent reduction over untreated control. Figures in the parentheses are #arc sine and @Atkinson transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Gall midge:

At GNV, drone spray was the best treatment with highest reduction (59.4 per cent) reduction in silver shoots over the untreated control. Whereas Knapsack spray reduced the silver shoots by 52.4 percent **(Table 2.3.4.4)**.

Table 2.3.4.4. Effect of spraying of agrochemicals with drones on rice gall midge

Treatment	Per cent silver shoots per hill	
	Location GNV	%ROC
Drone spray	10.8 c (6.2)	59.4
Knapsack spray	12.7 b (7.3)	52.4
Untreated control	26.6 a (15.5)	
LSD (P=0.05)	0.287	

* Percent reduction over untreated control. Figures in the parentheses are arc sine transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

White backed planthopper:

At NWG, drone spray was significantly superior to knapsack spray and the untreated control with 63.4 per cent reduction in the population **(Table 2.3.4.5)**.

Table 2.3.4.5. Evaluation of spraying of agrochemicals with drones against white backed planthopper

Treatment	No. of hoppers per hill	
	Location-NWG	%ROC
Drone spray	1.9 c (1.1)	63.4
Knapsack spray	2.6 b (1.5)	52.1
Untreated control	5.3 a (3.1)	
LSD (P=0.05)	0.2461	

* Percent reduction over untreated control. Figures in the parentheses are square root transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Mirid bugs:

Impact of insecticide spray was adverse with significant reduction in the population as compared to the untreated control. Knapsack spray reduced mirid population by 67.6 per cent and drone spray by 57.6 per cent **(Table 2.3.4.6)**.

Table 2.3.4.6. Effect of insecticide spraying of agrochemicals with drones on mirid bugs population

Treatment	No. of mirids per hill	
	Location-GNV	%ROC
Drone spray	4.6 b (2.1)	57.6
Knapsack spray	3.5 c (1.8)	67.6
Untreated control	10.8 a (3.2)	
LSD (P=0.05)	0.1228	

* Percent reduction over untreated control. Figures in the parentheses are square root transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Spiders:

Spider population also were affected by the insecticide spray at all the three tested locations, Gangavathi, Nawagam and Raipur. At GNV, knapsack spray resulted in significantly lower spider population as compared to drone spray and the untreated control. At NWG, in drone spray significantly lower spider population as compared to untreated control, but was at par with knapsack spray. At RPR, spider population in knapsack spray was significantly higher as compared to drone spray and was at par with the untreated control. However, pooled mean across the three locations revealed that spider population in drone and knapsack sprays was reduced by 25.5 and 21.1 per cent respectively as compared to the untreated control **(Table 2.3.4.7)**.

Table. 2.3.4.7. Effect of spraying of agrochemicals with drones on spiders

Treatment	No. of spiders per hill				
	Location#			Treatment*location@	
	GNV	NWG	RPR	Mean	%ROC
Drone spray	1.5 b (1.2)	0.8 b (0.9)	2.2 b (1.4)	1.5 b (10.1)	25.5
Knapsack spray	1.1 c (1.0)	0.9 ab (0.9)	2.7 a (1.6)	1.6 c (9.4)	21.1
Untreated control	2.6 a (1.6)	1.0 a (1.0)	2.4 ab (1.5)	2.0 a (12.7)	
LSD (P=0.05)	0.0264	0.0685	0.1338	0.2541	

* Percent reduction over untreated control. Figures in the parentheses are #arc sine and @Atkinson transformed values. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Effect on diseases:

Leaf Blast: The trial was conducted at Gangavathi and Nawagam. At Gangavathi, leaf blast disease severity was recorded as 12.73% (PDI) at booting stage. In T2 treatment, spraying of chemicals using battery operated knapsack sprayer at maximum tillering and booting stage reduced the PDI from 12.73% to 4.94%. In T1 treatment, same chemicals were sprayed using drones and the recorded PDI was 3.61%. Use of drones for spraying the chemicals reduced the PDI up to 71.65% as against 61.17% in case of battery operated knapsack sprayer. Similarly, at Nawagam 46.02% of PDI was recorded in the control treatment at booting stage. Application of chemicals using battery operated knapsack sprayer at two stages, recorded the PDI of 32.25%. With respect to drone spraying (T1 treatment) the recorded PDI was 29.68% as against 46.02% at booting stage in the control (T3 treatment). The results revealed that, the percentage of reduction of PDI with battery operated knapsack sprayer was 45.55% (T2 treatment) and it was 53.58% in T1 treatment with drone spraying as compared to control **(Table 2.3.4.8)**.

Sheath blight: The trial was conducted at Gangavathi. The PDI of sheath blight was 32.24% in the control treatment at booting stage. In the T1 and T2 treatments, the chemicals were sprayed at maximum tillering and booting stage. At booting stage, the treatment T1 recorded 16.55% PDI (use of drone for spraying chemicals) and the treatment T2 recorded 17.49% PDI (use of knapsack sprayer for spraying the chemicals) as against 32.24% in T3 treatment. The percentage of reduction of PDI was 48.65% in T1 treatment and 45.73% in T2 treatment **(Table 2.3.4.8)**.

Grain discolouration: At Rajendranagar, the trial was conducted for the management of grain discolouration. The chemicals were sprayed only at booting stage in both the treatments (T1 & T2). The Per cent Disease Index of grain discolouration was 36.21% in the control treatment. The treatment T1 recorded 20.31% of PDI and the treatment T2 recorded the PDI of 21.90% as against 36.21% in control. The percentage of reduction of PDI was 43.91% in the treatment where chemicals were sprayed with drone and 39.42% reduction of PDI was recorded in the treatment, in which chemicals were sprayed with battery operated knapsack sprayer **(Table 2.3.4.8)**.

Table 2.3.4.8: Evaluation of Drone spraying of chemicals for the management of leaf blast, sheath blight and grain discolouration

Treatment Details/ Disease/ Location	Leaf Blast							Sheath Blight			Grain Discoloration	
	GNV			NWG			Mean	GNV			RNR	
	PDI (%)			PDI(%)				PDI(%)			PDI (%)	
	MTS	BS	%ROC	MTS	BS	%ROC		MTS	BS	% ROC	BS	%ROC
Drone	2.82 (1.92)	3.61 (2.11)	71.65	27.48	29.68	35.5	53.58	6.15 (2.62)	16.55 (23.87)	48.65	20.31 (26.76)	43.91
Knapsack sprayer	3.94 (2.18)	4.94 (2.4)	61.17	29.48	32.25	29.92	45.55	7.39 (2.86)	17.49 (24.61)	45.73	21.9 (27.87)	39.52
Untreated Control	10.78	12.73		40.71	46.02			12.22	32.24		36.21	
C. V.	14.56	13.34		12.91	11.43			9.6	6.88		12.21	
C. D.	0.35	0.35		3.98	3.9			0.28	1.8		3.53	
Transfor mation	ST	ST						ST	AT		AT	

MTS- Maximum Tillering Stage; BS- Booting Stage; PDI – Percent Disease Index

Phytotoxicity symptoms:

No phytotoxicity symptoms were observed when the test insecticides/ fungicides/ and herbicides at given recommended doses were tank mixed and sprayed with drone and battery operated knapsack sprayer.

Grain Yield:

Impact of superior performance of drone spray is reflected in the grain yield. At, RNR in drone spray, grain yield was significantly higher as compared to both the knapsack spray and untreated control that were at par. At NWG drone and knapsack spray were at par and significantly superior to the untreated control. Whereas, at RPR grain yield was significantly higher as compared to remaining two treatments. Pooled mean revealed that grain yield was significantly higher in drone spray followed by the knapsack spray with 25 and 15 per cent increase over control **(Table 2.3.4.9)**.

Table 2.3.4.9. Effect of method of spraying of insecticides on the grain yield.

Treatment	Grain Yield (Kg/ha)				
	Location#			Treatment*location	
	RNR	NWG	RPR	Mean	%IOC
Drone spray	6760 a	5442a	4650a	5617a	25
Knapsack spray	5980b	5130a	4399b	5169b	15
Untreated control	5800b	3646b	4060c	4502c	
LSD (P=0.05)	407	412	133	189	

* Percent increase over untreated control. Means followed by same alphabet are significantly not different (P=0.05) (SAS version 9.4)

Summary:

The trial was conducted to evaluate the efficacy of application of agrochemicals through drones in comparison to battery operated knapsack sprayer for the management of insect pests like stem borer, leaf folder, gall midge, planthoppers; diseases like leaf blast, sheath blight and grain discolouration. The trial was conducted at 8 locations. Both the spraying methods, drone and battery operated knapsack spraying minimised the damage caused by stem borers, gall midge, leaf folder and white backed planthopper significantly. However, drone spraying outperformed knapsack spraying with 45.4 per cent reduction in DH, 54.1 per cent reduction in per cent WE, 59.4 per cent reduction in silver shoots ,66.7 per cent reduction in leaf folder damage and 63.4 per cent reduction in WBPH population over the untreated control. Whereas, in knapsack spray the reduction was 31.7, 40.9, 52.4, 61.2 and 52.1 per cent, respectively.

With respect to diseases, 45.6 per cent disease reduction of leaf blast in battery operated knapsack spray treatment and 53.6 per cent disease reduction with drone spraying as compared to control. Similarly, for sheath blight disease, spraying of chemicals with drone recorded the PDI reduction of 48.7% as against 45.7% in the treatment when battery operated Knapsack sprayer was used for spraying the chemicals. In case of grain discolouration disease, the chemicals were sprayed only at booting stage the percentage of reduction of PDI was 44% when chemicals were sprayed with drone and 39.42% reduction of PDI was recorded when chemicals were sprayed with battery operated knapsack sprayer.

Grain yield was significantly higher in drone spray followed by the knapsack spray with 25 and 15 per cent increase over control. However, population of the natural enemies; mirid bugs and spiders more affected by agrochemicals spraying; more in drone spraying as compared knapsack spraying. The effect on spiders was lower as compared to that on mirids. No phytotoxicity symptoms were observed due to drone spraying of test agrochemicals at given doses in combination with herbicides and fungicides as tank mix.

2.4 BIOCONTROL AND BIODIVERSITY STUDIES

2.4. Evaluation of Entomopathogens against Lepidopteran pests of rice (EELP)

The trial was initiated in 2024 with the objective of evaluating effective entomopathogens against lepidopteran pests of rice, identified though the AICRP on biocontrol programme, at multi-locations and hotspots. The trial tested the efficacy of different strains of the entomopathogens *viz.*, *Bacillus albus*, *Bacillus thuringiensis, Metarhizium anisopliae* and *Beauveria bassiana* in comparison to a recommended insecticide and an untreated control the details of which are given below. During kharif 2024, the trial was taken up at fourteen centres *viz.*, Brahmavar, Coimbatore, Chinsurah, Chiplima, Cuttack, Gangavati, Karjat, Kaul, Ludhiana, Mandya, Moncompu, Navasari, Raipur and Ranchi. Three rounds of foliar sprays of liquid formulations of entomopathogens were given at 14 days.

T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) 10ml/L

T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) 10ml/L

T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L

T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2g/ l of water or 1kg/ha in 500 l of water

T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water

T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water

T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL

T8. Control (Untreated)

The damage by stem borer was quantified as per cent damage of dead hearts or white ears and leaf folder and minor lepidopterans such as skippers and horned caterpillars as % damaged leaves.

1. *Brahmavar*

Observations were recorded on stem borer (SB), leaffolder (LF) and minor lepidopteran pest damage at Brahmavar. Significant variations were observed among the treatments. Though Cartap hydrochloride (T7) exhibited the lowest percentage of pest damage across all categories, with 11.22% stem borer damage and 11.37% by leaffolder at 7 and 15 days after spray (DAS), respectively (**Table 2.4.1**), among the entomopathogens *Beauveria bassiana* NRRI TF 6 (T6) and *Beauveria bassiana* NBAIR-Bb5a (T3) also demonstrated reduced pest damage compared to other treatments. Significantly high natural enemy populations were recorded in T6 (*Beauveria bassiana* NRRI TF 6) and T3 (*Beauveria bassiana* NBAIR-Bb5a) with the highest numbers of spiders (12.63 and 11.96 per 10 hills, respectively) and coccinellids (7.75 and 8.45 per 10 hills, respectively) (**Table 2.4.1**). The highest yield (6433.3 kg/ha) was observed in T7 (Cartap hydrochloride) followed by T6 (5166.7 kg/ha) and T3 (4766.7 kg/ha) as against the lowest yield of 1700 kg/ha in untreated control (T8).

2. *Coimbatore*

A low infestation of less than 2 per cent by leaffolder was observed at Coimbatore along with stem borer damage. Chemical control treatment (T7) recorded the lowest stem borer damage at both 7 DAS (3.49%) and 15 DAS (3.33%), followed closely by *Bacillus thuringiensis* (T4) with 5.24% and 5.08% damage, respectively (**Table 2.4.2**). In contrast, the untreated control (T8) had the highest pest damage at 15.93% (7 DAS) and 13.11% (15 DAS). All entomopathogen treatments were on par and recorded significantly higher number of natural enemies *viz.*, mirids (10.67/10 hills) and coccinellids (9.30/10 hills). The lowest populations of mirid (1.34/10 hills) and coccinellid (0.60/10 hills) were observed in chemical control (**Table 2.4.2**). The highest yield was recorded in (T7) chemical control (4068 kg/ha), followed by T4 (*Bacillus thuringiensis*) at 3723 kg/ha. *Bacillus thuringiensis* NRRI TB 261 (T4) emerged as the most effective biological control option.

3. *Chinsurah*

A low infestation of leaffolder was observed at Chinsurah along with stem borer damage. At 7 DAS after spray all treatments of entomopathogens were on par with chemical control with dead hearts ranging from 1.90 -6.68 % (**Table 2.4.3**). At 15 DAS, chemical control (T7) exhibited the lowest pest damage with a mean dead heart damage of 0.54% and 1.02% white ears (WE) by stem borer. Among the bioagents, *Metarhizium anisopliae* NBAIR-Ma35 (T2) recorded lowest white ears. Conversely, the untreated control (T8) showed the highest dead heart damage by stem borer, with 15.06% (7 DAS), 9.50% (15 DAS), and 10.72% (WE) (**Table 2.4.3**). Regarding natural enemies, T7 had the lowest populations of spiders (0.67/10 hills) and coccinellids (0.22/10 hills. In contrast, natural enemy populations remained relatively stable across biological treatments, with *Metarhizium anisopliae* (T5) and *Beauveria bassiana* (T6) supporting significantly higher spider (2.22–2.89) and coccinellid (1.64–2.44) populations.

Yield analysis revealed that T7 (Cartap hydrochloride + Chlorantraniliprole) produced the highest yield (6189 kg/ha), followed by *Metarhizium anisopliae* (T2) at 5950 kg/ha and *Beauveria bassiana* (T6) at 5787 kg/ha. The lowest yield was recorded in T8 (Control) at 4302 kg/ha.

4. *Chiplima*

Observations were recorded on Leaffolder and stem borer damage at Chiplima along with natural enemy population. Significant differences were seen in leaffolder damage among various treatments, but damage was at a low-level ranging from 0.8 – 7.89 per cent at 7 and 15 DAS (**Table 2.4.4**). Though chemical control (T7) showed the lowest SB damage at both 7 DAS (1.82%) and 15 DAS (1.41%), *Metarhizium anisopliae* NRRI TF 9 was on par with chemical control at 7 DAS. Conversely, the untreated control (T8) recorded the highest infestation, with 7.26% (7 DAS) and 9.66% (15 DAS). Among natural enemies, mirid population was significantly higher in the untreated control (T8) at 17.00 per 10 hills, while chemical control (T7) recorded the least (7.67) (**Table 2.4.4**). Spider numbers remained on par across treatments, except in T7 (3.11 per 10 hills), which had significantly lower numbers than other biological treatments. Coccinellids were not significantly affected across treatments. In terms of yield, T7 achieved the highest grain yield (4767 kg/ha), followed by *Bacillus thuringiensis* (T4) at 4422 kg/ha. The lowest yield was observed in T8 (Control) at 2400 kg/ha (**Table 2.4.4**).

5. *Cuttack*

Only leaffolder damage was observed. Chemical control (T7) recorded the lowest LF damage at both 7 DAS (4.21%) and 15 DAS (1.55%), significantly outperforming all other treatments (**Table 2.4.5**). In contrast, the untreated control (T8) had the highest infestation levels at 14.94% (7 DAS) and 9.66% (15 DAS). Among biological treatments, *Bacillus thuringiensis* (T4) and *Beauveria bassiana* (T3) recorded significantly lower LF damage than other entomopathogens. However, *Metarhizium anisopliae* (T2 and T5) exhibited relatively higher damage levels, indicating moderate efficacy. Chemical control (T7) (recorded the lowest spider population (0.33 per 10 hills) but statistically not significant across treatments, with values ranging from 1.33 to 2.67 per 10 hills in biocontrol plots. In terms of yield performance, T7 chemical control achieved the highest grain yield (6167 kg/ha), significantly exceeding all other treatments. *Bacillus thuringiensis* (T4) and *Bacillus albus* (T1) also produced relatively high yields of 5733 kg/ha and 5600 kg/ha, respectively (**Table 2.4.5**). The lowest yield was observed in T8 (Control) at 4100 kg/ha.

6. *Gangavathi:*

After the first spray stem borer damage was nil in all entomopathogen treatments while 8.06 and 20.04 per cent damage was recorded in chemical control (T7) and untreated control respectively at 7DAS and 24.53 per cent 15 DAS in untreated control. Leaffolder damage was nil in all treatments at 7 DAS excepting T7 (8.41 %) and T8 (20.49 %) while damage was only recorded in untreated control at 15 DAS (22.46 %). The pest population was very low and hence was not suitable for analysis after second and third spray.

7. *Karjat*

Observations were recorded on damage by stem borer, leaffolder and impact of treatments on spider population. Chemical control (T7) recorded the mean lowest pest damage (**Table 2.4.6**), with SB damage of 2.28% (7 DAS) and 2.19% (15 DAS), and LF damage of 3.47% (7 DAS) and 1.55% (15 DAS). This treatment was significantly more effective than all biological alternatives. Conversely, the untreated control (T8) had the highest infestation, with SB damage reaching 10.10% (7 DAS) and 11.06% (15 DAS), and LF damage at 17.25% (7 DAS) and

9.66% (DAS). Among entomopathogens, *Bacillus thuringiensis* (T4), *Bacillus albus* (T1), and *Beauveria bassiana* (T3 & T6) performed relatively well, maintaining lower pest levels compared to *Metarhizium*-based treatments (T2 & T5) (**Table 2.4.6**). Natural enemy populations showed a significant reduction in T7 (Cartap hydrochloride + Chlorantraniliprole), which had the lowest spider population (2.58 per 10 hills). In contrast, entomopathogen treatments supported higher spider population, with *Beauveria bassiana* (T6) showing the highest spider count (12.63 per 10 hills), comparable to the untreated control.

Yield performance followed a similar trend, with T7 producing the highest grain yield (6433 kg/ha), significantly outperforming all treatments (**Table 2.4.6**). Among the biological options, *Beauveria bassiana* (T6) and T3 performed best (5167 kg/ha and 4767 kg/ha, respectively), while *Bacillus thuringiensis* (T4) and *Metarhizium anisopliae* (T5) showed moderate yields (2700–4000 kg/ha). The untreated control had the lowest yield (1700 kg/ha).

8.*Kaul*

Significant treatment differences were observed for damage by stem borer and leaffolder. However, the maximum leaffolder damage was only 5.48% in untreated control. Chemical control (T7) had the least pest damage, with SB damage of 1.50% (7 DAS) and 3.23% (15 DAS) (**Table 2.4.7**). The untreated control (T8) had the highest pest infestation, with SB damage at 5.73% (7 DAS) and 7.42% (15 DAS). Among the biological treatments, *Bacillus thuringiensis* (T4) showed the lowest SB damage (2.87% at 7 DAS and 4.86% at 15 DAS. On the other hand, T7 had the lowest spider population (3.00 per 10 hills), suggesting a negative impact on natural enemies. The untreated control (T8) had the highest natural enemy counts, with 4.44 spiders and 1.89 coccinellids per 10 hills. Entomopathogen treatments (T1–T6) supported moderate to high natural enemy populations, with *Beauveria bassiana* (T5) and *Bacillus thuringiensis* (T4) showing slightly higher spider and coccinellid numbers. Among entomopathogens, *Bacillus thuringiensis* (T4) performed well, maintaining lower pest levels while supporting natural predators.

9. Ludhiana

The chemical treatment, (T7), resulted in the lowest pest damage, with SB damage of 2.70% (15 DAS), white ears 3.45%, and LF damage of 3.50% (7 DAS) and 4.07% (DAS) (**Table 2.4.8**). The untreated control (T8) exhibited the highest infestation, with SB damage at 6.81% (7 DAS) and 8.56% (15 DAS), and LF damage at 7.91% (7 DAS) and 10.70% (DAS). Among the entomopathogens, *Bacillus thuringiensis* (T4) recorded the lowest pest damage, with SB damage of 3.87% (7 DAS) and 3.97% (15 DAS), and LF damage of 3.97% (7 DAS) and 4.25% (DAS) but was on par with all other biological treatments. The spider population remained on par across treatments, ranging from 0.93 to 1.18 per 10 hills, with the highest count observed in the untreated control (T8). Chemical control (T7) had the highest yield (6670 kg/ha), followed by *Bacillus albus* (T1) at 6292 kg/ha, while the lowest yield was recorded in the untreated control (5282 kg/ha). *Bacillus thuringiensis* (T4) among bioagents provided significant pest suppression while maintaining natural enemy populations.

10. *Mandya*

Damage by stem borer and leaffolder was observed and recorded along with natural enemies like mirids, spiders and coccinellids. The chemical treatment, (T7), was the most effective in reducing pest damage, with SB damage of 4.93% (7 DAS) and 5.66% (15 DAS), and LF damage of 4.44% (7 DAS) and 4.59% (DAS) (**Table 2.4.9**). The untreated control (T8) exhibited the highest infestation, with SB damage at 20.32% (7 DAS) and 20.58% (15 DAS), and LF damage at 14.21% (7 DAS) and 14.85% (DAS). Among the entomopathogens, *Beauveria bassiana* NRRI TF 6 (T6) was the best, with SB damage of 9.31% (7 DAS) and 11.18% (15 DAS), and LF damage of 5.79% (7 DAS) and 5.93% (DAS).

Natural enemy populations, including mirids, spiders, and coccinellids, were highest in treatments with entomopathogens, particularly *Beauveria bassiana* NRRI TF 6 (T6) and *Beauveria bassiana* NBAIR-Bb5a (T3), while the chemical treatment (T7) resulted in the lowest numbers (**Table 2.4.9**). The yield was highest in the chemical treatment (T7) at 7333 kg/ha, followed by *Beauveria bassiana* NRRI TF 6 (T6) at 6067 kg/ha, while the untreated control (T8) recorded the lowest yield at 2600 kg/ha (**Table 2.4.9**). *Beauveria bassiana* (T3, T6) performed better, while maintaining beneficial insect populations.

11. *Moncompu*

Observation on stem borer, leaffolder and minor lepidopteran pest were recorded along with natural enemies. The chemical treatment (T7) resulted in the lowest pest damage, with SB damage at 1.41% (7 DAS) and 0.00% (15 DAS) and LF damage at 2.84% (7 DAS) and 0.33% (DAS) (**Table 2.4.10**). The untreated control (T8) had the highest infestation, with SB damage at 11.69% (7 DAS) and 14.95% (15 DAS) and LF damage at 13.52% (7 DAS) and 13.29% (DAS). Among the entomopathogens, *Bacillus thuringiensis* NRRI TB 261 (T4) showed the lowest pest infestation, with SB damage of 1.18% (7 DAS) and 0.96% (15 DAS), and LF damage of 4.55% (7 DAS) and 1.01% (15 DAS). Other treatments, such as *Bacillus albus* NBAIR-BATP (T1) and *Metarhizium anisopliae* NRRI TF 9 (T5), also demonstrated notable pest reduction (**Table 2.4.10**). Though highest numbers of minor pests, mirids, and spiders were observed in the untreated control (T8), while entomopathogens generally supported a higher population of natural enemies the treatment variations were not significant.

Yield was highest in *Bacillus albus* NBAIR-BATP (T1) at 4933.3 kg/ha, followed closely by *Metarhizium anisopliae* NRRI TF 9 (T5) at 4830 kg/ha and *Beauveria bassiana* NRRI TF 6 (T6) at 4856.7 kg/ha. The lowest yield was recorded in the untreated control (T8) at 4475 kg/ha (**Table 2.4.10**).

12. *Navsari*

The chemical treatment (T7) demonstrated the lowest pest damage, with SB damage at 9.47% (7 DAS) and 7.69% (15 DAS) and LF damage at 8.03% (7 DAS) and 7.27% (DAS) (**Table 2.4.11**). In contrast, the untreated control (T8) exhibited the highest infestation levels, with SB damage reaching 21.11% (7 DAS) and 24.97% (15 DAS), while LF damage was 18.02% (7 DAS) and 19.21% (DAS). Among the entomopathogens, *Bacillus thuringiensis* NRRI TB 261 (T4) was the most effective, reducing SB damage to 9.55% (7 DAS) and 9.64% (15 DAS) and LF damage to 9.07% (7 DAS) and 9.12% (DAS). *Metarhizium anisopliae* NBAIR-Ma35 (T2) also showed promising results with SB damage at 9.54% (7 DAS) and LF damage at 9.88% (15 DAS) (**Table 2.4.11**). In contrast, *Beauveria bassiana* NRRI TF 6 (T6) was among the least effective, with pest damage close to the untreated control.

Natural enemy populations, including mirids, spiders, and coccinellids, showed minor variations across treatments. Their presence was generally low, and no significant differences were observed between treatments.

Yield results showed that chemical treatment (T7) provided the highest yield at 4938 kg/ha, followed by *Bacillus thuringiensis* NRRI TB 261 (T4) at 3921 kg/ha and *Metarhizium anisopliae* NBAIR-Ma35 (T2) at 3646 kg/ha. The lowest yield was recorded in the untreated control (T8) at 2698 kg/ha (**Table 2.4.11**).

13.*Raipur*

The untreated control (T8) exhibited the highest pest damage (Table 2.5.12), with SB damage at 28.46% (15 DAS) and LF damage at 9.29% (7 DAS). In contrast, all treatments significantly reduced pest damage, with *Bacillus albus* NBAIR-BATP (T1) showing the lowest LF damage at 3.52% followed by *Beauveria bassiana* NBAIR-Bb5a (T3) at 3.56%. Natural enemy populations were on par across treatments, with spider counts ranging from 2.50 (T6) to 4.00 (T2 and T4), and coccinellid counts ranging from 4.00 (T4 and T6) to 6.00 (T5).

All treatments were on par for yield excepting untreated control which recorded the lowest yield. Yield ranged from 5508 – 5892 kg/ha among treatments.

14.*Ranchi*

All entomopathogen treatments significantly reduced pest infestation compared to the untreated control (T8), which showed the highest pest damage (SB: 12.04%, LF: 20.26%) and lowest yield (1793 kg/ha). Among bioagents, *Beauveria bassiana* NRRI TF 6 (T6) and *Metarhizium anisopliae* NRRI TF 9 (T5) performed relatively better, recording higher yields (5400 and 5317 kg/ha) and maintaining natural enemy populations. Cartap hydrochloride and/or Chlorantraniliprole (T7) recorded the highest grain yield (7567 kg/ha), which was significantly superior to all other treatments.

Evaluation of entomopathogens against lepidopteran pests of rice was taken up in fourteen locations to test the effectiveness of different strains of the *entomopathogens, Bacillus albus, Bacillus thuringiensis two strains of Beauveria bassiana and two strains of Metarhizium anisopliae, in comparison with chemical and untreated control. While chemical control consistently provided the lowest pest damage of stem borer and leaf folder and highest yield across all locations (6433–7567 kg/ha), it significantly reduced natural enemy populations of mirids, spiders and coccinellids. The entomopathogenic treatments consistently reduced lepidopteran pest damage and supported natural enemy abundance compared to theuntreated control. Bacillus thuringiensis* NRRI TB 261 was *highly effective at Chiplima and Coimbatore, with the lowest SB damage (2.56 – 5.80 %) and at Cuttack for leafffolder (6.31 %). Beauveria bassiana NBAIR-Bb5a and NRRI TF 6 strains and Metarhizium anisopliae strains (T3, T5, T6) resulted in moderate pest control and higher yields (up to 6067 kg/ha), with greater natural enemy retention. Control plots showed the highest pest damage and lowest yields (1700–3049 kg/ha). Overall, biopesticides offered sustainable, eco-friendly alternatives with varied but promising efficacy across locations.*

Table 2.4.1. Effect of entomopathogens on lepidopteran pests and natural enemies at Brahmavar, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#						Natural Enemies (No./ 10 hills) *			Yield ** (kg/ha)
	SB		LF		Minor pests		Mirids	Spiders	Cocci-nellids	
	7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS				
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	15.17^{b} (22.82)	16.75^{c} (24.09)	11.42^{b} (19.48)	12.40^{c} (20.33)	10.02^{d} (18.35)	10.52^{c} (18.56)	9.38^{a} (3.04)	8.41^{a} (2.94)	5.44^{a} (2.37)	2233^{ef}
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	15.36^{c} (22.92)	16.74^{c} (24.04)	10.38^{b} (18.39)	11.75^{c} (19.62)	7.95^{c} (16.33)	9.08^{c} (17.52)	11.21^{a} (3.29)	9.86^{a} (3.13)	7.82^{b} (2.83)	3333^{d}
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	13.34^{c} (21.31)	14.14^{b} (21.96)	7.65^{a} (15.87)	6.69^{a} (14.88)	3.12^{b} (10.03)	2.06^{b} (7.90)	14.81^{a} (3.70)	11.96^{a} (3.42)	8.45^{a} (2.84)	4767^{b}
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	17.64^{c} (24.74)	19.27^{d} (26.00)	11.94^{b} (19.82)	12.63^{c} (20.45)	8.79^{c} (17.19)	9.44^{c} (17.85)	7.50^{ab} (2.75)	8.30^{a} (2.88)	8.51^{a} (2.95)	2700^{e}
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	13.83^{c} (21.70)	16.30^{c} (23.69)	12.09^{b} (20.08)	13.74c (21.45)	9.97d (18.33)	10.56^{c} (18.89)	10.57^{a} (3.249)	10.84^{a} (3.38)	8.87^{a} (3.04)	4000^{c}
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	12.79^{c} (20.60)	14.53b (22.13)	8.22^{a} (16.48)	7.64^{b} (15.95)	2.92^{b} (9.67)	2.25^{b} (8.35)	12.33^{a} (3.42)	12.63^{a} (3.38)	7.75^{a} (2.77)	5167^{b}
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	11.22^{a} (19.55)	11.37^{a} (19.69)	6.76^{a} (14.19)	5.53^{a} (13.06)	0.82^{a} (4.18)	0.44^{a} (2.16)	2.73^{c} (1.69)	2.58^{b} (1.62)	0.96^{c} (1.12)	6433^{a}
T8. Control (Untreated)	20.29^{c} (26.66)	21.64^{d} (27.65)	15.70^{b} (22.84)	17.92^{c} (24.57)	12.74^{d} (20.83)	14.80^{d} (22.56)	10.67^{a} (3.24)	11.41^{a} (3.42)	12.09^{a} (3.46)	1700^{f}

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.2. Effect of entomopathogens on lepidopteran pests and natural enemies at Coimbatore, EELP, ***kharif*** 2024

TREATMENT	SB Per cent Damage#		Natural Enemies (No./ 10 hills) *		Yield** (kg/ ha)
	7 DAS	15 DAS	Mirids	Coccinellids	
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	12.39^e (20.25)	9.80^c (18.21)	1.70^a (3.02)	5.49^a (2.35)	3176^d
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	9.56^d (17.95)	8.63^c (17.02)	1.26^a (2.52)	6.40^a (2.59)	3355^{cd}
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	8.05^d (16.36)	8.43^c (16.84)	1.45^a (2.86)	4.84^a (2.25)	3466^{bc}
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	5.24^b (13.08)	5.08^b (12.84)	1.63^a (2.39)	6.93^a (2.69)	3723^b
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	6.48c (14.56)	7.67^c (16.03)	1.69^a (2.80)	8.30^a (2.95)	3569^{bc}
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	6.41c (14.58)	14.53^b (22.13)	1.53^a (2.71)	5.62^a (2.39)	3675^b
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	3.49^a (10.39)	3.33^a (9.44)	1.34^b (1.73)	0.60^b (1.00)	4068^a
T8. Control (Untreated)	15.93^f (23.33)	13.11^d (21.19)	10.67^a (3.24)	9.30^a (3.07)	3049^e

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.3. Effect of entomopathogens on lepidopteran pests and natural enemies at Chinsurah, EELP, ***kharif*** 2024

TREATMENT	SB Per cent Damage#			Natural Enemies (No./ 10 hills) *		Yield** (kg/ ha)
	7 DAS	15 DAS	WE	Spiders	Coccinellids	
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	6.68^a (14.37)	4.25^b (11.60)	4.63^e (12.41)	2.56^a (1.72)	1.89^a (1.50)	3176^d
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	3.64^a (9.41)	1.24^b (5.70)	1.53^b (7.11)	2.11^a (1.55)	2.22^a (1.59)	5950^b
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	6.61^a (14.18)	3.83^b (10.89)	3.28^d (10.38)	1.78^a (1.42)	2.00^a (1.49)	5153^d
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	5.80^a (13.37)	3.17^b (7.97)	5.18^e (13.11)	2.89^a (1.76)	1.67^a (1.39)	5091^d
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	5.15a (12.31)	3.02^b (9.49)	2.56^c (9.18)	2.00^a (1.47)	2.22^a (1.56)	5550^c
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	3.86a (10.32)	2.50^b (7.97)	2.79^c (9.59)	2.22^a (1.59)	2.44^a (1.64)	5787^b
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	1.90^a (6.79)	0.54^a (2.93)	1.02^a (5.72)	0.67^b (1.02)	0.22^b (0.82)	6189^a
T8. Control (Untreated)	15.06^b (22.70)	9.50^d (17.55)	10.72^f (19.07)	2.78^a (1.76)	2.11^a (1.56)	4302^e

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.4. Effect of entomopathogens on lepidopteran pests and natural enemies at Chiplima, EELP, ***kharif*** 2024

TREATMENT	SB Per cent Damage#		Natural Enemies (No./ 10 hills) *			Yield** (kg/ ha)
	7 DAS	15 DAS	Mirids	Spiders	Coccinellids	
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	3.51^b (10.22)	4.12^b (10.22)	5.00^b (2.32)	5.22^a (2.36)	1.22	4320^{bc}
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	4.11^b (10.55)	5.47^b (10.55)	3.33c (1.95)	4.67a (2.30)	1.22	4100^{de}
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	3.81^b (10.90)	3.77^b (10.89)	3.00^c (1.86)	3.78a (2.06)	1.44	4133^{de}
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	2.56^b (8.94)	2.90^a (8.99)	4.00^b (2.11)	4.89^a (2.30)	1.11	4422^b
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	3.37^a (10.29)	3.34^b (10.29)	4.33^b (2.18)	4.56^{aa} (2.23)	1.33	4267^{cd}
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	4.85^b (12.03)	5.60^b (12.03)	4.67^b (2.27)	4.56^a (2.23)	1.56	4067^e
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	1.82^a (7.68)	1.41^a (7.68)	7.67^b (2.84)	3.11^b (1.84)	0.33	4767^a
T8. Control (Untreated)	7.26^b (14.69)	9.66^d (14.69)	17.00^a (4.17)	6.67^a (2.62)	2.00	2400^f

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.5. Effect of entomopathogens on lepidopteran pests and natural enemies at Cuttack, EELP, ***kharif*** 2024

TREATMENT	LF Per cent Damage#		Spiders (No./ 10 hills) *	Yield** (kg/ ha)
	7 DAS	15 DAS		
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	8.80c (17.22)	3.74^b (11.10)	1.67	5600^b
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	11.39^c (19.60)	7.26^b (15.63)	1.33	4933^d
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	7.47^b (15.73)	4.55^b (12.06)	2.00	5133^{cd}
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	7.12^b (15.20)	3.24^b (10.19)	2.33	5733^b
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	11.92^c (20.16)	6.99b (15.23)	2.33	5233^c
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	9.38^c (17.78)	4.06^b (11.48)	2.33	4900^d
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	4.21^a (11.69)	1.55^a (5.85)	0.33	6167^a
T8. Control (Untreated)	14.94^c (22.71)	9.66^d (14.69)	2.67	4100^e

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.6. Effect of entomopathogens on lepidopteran pests and natural enemies at Karjat, EELP, kharif 2024

TREATMENT	Per cent Damage#				Spiders (No./ 10 hills) *	Yield ** (kg/ha)
	SB		LF			
	7 DAS	15 DAS	7 DAS	DAS		
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	4.54^b (12.14)	4.60^b (12.26)	7.93^b (16.28)	3.74^b (11.10)	8.41^a (2.94)	2233^{ef}
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	4.83^b (12.43)	5.93^b (13.98)	9.78^b (18.18)	7.26^b (15.63)	9.86^a (3.13)	3333^d
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	5.06^b (12.90)	5.17^b (13.07)	8.78^b (17.11)	4.55^b (12.06)	11.96^a (3.42)	4767^b
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	4.65^b (12.38)	4.60^b (12.27)	7.66^b (15.96)	3.24b (10.19)	8.30^a (2.88)	2700^e
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	5.85^b (13.92)	6.18^b (14.35)	9.94^b (18.34)	6.99b (15.23)	10.84^a (3.38)	4000^c
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	5.30^b (13.21)	5.37^b (13.31)	8.86^b (17.26)	4.06^b (11.48)	12.63^a (3.38)	5167^b
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	2.28^a (8.40)	2.19^a (7.79)	3.47^a (10.56)	1.55a (5.85)	2.58^b (1.62)	6433^a
T8. Control (Untreated)	10.10^c (18.24)	11.06^c (19.22)	17.25^c (24.43)	9.66^d (14.69)	11.41^a (3.42)	1700^f

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB-Stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.7. Effect of entomopathogens on lepidopteran pests and natural enemies at Kaul, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#				Natural Enemies (No./ 10 hills) *		
	SB		LF				
	7 DAS	15 DAS	7 DAS	DAS	Mirids	Spiders	Coccinellids
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	3.39b (10.53)	4.79b (12.58)	1.21	1.64	0.33	4.44	1.11
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	3.94b (11.06)	5.88b (13.93)	3.28	3.52	0.22	4.11	0.78
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	4.36b (11.74)	6.52b (14.68)	3.29	3.41	0.22	4.22	0.89
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	2.87b (9.56)	4.86b (12.64)	1.31	1.57	0.33	4.56	1.11
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	3.50b (10.41)	6.24b (14.37)	3.39	3.70	0.22	4.56	1.33
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	3.87b (10.90)	5.88b (13.97)	3.40	3.59	0.11	4.44	0.67
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	1.50a (6.92)	3.23a (9.65)	2.04	2.32	0.11	3.00	0.78
T8. Control (Untreated)	5.73b (13.31)	7.42b (15.70)	5.46	5.23	0.33	4.44	1.89

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB – stem borer; LF – leaffolder;

Table 2.4.8. Effect of entomopathogens on lepidopteran pests and natural enemies at Ludhiana, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#					Spiders (No./ hill) *	Yield** (kg/ha)
	SB (DH)		SB (WE)	LF			
	7 DAS	15 DAS		7 DAS	DAS		
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	4.14 b (11.74)	4.30 b (11.96)	5.32 b (13.33)	4.40	4.93a (12.65)	1.00	6292b
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ ml) @ 10ml/L	4.03 b (11.58)	4.48 b (12.19)	5.17 b (13.15)	4.77	5.51a (13.43)	1.00	5878c
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	4.04 b (11.60)	4.35 b (12.02)	4.97 b (12.88)	4.55	4.89a (12.66)	0.93	5903c
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	3.87 b (11.35)	3.97 b (11.49)	5.04 b (12.98)	3.97	4.25a (11.83)	0.98	5965c
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	3.98 b (11.51)	4.40 b (12.08)	5.22 b (13.2)	4.47	5.42a (13.32)	1.00	5863c
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	4.22 b (11.85)	4.60 b (12.37)	5.36 b (13.39)	5.18	6.25a (14.32)	1.02	5906c
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	2.22 a (8.56)	2.33 a (8.78)	3.45 a (10.7)	3.50	4.07a (11.63)	1.04	6670c
T8. Control (Untreated)	6.81 c (15.11)	8.27 c (16.63)	9.13 c (17.58)	7.91	10.70b (18.71)	1.18	5282d

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; DH-Deadheart; WE-Whitears; LF – leaffolder; **Yield extrapolated

Table 2.4.9. Effect of entomopathogens on lepidopteran pests and natural enemies at Mandya, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#				Natural Enemies (No./ 10 hills) *			Yield ** (kg/ha)
	SB		LF					
	7 DAS	15 DAS	7 DAS	DAS	Mirids	Spiders	Cocci-nellids	
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	12.90^c (20.94)	13.41^b (20.99)	9.29^c (17.68)	10.86^c (19.16)	24.11	14.67	6.89^b (2.67)	3133^{ef}
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	11.08^c (19.32)	11.75^b (19.56)	7.07^c (15.20)	7.34^b (15.52)	27.00	17.22	10.33^a (3.23)	4233^d
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	7.27^b (15.45)	9.15^b (17.12)	5.20^b (12.93)	5.96 ^{b} (13.93)	33.33	21.89	14.00^a (3.74)	5667^b
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	7.2^b (15.39)	7.71^b (15.57)	7.31^c (15.39)	7.93^b (16.18)	22.11	14.56	11.56^a (3.41)	3600^e
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	11.01^c (19.29)	11.93^b (19.88)	7.38^c (15.66)	8.19^b (16.54)	26.22	18.44	11.44^a (3.43)	4900^c
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	9.31^c (17.67)	11.18^b (19.11)	5.79^b (13.75)	5.93^b (13.90)	29.44	22.11	13.89^a (3.76)	6067^b
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	4.93^a (12.59)	5.66^a (13.27)	4.44^a (11.87)	4.59^a (12.19)	16.00	10.56	4.33 ^{c} (2.15)	7333^a
T8. Control (Untreated)	20.32^d (26.69)	20.58^c (26.82	14.21^c (22.02)	14.85^d (22.61)	25.78	18.78	14.56^a (3.79)	2600^f

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.10. Effect of entomopathogens on lepidopteran pests and natural pests at Moncompu, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#						Natural Enemies (No./ 10 hills) *			Yield** (kg/ha)
	SB		LF		Minor pests		Mirids	Spiders	Cocci-nellids	
	7 DAS	15 DAS	7 DAS	DAS	7 DAS	15 DAS				
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	1.84[a] (6.16)	0.39[a] (2.05)	5.79[a] (13.23)	0.93[a] (5.01)	1.11	0.00	2.89	1.00	6.00	4933[a]
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	2.69[a] (8.34)	1.00[a] (4.61)	4.69[a] (12.10)	2.02[a] (7.65)	3.75	0.92	1.67	1.00	5.56	4847[a]
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	2.48[a] (7.35)	1.00[a] (3.88)	4.23[a] (11.72)	1.51[a] (6.70)	2.13	0.49	2.89	0.93	5.56	4720[ab]
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	1.18[a] (5.05)	0.96[a] (4.55)	4.55[a] (11.86)	1.01[a] (5.45)	1.55	0.22	3.56	0.98	4.22	4680[ab]
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	1.97[a] (7.13)	0.82[a] (3.00)	4.02[a] (11.14)	2.02[a] (7.64)	1.98	0.61	1.56	1.00	4.67	4830[a]
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	2.50[a] (8.23)	1.26[a] (5.73)	5.73[a] (13.29)	2.04[a] (7.86)	2.96	0.94	2.11	1.02	3.33	4857[a]
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	1.41[a] (6.12)	0.00[a] (0.00)	2.84[a] (9.57)	0.33[a] (2.81)	1.79	0.00	2.11	1.04	3.33	4773[a]
T8. Control (Untreated)	11.69[b] (19.89)	14.95[b] (22.41)	13.52[b] (21.24)	13.29[b] (21.21)	5.27	6.53	2.56	1.18	6.00	4475[b]

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.11. Effect of entomopathogens on lepidopteran pests and natural enemies at Navsari, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#				Natural Enemies (No./ 10 hills) *			Yield ** (kg/ha)
	SB		LF		Mirids	Spiders	Cocci-nellids	
	7 DAS	15 DAS	7 DAS	DAS				
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	14.88^c (22.64)	15.43^d (23.01)	12.10^c (20.28)	13.09^d (21.15)	0.56	1.44	0.22	3208^d
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	9.54^a (17.91)	11.36^c (19.57)	11.17^c (19.50)	9.88^b (18.26)	0.78	1.44	0.33	3646^c
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	14.81^c (22.46)	16.57^d (23.79)	13.74^c (21.67)	14.63^d (22.45)	1.33	0.89	0.56	3063^d
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	9.55^a (17.97)	9.64^b (17.97)	9.07^b (17.44)	9.12^b (17.55)	0.44	1.44	0.11	3921^b
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	11.85^b (19.93)	13.98^d (21.85)	10.99^c (19.32)	10.80^c (19.09)	0.89	1.11	0.33	3500^c
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	16.26^c (23.65)	18.98^d (25.54)	15.60^e (23.16)	15.93^d (23.39)	0.56	1.00	0.22	3010^d
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	9.47^a (17.81)	7.69^a (16.02)	8.03^a (16.37)	7.27^a (15.52)	0.22	0.33	0.00	4938^a
T8. Control (Untreated)	21.11^d (27.15)	24.97^e (29.76)	18.02^e (24.99)	19.21^e (25.88)	0.89	1.11	0.33	2698^e

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.12. Effect of entomopathogens on lepidopteran pests and natural enemies at Raipur, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#		Natural Enemies (No./ 10 hills) *		Yield ** (kg/ha)
	SB	LF	Spiders	Coccinellids	
	15 DAS	7 DAS	3.97	5.26	
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	16.58a (23.96)	3.56a (10.58)	4.00	4.00	5533[a]
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	18.26a (25.18)	4.28a (11.64)	3.50	6.00	5508[a]
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	17.53a (24.64)	4.60a (11.95)	2.50	4.00	5600[a]
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	17.75a (24.89)	4.88a (12.49)	3.04	5.57	5892[a]
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	19.25a (25.72)	5.33a (12.90)	3.50	5.25	5575[a]
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	28.46b (32.24)	9.29b (17.61)	3.97	5.26	5525[a]
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	16.58a (23.96)	3.56a (10.58)	4.00	4.00	5642[a]
T8. Control (Untreated)	18.26a (25.18)	4.28a (11.64)	3.50	6.00	4708[b]

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

Table 2.4.13. Effect of entomopathogens on lepidopteran pests and natural enemies at Ranchi, EELP, ***kharif*** 2024

TREATMENT	Per cent Damage#				Natural Enemies (No./ 10 hills) *			Yield** (kg/ha)
	SB		LF		Mirids	Spiders	Cocci-nellids	
	7 DAS	15 DAS	7 DAS	15 DAS				
T1. *Bacillus albus* NBAIR-BATP (1 x 10^8cfu/ml) @ 10ml/L	6.95^a (15.17)	15.17^a (14.08)	4.47 (11.84)	3.28^a (10.10)	10.00^b (3.23)	24.44^b (4.99)	14.44^b (3.86)	4583^b
T2. *Metarhizium anisopliae* NBAIR-Ma35 (1 x 10^8 cfu/ml) @ 10ml/L	6.19^a (14.25)	14.25^a (13.21)	4.18 (11.29)	2.58^a (8.41)	10.67^b (3.33)	21.44^b (4.68)	13.33^b (3.70)	4267^b
T3. *Beauveria bassiana* NBAIR-Bb5a (1 x 10^8cfu/ml) 10ml/L	5.77^a (13.77)	13.77^a (12.63)	4.15 (11.35)	3.01^a (9.52)	11.67^b (3.48)	20.44^b (4.57)	13.33^b (3.71)	4233^b
T4. *Bacillus thuringiensis* NRRI TB 261 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	6.48^a (14.55)	14.55^a (16.72)	9.15 (15.22)	3.27^a (9.95)	10.33^b (3.27)	21.20^b (4.65)	12.89^b (3.65)	3983^b
T5. *Metarhizium anisopliae* NRRI TF 9 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	5.47^a (13.35)	13.35^a (12.31)	4.65 (12.14)	4.89^b (11.51)	10.44^b (3.30)	22.78^b (4.81)	14.00^b (3.79)	5317^b
T6. *Beauveria bassiana* NRRI TF 6 (1 x 10^8cfu/ml) 2 g/ l of water or 1kg/ha in 500 l of water	6.04^a (14.05)	14.05^a (12.93)	4.30 (11.57)	3.05^a (9.71)	10.56^b (3.31)	20.67^b (4.60)	12.89^b (3.65)	5400^b
T7. Cartap hydrochloride 4G granules @ 25kg /ha at the vegetative phase and /or Chlorantraniliprole 18 SC at booting stage @150 ml/ha based on ETL	6.45^a (14.57)	14.57^a (13.26)	4.65 (12.04)	5.77^b (12.18)	10.44^b (3.26)	19.22^c (4.40)	14.11^b (3.78)	7567^a
T8. Control (Untreated)	12.04^b (20.26)	20.26^b (21.18)	8.36 (16.76)	8.80^b (17.24)	19.33^a (4.44)	36.00^a (6.04)	23.22^a (4.85)	1793^c

Figures in parentheses are #Arcsine/ *square root transformed; Means followed by common letters in the same column are not significantly different at 5% level; DAS- days after spraying; SB- stem borer; LF – leaffolder; **Yield extrapolated

2.5 ECOLOGICAL STUDIES

Ecological studies consisted of three trials: i) Influence of Establishment Methods on Pest Incidence (IEMP), ii) Pest Incidence in Natural Farming (PINF) and iii) Evaluation of Pheromone Blends for Insect Pests of Rice (EPBI).

2.5.1 Influence of Establishment Methods on Pest Incidence (IEMP)

With increasing water scarcity worldwide, in Asia in general and India in particular, there is growing pressure to minimize water usage in irrigated agriculture. In India, traditional rice cultivation poses a significant challenge to water conservation. To address this issue, rice farmers are increasingly adopting alternative establishment methods such as the System of Rice Intensification (SRI), mechanical transplanting, aerobic rice, and direct seeding (wet and dry) or alternate wetting and drying. With this in mind, a collaborative trial with the Agronomy division at the respective centres was designed to evaluate the impact of crop establishment methods on the incidence of insect pests.
During *Kharif* 2024, the trial was conducted at 13 locations, *viz*. Aduthurai, Chatha, Chinsurah, Chiplima, Gangavathi, Ghaghraghat, Jagdalpur, Moncompu, Nawagam, Pantnagar, Pattambi, Pusa and Titabar. The pest incidence *vis* – a-*vis* establishment methods in the trial at each location and overall insect pest incidence across locations are discussed below:

1. Aduthurai

Pest incidence in three establishment methods, *viz*., mechanical transplanting, wet direct seeding and normal transplanting were assessed with ADT 59 variety at this location (**Table 2.5.1.1**). The incidence of dead hearts caused by stem borer at 45 DAT was high in wet direct seeding (14.6% DH) and was at par with normal transplanting (10.2% DH) and mechanical transplanting (9.1% DH).

The incidence of white ear heads (<10% WE), silver shoots caused by gall midge (<8% SS), leaf folder (<9% LFDL), whorl maggot (<8% WMDL), hispa (<8% HDL), thrips (<9% THDL) and brown planthopper (<4 5hills) was low in all the three methods of crop establishment methods. However, White ear incidence was significantly high in normal; transplanting and at par with mechanical transplanting; leaffolder incidence was significantly high in direct seeding as compared to other planting methods.

Table 2.5.1.1. Influence of Crop Establishment Methods on Pest Incidence at Aduthurai, ***Kharif*** 2024

Treatments	% DH		% WE	% SS	% SS	% LFDL	% WMDL	% HDL	%THDL	BPH/ 5 hills
	45 DAT/ DAS	60 DAT/ DAS	Pre har	60 DAT/ DAS	75 DAT/ DAS	90 DAT/ DAS	15 DAT/ DAS	15 DAT/ DAS	15 DAT/ DAS	90 DAT/ DAS
T1 = Mechanical transplanting	9.1 (2.9)a	7.0 (2.3)a	6.3 (2.6)ab	5.1 (2.1)a	7.3 (2.6)a	5.7 (2.5)ab	7.4 (2.8)a	3.0 (1.9)a	3.9 (2.0)a	3.3 (2.0)a
T2 = wet Direct seeding	14.6 (3.8)a	5.5 (2.1)a	5.7 (2.4)b	5.2 (2.1)a	6.0 (2.2)a	8.4(2.9)a	7.9 (2.6)a	5.7 (2.1)a	4.3 (1.7)a	1.8 (1.4)a
T3 = Normal transplanting	10.2 (3.0)a	10.0 (2.9)a	9.3 (3.1)a	10.0 (3.0)a	3.7 (1.7)a	3.8(2.0)b	4.2 (1.9)a	7.9 (2.7)a	8.6 (2.5)a	3.3 (1.9)a
LSD (0.05)	1.73	2.36	0.52	1.03	1.68	0.57	1.65	1.75	2.05	0.63
CV (%)	26.9	26.1	13.2	29.80	23.40	15.9	26.9	23.7	22.00	24.9

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

2. Chatha

Two establishment methods, normal Transplanting and line-sowing methods were evaluated as main plots and weedy check, manual weeding and chemical weed control as sub-plots with Basmathi-370 variety at this location. Among the main plot treatments, the incidence of white ear heads caused by stem borer ranged between 13.0 and 21.1% and was at par in both the establishment methods (**Table 2.5.1.2)**. However, among the sub-plot treatments, the incidence was significantly lower in weedy check (11.7% WE) compared to chemical weed control (23.5% WE). The leaf folder damage varied from 19.0 - 41.0% LFDL in different observations and was at par in both the establishment methods. Similarly, the leaf folder damage was at par in all the sub-plot treatments and the interactions.

3. Chinsurah

The effect of Mechanical transplanting, wet direct seeding and normal transplanting methods on pest incidence was assessed on the Lalat variety at this location. The incidence of white earheads was high and varied from 13.9 – 22.1% but was at par in all three-crop establishment methods (**Table 2.5.1.3**). However, the incidence of dead hearts, leaf folder-damaged leaves and whorl maggot-damaged leaves were low (<10%) in all the establishment methods.

Table 2.5.1.2. Influence of Crop Establishment Methods on Pest Incidence at Chatha, ***Kharif*** 2024

Main plots		%WE	%LFDL			
		Pre harvest	67 DAT/DAS	74 DAT/DAS	94 DAT/DAS	117 DAT/DAS
Transplanting		21.1(4.4)a	19.0(4.3)a	32.5(5.7)a	30.6(5.5)a	35.9(6.0)a
Line sowing		13.0(3.4)a	22.6(4.7)a	41.0(6.4)a	22.4(4.8)a	30.3(5.5)a
LSD (0.05)		6.2	3.1	1.3	2.5	2.6
CV (%)		37.5	34.1	10.4	24.1	22.2
Subplots						
Weedy check		11.7(3.2)b	18.1(4.3)a	37.7(6.2)a	26.9(5.2)a	30.8(5.6)a
Manual weeding		16.0(4.0)ab	22.0(4.6)a	37.0(6.1)a	26.9(5.2)a	33.2(5.8)a
Chemical weed control		23.5(4.7)a	22.2(4.7)a	35.5(6.0)a	25.8(5.1)a	35.3(5.9)a
LSD (0.05)		0.8	0.6	0.4	0.5	0.7
CV (%)		15.3	10.2	4.6	6.9	9.4
Transplanting	Weedy check	13.1(3.6)a	18.8(4.4)a	32.5(5.8)a	33.8(5.8)a	35.9(6.0)a
	Manual weeding	18.5(4.3)ab	17.9(4.2)a	34.8(5.9)a	28.6(5.4)a	37.1(6.1)a
	Chemical weed control	31.6(5.5)b	20.1(4.5)a	30.1(5.5)a	29.4(5.4)a	34.7(6.0)a
Line sowing	Weedy check	10.2(2.8)a	17.3(4.2)a	42.9(6.6)a	19.9(4.5)a	25.8(5.1)a
	Manual weeding	13.5(3.6)a	26.1(5.1)a	39.2(6.3)a	25.2(5.0)a	29.3(5.4)a
	Chemical weed control	15.3(3.8)ab	24.4(5.0)a	40.9(6.4)a	22.1(4.7)a	35.9(5.9)a
LSD (0.05) M in S		1.1	0.9	0.5	0.7	1
LSD (0.05) S in M		6.2	3.2	1.3	2.5	2.6

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

Table 2.5.1.3. Influence of Crop Establishment Methods on Pest Incidence at Chinsurah, ***Kharif*** 2024

Treatments	% DH			% WE	% LFDL			% WMDL	
	60 DAT/ DAS	75 DAT/ DAS	90 DAT /DAS	Pre har	60 DAT/ DAS	75 DAT/ DAS	90 DAT/ DAS	45 DAT/ DAS	60 DAT/ DAS
T1=Mechanical transplanting	2.0 (1.6)a	3.5 (2.0)b	2.1 (1.6)c	13.9 (3.8)a	1.7 (1.5)b	0.5 (1.0)c	0.8 (1.1)b	1.7 (1.5)c	1.2 (1.3)b
T2 = Wet Direct seeding	3.4 (2.0)a	7.6 (2.9)a	6.0 (2.6)a	22.1 (4.7)a	3.1 (1.9)a	3.1 (1.9)a	3.5 (2.0)a	5.2 (2.4)a	3.4 (2.0)a
T3 = Normal transplanting	3.6 (2.0)a	4.6 (2.3)b	3.2 (1.9)b	15.6 (4.0)a	1.4 (1.4)b	1.8 (1.5)b	1.7 (1.5)b	3.4 (2.0)b	2.6 (1.8)a
LSD (0.05)	0.5	0.3	0.3	1.1	0.2	0.4	0.5	0.3	0.3
CV (%)	11.2	10.7	5.8	11.2	4.6	4.6	13.1	6.4	7.7

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

4. Chiplima

At this location, seven crop establishment methods, viz., broadcasting sprouted seeds; manual line sowing, mechanised line sowing, raised bed system, drum seeding and broadcasting with dry seed; and normal transplanting, broadcasting with dry seeds were evaluated with MTU 1156 variety (**Table 2.5.1.4**).

Table 2.5.1.4. Influence of Crop Establishment Methods on Pest Incidence at Chiplima, Kharif 2024

Treatments	% DH		% WE	% LFDL		BPH/ 5 hills	
	50 DAT/DAS	75 DAT/DAS	Pre harvest	50 DAT/DAS	75 DAT/DAS	50 DAT/DAS	75 DAT/DAS
T1 = Broadcasting sprouted seeds	3.4 (2.0)cde	3.9 (2.1)bc	9.2 (3.1)ab	2.2 (1.7)a	1.3 (1.4)ab	3.3 (1.9)bcd	39.0 (6.3)a
T2 =Manual line sowing	2.9 (1.9)de	3.6 (2.0)bc	6.5 (2.6)bc	1.3 (1.3)c	1.1 (1.3)b	1.7 (1.4)d	31.3 (5.6)b
T3 = Mechanized line sowing	2.6 (1.7)e	3.0 (1.9)c	5.5 (2.4)c	1.1 (1.3)c	0.7 (1.1)c	1.7 (1.5)cd	25.7 (5.1)c
T4 =Raised bed system	4.6 (2.3)bc	4.6 (2.3)bc	9.0 (3.1)ab	1.4 (1.4)bc	1.3 (1.4)ab	3.7 (2.0)bc	37.3 (6.1)a
T5=Drum seeding with dry seeds	5.3 (2.4)b	5.7 (2.5)ab	8.2 (2.9)bc	1.2 (1.3)c	1.3 (1.3)ab	2.0 (1.6)bcd	27.7 (5.3)bc
T6=Normal transplanting	3.8 (2.0)cd	4.5 (2.2)bc	7.2 (2.8)bc	1.7 (1.5)ab	1.3 (1.3)ab	38.0 (6.2)a	38.0 (6.2)a
T7=Broadcasting with dry seeds	6.9 (2.7)a	7.0 (2.8)a	12.3 (3.6)a	2.0 (1.6)a	1.6 (1.5)a	4.3 (2.2)b	39.0 (6.3)a
LSD (0.05)	0.3	0.5	0.5	0.1	0.2	0.6	0.5
CV (%)	7.7	12.2	9.6	5.5	6.5	14.8	4.5

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different

The incidence of dead hearts (<8%), leaf folder damage (<3%) and brown planthoppers (<8/hill) was low in all the establishment methods. However, dead hearts (6.9% DH) and White earheads (12.3% WE) caused by stem borer were significantly high in T7 = broadcasting with dry seeds compared to T3 = mechanised line sowing (2.6% DH; 5.5% WE).

5. Gangavathi

Gangavathi Sona variety was grown in three establishment methods, *viz.*, mechanical transplanting, direct seeding and normal transplanting methods. The incidence of dead hearts at 45 DAT was significantly low in mechanical transplanting (8.2%) and was at par with direct seeding (13.8%) as compared to the normal transplanting method (16.9%). Whereas at 75 DAT, dead hearts were significantly high in direct seeding (20.2% DH) and were at par with mechanical transplanting (18.9% DH) compared to normal transplanting (10.7% DH). The white ear heads varied from 19.9 – 21.4% in different establishment methods and were at par. Silver shoots caused by gall midge were significantly low in direct seeding (0.1 – 0.3% SS) compared to normal transplanting (29.0 – 36.9% SS) and mechanical transplanting (28.8 – 42.8% SS) from 30 – 60 DAT (**Table 2.5.1.5**). Similarly, the BPH population was significantly low in direct seeding (17-20/hill) compared to mechanical transplanting (33-37/hill) and normal transplanting (36-

67/hill) methods. The incidence of whorl maggot and hispa was at par in all the establishment methods.

Table 2.5.1.5. Influence of Crop Establishment Methods on Pest Incidence at Gangavathi, ***Kharif*** 2024

Treatments	% DH		% WE	% SS			% WMD	% HDL	BPH No./hill	
	45 DAT/ DAS	75 DAT/ DAS	Pre har	30 DAT/ DAS	45 DAT/ DAS	60 DAT/ DAS	60 DAT /DAS	30 DAT/ DAS	75 DAT/ DAS	90 DAT /DAS
M1= Mechanical Transplanting	8.2 (2.5)b	18.9 (4.4)a	19.9 (3.7)a	28.8 (4.9)a	42.8 (6.5)a	40.7 (6.4)a	21.1 (4.6)a	3.2 (1.7)a	33 (6)b	37 (6)a
M2= Wet Direct seeding	13.8 (3.7)ab	20.2 (4.5)a	20.0 (2.0)a	0.1 (0.8)b	0.2 (0.8)b	0.3 (0.9)b	9.6 (3.2)a	3.3 (1.8)a	20 (5)c	17 (4)b
M3=Normal Transplanting	16.9 (4.1)a	10.7 (3.3)b	21.4 (4.4)a	29.0 (5.0)a	30.7 (5.1)a	36.9 (5.6)a	12.8 (3.1)a	4.9 (2.3)a	67 (8)a	36 (6)a
LSD	1.5	1.0	0.6	2.1	2.3	2.4	2.0	1.0	12.3	0.7
CV (%)	28.9	17.0	0.3	22.0	28.5	19.7	28.0	14.4	17.2	8.2

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

6. Ghaghraghat

Three establishment methods, *viz.,* Dry direct seeding, Wet direct seeding, and normal transplanting, were evaluated with the NDR 2065 variety at this location. The incidence of dead hearts caused by stem borer was high in all three methods (15.7 – 46.8% DH) and was at par in all the observations starting from 45 DAT to 75 DAT (**Table 2.5.1.6**). The incidence of white ear heads was significantly low in normal transplanting (11.1% WE), while they were high and at par with each other in wet direct seeding (28.5% WE) and dry direct seeding (34.7% WE). Leaf folder damage was significantly high in dry direct seeding (20.5 – 38.8% LFDL), which was at par with wet direct seeding (16.4-31.9% LFDL) as compared to normal transplanting (5.7-8.7% LFDL) from 45 DAT to 105 DAT. Hispa damage was also significantly high in dry direct seeding (29.0% HDL) followed by wet direct seeding (12.3% HDL) and normal transplanting (2.9% HDL). The BPH population was observed only in normal transplanting and wet direct seeding at 75 days after transplanting (DAT), while it was not reported from wet direct seeding. However, the population was at par in all three establishment methods at 90 DAT.

Table 2.5.1.6. Influence of Crop Establishment Methods on Pest Incidence at Ghaghraghat, ***Kharif*** 2024

Treatments	% DH			% WE	% LFDL				% HDL	BPH No./hill	
	45 DAT	60 DAT	75 DAT	Pre har	45 DAT	75 DAT	90 DAT	105 DAT	45 DAT	75 DAT	90 DAT
T1= Dry Direct seeding	22.2 (4.1)a	35.5 (6.0)a	46.8 (6.7)a	34.7 (5.9)a	20.5 (4.5)a	38.8 (6.3)a	30.5 (5.6)a	37.7 (6.1)a	29.0 (5.4)a	0.0 (0.7)b	35.0 (0.6)a
T2 =Normal transplanting	15.7 (3.5)a	26.9 (4.5)a	22.8 (4.4)a	11.1 (3.4)b	8.7 (3.0)b	5.7 (2.5)c	5.8 (2.5)b	6.2 (2.6)b	2.9 (1.8)c	23.7 (4.8)a	44.3 (4.9)a
T3=Wet direct seeding	19.4 (3.9)a	15.9 (3.4)a	27.4 (5.3)a	28.5 (5.4)a	16.4 (4.0)ab	27.8 (5.3)b	31.9 (5.7)a	30.6 (5.6)a	12.3 (3.5)b	28.0 (5.3)a	46.7 (4.6)a
LSD (0.05)	5.8	5.7	3.4	1.1	1.4	0.4	0.5	1.6	1.0	1.6	1.5
CV (%)	27.1	24.1	27.9	9.8	16	3.6	4.7	14.6	12.1	19.3	6.7

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

7. Jagdalpur

Three establishment methods such as normal transplanting, puddled direct seeding and unpuddled direct seeding as main plots and weed management practices like weedy check, mechanical weeding and chemical weed control as subplots were evaluated with Samleshwari variety at this location. Silver shoots caused by gall midge were significantly low in both puddled direct seeding (<8% SS) and unpuddled direct seeding (<4% SS) compared to the normal transplanting method (30.9 – 34.2% SS) (**Table 2.5.1.7**). Low incidence of dead hearts (<7% DH), white ears (<9% WE), leaf folder damaged leaves (<5% LFDL), whorl maggot damaged leaves (<9% WMDL) and thrips-damaged leaves (<9% THDL) was noticed in both main plot and subplot treatments and were at par with each other.

Table 2.5.1.7. Influence of Crop Establishment Methods on Pest Incidence at Jagdalpur, ***Kharif*** 2024

Main plots		% DH		% WE	% SS		% LFDL		% THDL	% WMDL
		60 DAT/ DAS	90 DAT/ DAS	Pre-harvest	60 DAT/ DAS	75 DAT/ DAS	60 DAT/ DAS	90 DAT/ DAS	60 DAT/ DAS	30 DAT /DAS
T1 = Normal transplanting		6.8 (2.4)a	5.7 (2.3)a	8.0 (2.8)a	30.9 (5.6)a	34.2 (5.8)a	4.7 (1.9)a	4.9 (2.3)a	7.3 (2.7)a	8.6 (2.6)a
T2 = Puddled direct seeding		4.4 (1.8)a	5.7 (2.3)a	4.3(2.1)a	4.6 (2.1)b	7.6 (2.5)b	3.6 (1.9)a	4.9 (2.2)a	6.6 (2.6)a	0.2 (0.8)b
T3 = Unpuddled direct seeding		0.0 (0.7)a	5.6 (2.3)a	6.0 (2.4)a	3.4 (1.6)b	3.6 (1.8)b	2.6 (1.7)a	4.3 (2.1)a	8.1 (2.9)a	0.5 (0.9)b
LSD (0.05)		1.90	1.30	0.80	1.50	1.50	1.00	0.80	1.10	1.20
CV (%)		28.00	24.20	24.20	27.50	27.50	23.60	26.50	30.90	24.40
Sub-plots										
S1 = Weedy check		5.5 (2.1)a	3.5 (1.9)b	6.5 (2.5)a	12.3 (2.9)a	9.3 (2.6)b	2.2 (1.5)a	3.9 (2.0)a	8.1 (2.9)a	1.6 (1.3)a
S2 = Mechanical weeding		2.9 (1.4)a	8.1 (2.9)a	7.8 (2.7)a	10.9 (2.9)a	19.5 (4.0)a	3.1 (1.8)a	4.4 (2.2)a	7.8 (2.8)a	1.5 (1.3)a
S3 = Chemical weed control		2.8 (1.3)a	5.5 (2.3)ab	4.1 (2.0)a	15.6 (3.5)a	16.7 (3.5)ab	5.7 (2.2)a	5.7 (2.5)a	6.1 (2.5)a	6.3 (1.8)a
LSD (0.05)		0.90	0.80	1.00	0.90	1.20	0.90	0.60	0.60	1.00
CV (%)		21.90	23.90	20.90	29.10	29.10	28.40	26.30	20.90	29.30
T1 = Normal transplanting	S1	5.7 (2.4)a	4.4 (2.2)	10.1 (2.2)a	30.5 (5.5)	23.0 (4.7)ab	3.7 (1.2)ab	5.7 (2.5)a	6.8 (2.6)a	3.3 (1.7)b
	S2	6.2 (2.2)ab	10.4 (3.2)	10.4 (3.2)a	26.7 (5.2)	39.8 (6.3)a	0.6 (1.0)b	3.9 (2.0)a	8.4 (3.0)a	3.8 (2.0)b
	S3	8.5 (2.6)ab	2.4 (1.5)	3.4 (1.8)	35.4 (6.0)	39.8 (6.3)a	9.9 (2.7)a	5.1 (2.3)a	6.8 (2.7)a	18.8 (3.9)a
T2 = Puddled direct seeding	S1	10.7 (3.2)a	2.0 (1.5)	3.6 (2.0)a	6.4 (2.6)	2.9(1.7)d	1.4 (1.3)b	3.5 (1.8)a	8.9 (3.0)a	0.0 (0.7)b
	S2	2.6 (1.4)b	7.1 (2.6)	4.1 (1.9)a	3.2 (1.7)	15.1 (3.9)bc	5.4 (2.4)ab	4.6 (2.3)a	6.0 (2.5)a	0.6 (0.7)b
	S3	0.0 (0.7)b	8.1 (2.8)	5.2 (2.3)a	4.5 (2.0)	4.8 (2.0)cd	4.0 (1.2)ab	6.5 (2.6)a	6.6 (2.1)a	0.0 (0.7)b
T3 = Unpuddled direct seeding	S1	0.0 (0.7)b	4.1 (1.9)	5.5 (2.2)a	0.0 (0.7)	2.0 (1.3)d	1.4 (1.3)ab	2.7 (1.6)a	8.7 (3.0)a	1.6 (1.4)b
	S2	0.0 (0.7)b	6.8 (2.7)	8.8 (3.0)a	3.2 (1.7)	3.6 (1.8)d	3.2 (1.8)ab	4.6 (2.2)a	8.9 (3.0)a	0.0 (0.7)b
	S3	0.0 (0.7)b	5.9 (2.4)	3.8 (1.9)a	6.9 (2.4)	5.3 (2.1)cd	3.3 (1.9)ab	5.6 (2.4)a	6.6 (2.6)a	0.0 (0.7)b
LSD (0.05) M in S		1.50	1.40	1.70	1.60	2.00	1.60	1.00	1.00	1.80
LSD (0.05) S in M		2.20	1.80	1.60	2.00	2.20	1.60	1.10	1.40	1.90

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

8. Moncompu

At this location, two crop establishment methods, wet drum seeding and normal transplanting were evaluated as main plot treatments with cono weeding and chemical weed control as sub-plot treatments in the Uma variety. Dead hearts caused by stem borer were high in both the main plots and subplots at 75 DAT but were at par with each other (**Table 2.5.1.8**). Similarly, white ear heads were high in the normal transplanting method (16% WE), which was on par with drum seeding (8.0%). Leaf folder damage was relatively high in the normal transplanting method (14-19.7% LFDL) but was at par with drum seeding (11.0 – 12.3% LFDL). Among the subplot treatments, the leaf folder incidence was significantly lower in chemical weed control (8.6% LFDL) compared to cono-weeding (15.5% LFDL). Thrips incidence was significantly lower in wet drum seeding (0% THDL) compared to the normal transplanting method (69% THDL). The incidence of BPH was significantly lower in wet drum seeding (4/hill) than in normal transplanting (16/hill) at 60 DAT. Low incidence of hispa (<8% HDL), caseworm (<8% CWDL) and WBPH (<5/hill) was observed in all the main plot and sub-plot treatments.

Table 2.5.1.8. Influence of Crop Establishment Methods on Pest Incidence at Moncompu, ***Kharif*** 2024

Treatments		% DH		%WE	%LFDL		%HDL	% CWDL	% THDL	BPH No./hill	WBPH No./hill
		45 DAT/ DAS	75 DAT/ DAS	Pre har	30 DAT/ DAS	45 DAT/ DAS	30 DAT/ DAS	45 DAT/ DAS	15 DAT/ DAS	60 DAT/ DAS	60 DAT/ DAS
Wet Drum seeding		7.9 (2.3)a	20.2 (3.1)a	8.0 (2.3)a	12.3 (3.5)a	11.0 (3.2)a	5.2 (2.1)a	0.5 (0.9)b	0.0 (0.7)b	4 (2)b	4 (2)a
Normal Transplanting		8.4 (2.3)a	11.9 (3.0)a	16.0 (3.4)a	19.7 (4.1)a	14.0 (3.5)a	4.5 (1.7)a	7.3 (2.8)a	69.0 (8.2)a	16 (4)a	5 (2)a
LSD (0.05)		8.09	10.54	4.25	3.07	2.07	12.96	1.27	3.02	1.74	1.78
CV (%)		22.60	26.60	20.1	26.8	3.38	26.6	28.70	4.46	23.93	25.61
Sub plots											
Cono weeding		12.2 (3.1)a	13.2 (3.4)a	16.4 (3.7)a	22.3 (4.7)a	15.5 (3.9)a	2.6 (1.4)a	4.3 (1.9)a	32.2 (4.3)a	10 (3)a	4 (2)a
Chemical weed control		4.2 (1.7)a	18.9 (2.7)a	7.3 (2.0)a	9.6 (2.9)a	8.6 (2.8)b	7.0 (2.4)a	3.5 (1.7)a	36.3 (4.7)a	10 (3)a	5 (2)a
LSD (0.05)		2.43	3.84	3.77	2.51	1.08	1.69	0.92	2.56	0.7	0.89
CV (%)		26.10	18.70	102.2	21.4	12.00	15.1	12.10	24.30	14.97	27.42
Drum seeding	Cono weeding	11.1 (3.0)a	7.2 (2.4)a	10.3 (2.9)a	17.1 (4.1)a	9.4 (3.1)ab	5.3 (2.1)a	1.0 (1.1)b	0.0 (0.7)b	2 (2)c	2 (1)a
	Chemical weed control	4.8 (1.8)a	33.3 (3.8)a	5.5 (1.9)a	7.7 (2.9)a	11.0 (2.3)ab	5.0 (2.1)a	0.0 (0.7)b	0.0 (0.7)b	5 (2)bc	6 (2)a
Normal Transplanting	Cono weeding	13.2 (3.2)a	19.2 (4.4)a	22.4 (4.7)a	28.0 (5.2)a	22.0 (4.7)a	0.0 (0.7)a	7.6 (2.8)a	64.4 (7.9)a	18 (4)a	5 (2)a
	Chemical weed control	3.7 (1.6)a	4.4 (1.7)a	9.1 (2.2)a	12.0 (3.0)a	6.3 (2.3)b	9.0 (2.7)a	2.7 (1.3)a	73.0 (8.6)a	14 (4)ab	4 (2)a
LSD (0.05) M in S		3.44	5.43	5.32	3.54	1.51	1.78	1.31	2.75	0.99	1.25
LSD (0.05) S in M		8.37	11.07	5.54	3.48	2.29	2.48	1.53	3.16	1.85	1.95

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

9. Nawagam

Three establishment methods, normal transplanting, wet direct seeding and aerobic rice were evaluated with the Mahisagar variety. Very low incidence of dead hearts (<8% DH), white ears (<10% WE), leaf folder damage (<5% LFDL) and WBPH population (<2/hill) was observed in all the establishment methods (**Table 2.5.1.9**). However, a significant difference in WBPH population was observed between normal transplanting and the other two methods

Table 2.5.1.9. Influence of Crop Establishment Methods on Pest Incidence at Nawagam, ***Kharif*** 2024

Treatments	% DH			% WE	% LFDL			WBPH	
	45 DAT/ DAS	60 DAT/ DAS	75 DAT/ DAS	Pre har.	45 DAT/ DAS	60 DAT/ DAS	75 DAT/ DAS	60 DAT/ DAS	75 DAT/ DAS
T1 = Normal transplanting	2.3 (1.7)a	4.2 (2.0)a	7.6 (2.8)a	9.0 (3.0)a	2.9 (1.9)a	3.0 (1.9)a	4.6 (2.3)a	1.5 (1.4)a	3.0 (1.9)a
T2 = Wet Direct seeding	4.4 (2.0)a	5. 6(2.4)a	4.8 (2.3)b	6.7 (2.7)a	2.0 (1.6)a	2.3 (1.9)a	2.9 (1.9)a	0.4 (0.9)b	1.5 (1.4)b
T3 = Aerobic rice	1.8 (1.3)a	3.1 (1.7)a	6.3 (2.6)ab	6.2 (2.3)a	2.4 (1.6)a	2.4 (1.6)a	2.5 (1.7)a	0.9 (1.4)ab	1.6 (1.4)b
LSD (0.05)	1.1	1.4	0.5	1.2	0.6	0.8	0.7	0.3	0.3
CV (%)	43.8	46.6	12.6	30.5	25.3	30.1	24.1	20.2	12.2

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

10. Pantnagar

PD 24 variety was grown in four establishment methods, *viz.*, wet direct seeded rice (Wet DSR), dry direct seeding, normal transplanting and aerobic rice. The incidence of dead hearts was significantly higher in wet DSR (21.3% DH) and was at par with the normal transplanting method (11% DH) than in aerobic rice (5.9% DH) and direct seeding (5.5% DH). The incidence of white ear heads (<9% WE), leaf folder (<3% LFDL), whorl maggot (<5% WMDL) and hispa (<9% HDL) was low in all four-establishment methods (**Table 2.5.1.10**).

Table 2.5.1.10. Influence of Crop Establishment Methods on Pest Incidence at Pantnagar, ***Kharif*** 2024

Treatments	% DH			% WE	% LFDL		% WMDL	% HDL
	30 DAT/ DAS	45 DAT/ DAS	75 DAT/ DAS	Pre har	30 DAT/ DAS	45 DAT/ DAS	30 DAT/ DAS	30 DAT /DAS
T1=Wet DSR	21.3 (4.6)a	11.8 (3.3)a	3.1 (1.8)	5.0 (2.4)a	1.9 (1.4)a	1.9 (1.4)a	2.7 (1.7)a	4.4 (2.0)a
T2 = Dry Direct seeding	5.5 (2.4)b	4.3 (2.2)a	0.8 (1.0)b	8.8 (2.7)a	1.3 (1.2)a	1.5 (1.2)a	3.7 (1.2)a	5.0 (2.2)a
T3 = Normal transplanting	11.0 (3.3)ab	6.1 (2.6)a	7.7 (2.7)ab	6.7 (2.4)a	2.2 (1.5)a	2.2 (1.5)a	4.7 (2.2)a	1.8 (1.5)a
T4=Aerobic rice	5.9 (2.2)b	11.3 (3.2)a	19.0 (4.4)a	5.5 (2.4)a	0.0 (0.7)a	0.0 (0.7)a	0.7 (1.0)a	8.6 (3.0)a
LSD (0.05)	1.7	1.9	2	2.5	1.1	1.5	1.3	1.6
CV (%)	27.8	24.1	19.8	22.1	23.6	20.2	19.6	26.2

Values in parenthesis are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

11. Pattambi

At this location, four establishment methods, *viz.*, mechanical transplanting, wet direct seeding, normal transplanting and aerobic rice were evaluated with the Aishwarya variety (**Table 2.5.1.11**). The incidence of white ear heads was significantly low in direct seeding (11.1% WE) compared to aerobic rice (18.5% WE), mechanical transplanting (21.6% WE) and normal transplanting (24.6% WE). Silver shoots caused by gall midge were significantly high and at par in both mechanical transplanting and normal transplanting (37% SS) followed by direct seeding (29% SS) and aerobic rice (22% SS) at 75 DAT. A similar trend was noticed at 90 DAT also. Caseworm damage was significantly high in the normal transplanting method (11.5–28.2% CWDL) as compared to the other three methods. The incidence of dead heart (<5% DH) and whorl maggot (<11% WMDL) was low in all four crop establishment methods.

Table 2.5.1.11. Influence of Crop Establishment Methods on Pest Incidence at Pattambi, ***Kharif*** 2024

Treatments	% DH			% WE	% SS			% WMDL	% CWDL	
	45 DAT/ DAS	60 DAT/ DAS	75 DAT/ DAS	Pre har	45 DAT/ DAS	75 DAT/ DAS	90 DAT/ DAS	15 DAT/ DAS	15 DAT/ DAS	30 DAT/ DAS
T1 = Mechanical transplanting	2.2 (1.7)a	1.8 (1.5)a	3.0 (1.8)ab	21.6 (4.7)a	12.2 (3.6)a	37.0 (6.1)a	36.2 (6.0)b	9.1 (3.1)a	10.4 (3.3)b	6.3 (2.7)ab
T2 = wet Direct seeding	2.8 (1.8)a	3.9 (1.9)a	1.5 (1.4)bc	11.1 (3.3)b	12.0 (3.6)a	29.0 (5.4)b	27.6 (5.3)c	9.0 (3.1)a	4.2 (2.1)b	5.1 (2.3)b
T3 = Normal transplanting	4.0 (1.9)a	3.6 (2.0)a	4.1 (2.1)a	24.6 (5.0)a	12.2 (3.6)a	37.0 (6.1)a	49.1 (7.0)a	8.8 (3.0)a	28.2 (5.3)a	11.5 (3.5)a
T4 = Aerobic rice	2.3 (1.6)a	3.1 (1.7)a	0.4 (0.9)c	18.5 (4.3)a	12.2 (3.5)a	22.0 (4.7)c	28.3 (5.4)c	10.6 (3.3)a	4.8 (2.3)b	4.9 (2.3)b
LSD (0.05)	1.5	1.3	0.7	0.8	0.5	0.3	0.6	0.6	1.2	0.9
CV (%)	24.5	26.8	24.0	9.4	7.5	2.6	5.2	9.4	18.2	17.4

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

12. Pusa

Rajendra Saraswati variety was grown in three establishment methods, viz., puddled direct seeding, dry direct seeding and normal transplanting methods. At 30 DAT, dead heart damage was high in puddled direct seeding (25.5%), followed by direct seeding (11.5%) and normal transplanting (8.6%). However, the damage was at par in all three establishment methods in all the observations (**Table 2.5.1.12**). Similarly, white ear damage (15.4-19.3% WE) and leaf folder damage (11.4 – 19% LFDL) were also at par in all three establishment methods.

Table 2.5.1.12. Influence of Crop Establishment Methods on Pest Incidence at Pusa, ***Kharif*** 2024

Treatments	% DH				% WE	% LFDL				
	30 DAT/ DAS	45 DAT/ DAS	60 DAT/ DAS	75 DAT/ DAS	Pre har	30 DAT/ DAS	45 DAT/ DAS	60 DAT/ DAS	75 DAT/ DAS	90 DAT/ DAS
T1 = Puddled direct seeding	25.5 (5.0)a	11.5 (3.5)a	14.5 (3.9)a	18.7 (4.4)a	15.4 (4.0)a	13.0 (3.6)a	12.1 (3.6)a	11.4 (3.5)a	17.2 (4.2)a	12.2 (3.6)a
T2 = Dry Direct seeding	11.5 (3.0)a	14.5 (3.8)a	12.0 (3.5)a	11.3 (3.4)a	19.3 (4.4)a	12.4 (3.5)a	10.3 (3.3)a	6.8 (2.7)a	11.7 (3.5)a	14.7 (3.9)a
T3 = Normal transplanting	8.6 (2.7)a	8.7 (2.7)a	9.8 (3.2)a	14.2 (3.7)a	16.0 (4.0)a	16.3 (4.0)a	15.7 (4.0)a	16.7 (4.1)a	19.0 (4.5)a	18.3 (4.4)a
LSD (0.05)	4.13	2.61	1.19	2.48	1.37	1.98	1.54	0.75	1.03	1.18
CV (%)	21.4	24.1	14.9	28.9	14.6	23.4	18.9	9.85	11.3	13.3

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

13. Titabar

At this location, four establishment methods, *viz.*, mechanical transplanting, wet direct seeding, normal transplanting and aerobic rice, were assessed with Shraboni variety (**Table 2.5.1.13**). The incidence of stem borer, gall midge, leaf folder, whorl maggot and caseworm was low in all the four methods of crop establishment methods.

Table 2.5.1.13. Influence of Crop Establishment Methods on Pest Incidence at Titabar, ***Kharif*** 2024

Treatments	% DH		% WE	%SS		% LFDL		% WMDL	% CWDL
	45 DAT/ DAS	75 DAT/ DAS	Pre har	30 DAT/ DAS	60 DAT/ DAS	30 DAT/ DAS	75 DAT/ DAS	45 DAT/ DAS	60 DAT/ DAS
M1 = Mechanical transplanting	5.0 (2.1)ab	6.0 (2.5)a	8.3 (2.9)a	0.0 (0.7)a	0.0 (0.7)a	5.6 (2.3)a	3.3 (1.5)a	4.4 (2.0)a	5.2 (2.1)a
M2 = wet Direct seeding	2.2 (1.4)b	3.7 (1.9)a	6.4 (2.6)a	4.8 (1.2)a	4.8 (2.0)a	5.3 (2.2)a	3.1 (1.4)a	4.2 (2.0)a	2.8 (1.7)ab
M3 = Normal transplanting	8.4 (3.0)a	3.5 (1.8)a	2.8 (1.7)a	0.0 (0.7)a	2.4 (1.4)a	0.0 (0.7)a	3.3 (1.5)a	4.6 (2.1)a	0.0 (0.7)b
M4 = Aerobic rice	3.9 (1.9)ab	2.8 (1.7)a	3.1 (1.8)a	6.0 (2.3)a	3.5 (1.9)a	1.6 (1.3)a	1.9 (1.4)a	2.5 (1.6)a	3.7 (2.0)a
LSD (0.05)	1.5	1.6	1.6	2.1	2.2	1.9	1.7	1.9	1.3
CV (%)	26.1	21.0	26.0	26.2	22.1	20.9	20.3	19.6	17.7

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

Across locations, the incidence of dead hearts and white ear heads caused by stem borer, silver shoots caused by gall midge, damaged leaves caused by leaf folder, whorl maggot, hispa, thrips, and caseworm, brown planthopper and white-backed planthopper was observed in all the crop establishment methods during *Kharif* 2024. The wet seeding, drum seeding, direct seeding and wet DSR data were all compiled as Wet DSR. Similarly, unpuddled direct seeding, aerobic rice and line sowing data was compiled as Dry DSR. The incidence of dead hearts was low in Dry DSR (5.7% DH) and mechanical transplanting (5.9% DH) followed by normal transplanting (9.4% DH) and high in Wet DSR (14.2% DH). The incidence of white earheads was low in Dry DSR (8.4% WE) and was almost similar in the other three crop establishment methods (**Figure 2.5.1.1**). The incidence of silver shoots caused by gall midge was lower in Dry DSR (11.3% SS) followed by wet DSR (14.7% SS). Gall midge damage was very high in normal transplanting method (29.6% SS) followed by mechanical transplanting method (26.7% SS).

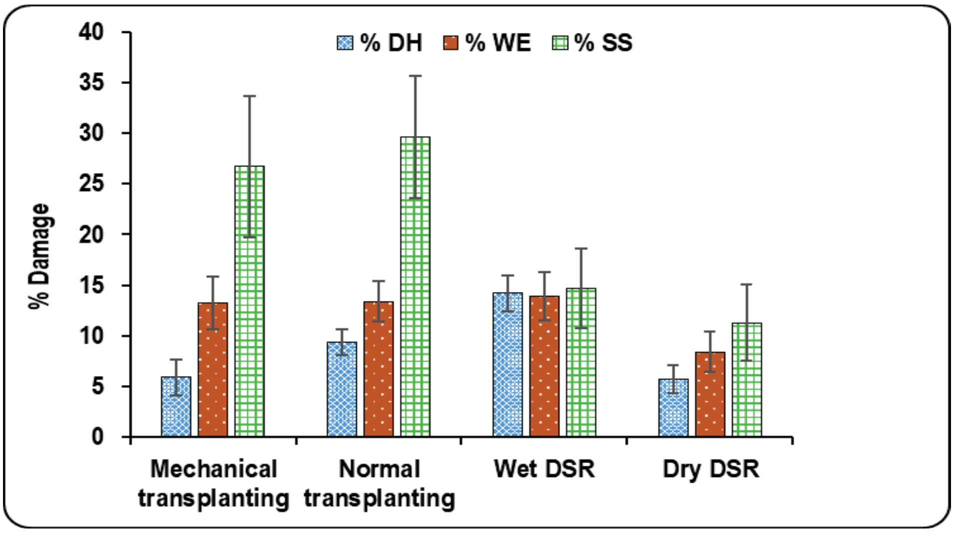


Figure 2.5.1.1. Incidence of stem borer and gall midge in different crop establishment methods across locations

Among the foliage feeders, leaf folder damaged leaves were low in Dry DSR (2.4% LFDL) and mechanical transplanting (3.5% LFDL) while they were high and the same in both normal transplanting (11.5% LFDL) and Wet DSR (11.3% LFDL). Whorl maggot and hispa damage was low in all the establishment methods (**Figure 2.5.1.2**). Thrips-damaged leaves were high in normal transplanting method (28.3%) as compared to other three methods. Caseworm damage was relatively high in normal transplanting (15.7%) compared to other methods.

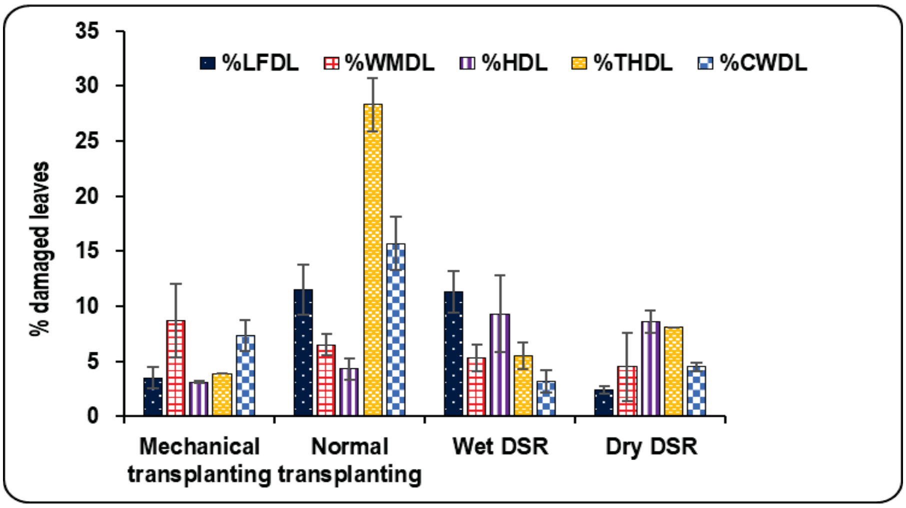


Figure 2.5.1.2. Incidence of foliage-feeding insects in different crop establishment methods across locations

Among the sucking pests, BPH incidence was low in Dry DSR (16 /hill) followed by mechanical transplanting (28/hill). BPH incidence was relatively high in normal transplanting (32/hill) and wet DSR (31/hill). WBPH incidence was low in all the establishment methods (**Figure 2.5.1.3**).

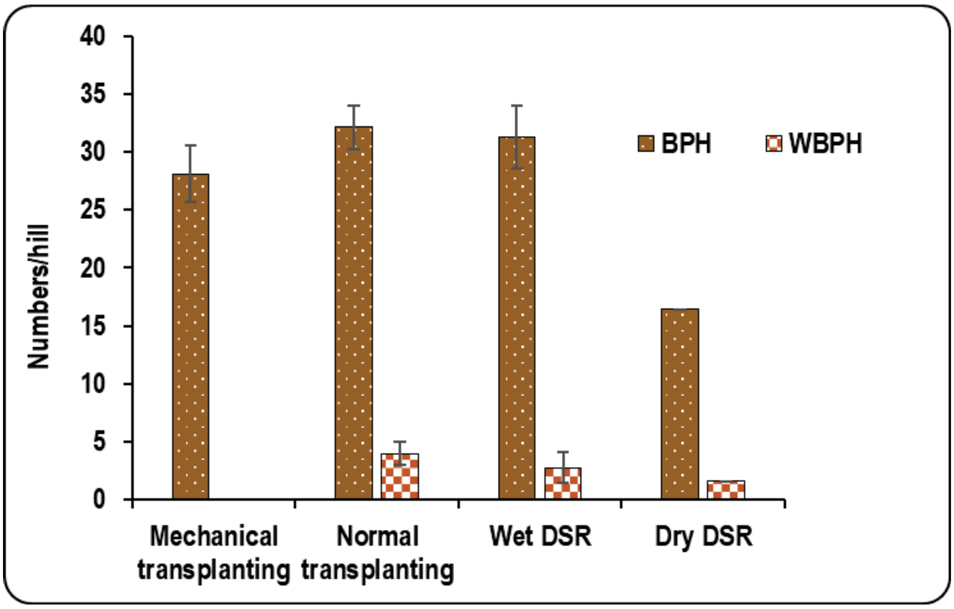


Figure 2.5.1.3. Incidence of sucking pests in different crop establishment methods across locations

Influence of crop establishment methods on pest incidence (IEMP), a collaborative trial with Agronomy, was conducted at 13 locations during Kharif 2024. Across the locations, the incidence of dead hearts (5.7%) and white ears (8.4%) caused by stem borer was relatively low in dry DSR followed by mechanical transplanting while it was high in wet DSR (14.2% DH) than in normal transplanting (9.4% DH). Gall midge incidence was high in normal transplanting (29.6% SS) and mechanical transplanting (26.7% SS) and relatively low in dry DSR (11.3% SS) and wet DSR (14.7% SS). The incidence of leaf folder (11.5% LFDL), thrips (28.3% THDL) and caseworm (15.7% CWDL) was high in the normal transplanting method as compared to the other three methods. The incidence of BPH was low in dry DSR (16/hill) and WBPH was low in all the establishment methods. Overall, the incidence of insect pests was high in normal transplanting and wet DSR methods, followed by the mechanical transplanting method while the incidence was low in the dry DSR method.

2.5.2. Pest Incidence in Natural Farming (PINF)

Natural farming (NF) is an ecological farming approach enriched with modern understanding of ecology, resource recycling and on-farm resource optimization. It is largely based on on-farm biomass recycling with major stress on biomass mulching, use of on-farm cow dung, urine formulations, maintaining soil aeration and exclusion of all synthetic chemical inputs.

In India, states like Andhra Pradesh, Karnataka, Himachal Pradesh, Gujarat, Uttar Pradesh and Kerala are already following natural farming and have developed successful models. Currently, the adoption of the natural farming system is at an early stage and gradually gaining acceptance among the farming community. Keeping this in view, a collaborative trial with the Agronomy section was designed to evaluate insect pest incidence in natural farming.

The trial was formulated with five treatments replicated four times in Randomised block design with the most popular high yielding variety of that location. The treatments included are:

T1 = Control (No addition of any inputs for operations including weeding),

T2 = Complete NF (1. *Beejamrit* + *Ghanjeevamrit* + *Jeevamrit*; 2. Crop residue mulching; 3. Intercropping)

[Pre-monsoon dry sowing (PMDS) / Muti-variate cropping (MVC) with multiple crops during fallow + Prophylactic/preventive method of application of *Neemastra*, *Dashparni ark*, *Brahmastra*, Neem seed kernel extract, border crop, trap crop, seed treatment with *Trichoderma* or *Pseudomonas* and curative application of leaf extracts of Datura, Vitex, *Agniastra*, sour buttermilk, 2G/3G extract and use of bio-control agents and mechanical traps]

T3 = All India – Network Programme on Organic Farming (AI-NPOF) package

T4 = Integrated Crop Management (50 % nutrient application through organic manures and 50% nutrient application through inorganic sources with pre-monsoon dry sowing / Multi-variate cropping (MVC) with multiple crops during fallow. Prophylactic/preventive method of application of *Neemastra*, *Dashparni ark*, *Brahmastra*, Neem seed kernel extract, border crop, trap crop, seed treatment with Trichoderma, *Pesudomonas* and Curative application of leaf extracts of Datura, *Vitex*, *Agniastra,* sour buttermilk, 2G/3G extract and use of bio-control agents and mechanical traps)

T5 = Integrated Crop Management (50 % nutrient application through organic manures and 50% nutrient application through inorganic sources with application of need-based pesticides for pest management)

During *Kharif* 2024, the trial was conducted at 12 locations, *viz.*, Chatha, Chinsurah, Gangavathi, Ghagraghat, Khudwani, Mandya, Maruteru, Moncompu, Pantnagar, Pattambi, Raipur and Titabar. Location-wise results of the trial are discussed below.

1. Chatha

The Basmati 370 variety was grown at this location. Leaf folder incidence was significantly lower in T2-Complete natural farming (7.6% LFDL) and was at par in T3- AI-NPOF package (9.2% LFDL) as compared to the other three treatments at 45 DAT (**Table 2.5.2.1**). However, the incidence was at par in all the treatments at 75 DAT. Leaf folder damage was significantly lower in T2-Complete natural farming (7.7% LFDL) as compared to the other four treatments at 95 DAT. A low population of green leafhopper, grasshopper and white leafhopper (*Cofana spectra*) was reported in all the treatments as compared to control.

Table 2.5.2.1. Pest incidence in natural farming trial at Chatha, ***Kharif*** 2024

Treatments	% LFDL				GLH (No./sweep)		GrH (No/sweep)		***Cofana***
	45 DAT	55 DAT	75 DAT	95 DAT	45 DAT	85 DAT	45 DAT	85 DAT	85 DAT
T1 = Control (No addition of any inputs)	11.3 (3.4)a	13.9 (3.8)a	12.7 (3.6)a	10.7 (3.3)a	3.0 (1.9)a	3.0 (1.9)a	3.3 (1.9)a	3.0 (1.9)a	4.0 (2.1)a
T2 = Complete Natural Farming (NF)	7.6 (2.8)b	9.2 (3.1)b	12.9 (3.7)a	7.7 (2.9)b	3.3 (1.9)a	2.3 (1.6)a	3.0 (1.9)a	2.7 (1.8)a	2.3 (1.7)b
T3 = AI-NPOF package	9.2 (3.1)ab	9.1 (3.1)b	13.2 (3.7)a	11.6 (3.5)a	3.0 (1.9)a	2.7 (1.7)a	2.3 (1.6)a	2.7 (1.8)a	2.3 (1.6)b
T4 = Integrated Crop Management with NF	10.7 (3.4)a	12.2 (3.6)ab	13.1 (3.7)a	10.8 (3.4)a	3.0 (1.9)a	2.3 (1.6)a	2.3 (1.7)a	1.7 (1.5)a	2.3 (1.7)b
T5 = Integrated Crop Management (50% organic and 50% inorganic sources) with need-based pesticides	10.3 (3.3)a	11.0 (3.4)ab	10.0 (3.2)a	11.6 (3.5)a	2.3 (1.7)a	2.3 (1.6)a	3.0 (1.9)a	2.7 (1.8)a	2.3 (1.6)b
HSD (0.05)	0.39	0.53	0.62	2.14	0.51	0.58	0.47	0.42	0.30
CV (%)	6.57	8.49	9.27	10.80	14.70	18.10	13.97	13.01	9.20

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

2. Chinsurah

The incidence of stem borer, leaf folder and whorl maggot was observed in Sukumar variety. Dead hearts caused by stem borer were significantly low in T2-Complete natural farming (1.1% DH) and was at par with T4-Integrated crop management with NF (1.9% DH) and T5-ICM with need-based pesticides (1.9% DH) at 65 DAT. Dead heart incidence was significantly high in the T1-control plot (24.1% DH), followed by T3- AI-NPOF package (8.4% DH). A similar trend was observed at 75 DAT and 95 DAT (**Table 2.5.2.2**). However, white ears caused by stem borer were significantly lower and at par in all the treatments as compared to the control (14.6% WE). The incidence of leaf folder (<6% LFDL) and whorl maggot (<5% WMDL) was too low in all the treatments to draw valid conclusions.

Table 2.5.2.2. Pest incidence in natural farming trial at Chinsurah, ***Kharif*** 2024

Treatment	%DH			%WE	%LFDL		%WMDL
	65 DAT	75 DAT	95 DAT	Preharvest	75 DAT	85 DAT	65 DAT
T1 = Control (No addition of any inputs)	24.1 (5.0)a	20.7 (4.6)a	23.5 (4.9)a	14.6 (3.9)a	4.1 (2.2)a	5.4 (2.4)a	4.4 (2.2)a
T2 = Complete Natural Farming (NF)	1.1 (1.3)c	3.7 (1.9)b	2.8 (1.8)bc	0.4 (0.9)b	2.6 (1.7)b	2.7 (1.7)b	1.2 (1.3)c
T3 = AI-NPOF package	8.4 (3.0)b	13.9 (3.8)a	7.3 (2.7)b	1.3 (1.2)b	1.8 (1.5)c	1.7 (1.5)bc	2.9 (1.8)ab
T4 = Integrated Crop Management with NF	1.9 (1.4)c	2.8 (1.6)b	1.4 (1.2)c	0.8 (1.0)b	1.0 (1.2)d	1.4 (1.4)c	1.7 (1.5)bc
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	1.9 (1.4)c	1.8 (1.5)b	2.6 (1.6)c	1.2 (1.2)b	2.7 (1.8)b	2.4 (1.7)b	2.0 (1.6)bc
HSD (0.05)	0.7	0.9	0.9	0.8	0.2	0.2	0.4
CV (%)	17.3	20.7	24.4	32.8	9.2	8.9	15.7

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

3. Gangavathi

At this location, the incidence of stem borer, gall midge, leaf folder, whorl maggot, BPH and WBPH was observed in all the treatments in RNR 15048 variety (**Table 2.5.2.3**). Dead heart damage was significantly lower in T5-ICM with need-based pesticides (4.2% DH) and high in T1-control (25% DH) at 35 DAT. Dead heart incidence was at par in the other three treatments (12.4-14% DH). A similar trend was observed at 45 DAT, with significantly higher damage in the T1-control (32.7% DH). In the same way, white ear incidence was significantly low in T5-ICM with need-based pesticides (4.6% WE) compared to the T1-control (19.8% WE). Gall midge incidence was very high, with maximum damage in T1-control (48.9% SS) as against T5-ICM with need-based pesticides (4.6% SS) at 45 DAT. The damage was at par in the other three treatments (20.1 – 26% SS). The trend was the same at 55 DAT also. Leaf folder incidence was significantly lower in T5-ICM with need-based pesticides (3.4% & 5.3% LFDL), compared to control (25.2% & 20.7% LFDL) at 45 and 65 DAT, respectively. At 75 DAT, BPH numbers were significantly low in T5-ICM with need-based pesticides (61.3/5 hills) as against T1-control (218.3/5 hills), followed by T2-Complete NF (82/5 hills). The population was at par in the other two treatments of T3 and T4 (66.8/5 hills). At 85 DAT, the BPH population was low in T5, high in T1 and at par in T2, T3, and T4 treatments. A similar trend was observed in the WBPH population at 75 and 85 DAT.

Table 2.5.2.3. Pest incidence in natural farming trial at Gangavathi, Kharif 2024

Treatments	%DH		%WE	%SS		%LFDL		%WMDL	BPH (No./5hills)		WBPH (No./5hills)	
	35 DAT	45 DAT	Preharvest	45 DAT	55 DAT	45 DAT	65 DAT	35 DAT	75 DAT	85 DAT	75 DAT	85 DAT
T1 = Control (No addition of any inputs)	25.0 (5.1)a	32.7 (5.7)a	19.8 (4.5)a	48.9 (7.0)a	51.6 (7.2)a	25.2 (5.1)a	20.7 (4.6)a	7.7 (2.9)a	218.3 (14.8)a	271.0 (16.5)a	92.5 (9.6)a	108.3 (10.4)a
T2 = Complete Natural Farming (NF)	14.0 (3.8)b	18.8 (4.4)b	10.5 (3.3)b	26.0 (5.1)b	23.4 (4.9)b	10.1 (3.2)b	8.5 (3.0)b	8.1 (2.9)a	82.0 (9.1)b	76.8 (8.8)b	42.0 (6.5)b	50.0 (7.1)b
T3 = AI-NPOF package	12.4 (3.6)b	16.4 (4.1)b	7.6 (2.9)b	20.5 (4.5)b	20.5 (4.6)b	8.4 (3.0)b	7.4 (2.8)c	4.5 (2.2)b	66.8 (8.2)c	72.8 (8.6)b	36.3 (6.1)c	47.5 (6.9)b
T4 = Integrated Crop Management with NF	12.8 (3.6)b	16.1 4.1)b	7.6 (2.8)b	20.1 (4.5)b	20.4 (4.6)b	8.7 (3.0)b	7.8 (2.9)bc	4.5 (2.3)b	66.8 (8.2)c	72.8 (8.6)b	36.3 (6.1)c	47.5 (6.9)b
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	4.2 (2.1)c	6.5 (2.6)c	4.6 (2.2)c	12.3 (3.6)c	11.9 (3.5)c	3.4 (1.9)c	5.3 (2.4)d	1.1 (1.3)c	61.3 (7.9)d	65.0 (8.1)c	29.5 (5.5)d	39.5 (6.3)c
HSD (0.05)	0.2	0.5	0.6	0.7	0.4	0.3	0.2	0.4	0.3	0.4	0.4	0.4
CV (%)	4.1	7.8	11.5	9.2	5.3	7	3.5	10.2	1.8	2.5	4.2	3.9

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

4. Ghaghraghat

Stem borer and leaf folder incidence was observed in NDGR 2065 variety grown in all the treatments. At 55 DAT, dead heart damage was significantly lower in T5-ICM with need-based pesticides (5.4% DH) compared to T1-control (14.9% DH), which was at par with T3-AI-NPOF package (14.9% DH) and T2-complete natural farming (11.1% DH) at 55 DAT (**Table 2.5.2.4**). A similar trend was also observed at 65 days after treatment (DAT). However, the incidence was reduced at 85 DAT in all treatments, while it was significantly lower in T5-ICM with need-based pesticides (4.7% DH) compared to T1-control (13.3% DH). White ear incidence was significantly higher in T1 control treatment (14.4% WE) and was at par with T3, AI-NPOF package (11.8% WE). White ear damage was at par in T2-complete natural farming (8.8% WE) and T4-ICM with NF (8.5% WE). Leaf folder damage was significantly lower in T5-ICM with need-based pesticides (5.4% LFDL) and high in T1-control (10.6% LFDL), which was at par with T3-AI-NPOF package (10.6% LFDL). The leaf folder damage was 9.1% in T4-ICM with NF (8.5% WE), followed by T2-complete natural farming (7% LFDL).

Table 2.5.2.4. Pest incidence in natural farming trial at Ghaghraghat, ***Kharif*** 2024

Treatments	%DH				%WE	%LFDL		
	55 DAT	65 DAT	85 DAT	95 DAT	Pre harvest	55 DAT	65 DAT	75 DAT
T1 = Control (No addition of any inputs)	14.9 (3.9)a	14.7 (3.9)a	12.2 (3.5)a	13.3 (3.7)a	14.4 (3.9)a	10.6 (3.3)a	11.6 (3.5)a	10.8 (3.4)a
T2 = Complete Natural Farming (NF)	11.1 (3.4)ab	12.6 (3.6)ab	10.7 (3.3)a	9.8 (3.2)b	8.8 (3.1)bc	7.0 (2.8)c	8.5 (3.0)b	7.1 (2.8)c
T3 = AI-NPOF package	14.9 (3.9)a	14.7 (3.9)a	10.3 (3.3)a	10.9 (3.4)b	11.8 (3.5)ab	10.6 (3.3)a	11.6 (3.5)a	10.8 (3.4)a
T4 = Integrated Crop Management with NF	8.5 (3.0)bc	11.1 (3.4)b	9.5 (3.2)a	10.3 (3.3)b	8.5 (2.9)c	9.1 (3.1)b	9.4 (3.2)b	9.3 (3.1)b
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	5.4 (2.4)c	6.7 (2.6)c	3.1 (1.8)b	4.7 (2.3)c	5.5 (2.4)d	5.4 (2.4)d	5.9 (2.5)c	5.6 (2.5)d
HSD(0.05)	0.59	0.42	0.48	0.33	0.48	0.15	0.28	0.18
CV(%)	11.90	17.50	10.40	6.80	23.50	3.20	5.90	3.90

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

5. Khudwani

At this location, Shalimar Rice - 4 variety was grown, and grasshopper incidence was observed in all the treatments (**Table 2.5.2.5**). Grasshopper damage varied from 15.7 – 22.2% GrHDL and was at par in all the treatments at 45 – 90 DAT. Pest count of grasshoppers, rice skipper larvae, natural enemies like spiders, ladybird beetles, dragon and damsel flies was at par in all the treatments.

Table 2.5.2.5. Pest incidence in natural farming trial at Khudwani, ***Kharif*** 2024

Treatments	% GrHDL			Number/ hill				Visual count No./plot	
				Grasshoppers	Rice skipper larvae	Spiders	Ladybird beetles	Dragon flies	Damsel flies
	45 DAT	60 DAT	90 DAT	60 DAT	30 DAT	60 DAT	75 DAT	60 DAT	30 DAT
T1 = Control (No addition of any inputs)	17.6(4.2)a	21.4(4.6)a	15.7(4.0)a	2.0(1.6)a	0.6(1.0)a	1.4(1.4)a	0.6(1.0)a	0.2(0.8)a	0.8(1.1)a
T2 = Complete Natural Farming (NF)	18.0(4.3)a	19.8(4.5)a	16.2(4.1)a	1.4(1.3)a	0.6(1.0)a	0.4(0.9)a	0.6(1.0)a	0.2(1.4)a	0.6(1.0)a
T3 = AI-NPOF package	19.9(4.5)a	19.6(4.5)a	18.5(4.4)a	2.0(1.6)a	0.8(1.1)a	1.2(1.3)a	0.2(0.8)a	0.6(1.4)a	1.0(1.2)a
T4 = Integrated Crop Management with NF	18.3(4.3)a	20.6(4.4)a	16.2(4.1)a	1.6(1.4)a	1.2(1.3)a	0.8(1.1)ab	0.4(0.9)a	0.2(1.2)a	1.0(1.2)a
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	19.2(4.4)a	22.2(4.8)a	18.0(4.2)a	2.0(1.6)a	0.8(1.1)a	1.0(1.2)ab	0.4(0.9)a	0.4(1.6)a	1.0(1.2)a
HSD (0.05)	0.47	0.67	0.65	0.38	0.42	0.36	0.35	0.29	0.38
CV (%)	8.03	10.83	11.78	18.74	28.61	23.1	28.00	25.01	25.44

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

6. Mandya

The incidence of stem borer and leaf folder was very high in all the treatments in the KMP–175 variety at this location (**Table 2.5.2.6**).The incidence of dead hearts was significantly lower in T5-ICM with need-based pesticides (15.4% DH) and was at par with T4-ICM with NF (26.1% DH) and T2-complete natural farming (29.2% DH) compared to T1-control (65.3% DH), which was at par with T3-AI-NPOF package (45% DH) at 65 DAT. A similar trend was observed at 45 DAT and 75 DAT, with significantly lower dead hearts in T5 and higher dead hearts in T1. The trend was the same for white ear incidence in different treatments. Similarly, leaf folder incidence was significantly lower in T5-ICM with need-based pesticides (12.2 – 19.9% LFDL) and was at par with T4-ICM with NF (14.9% LFDL) and T2-complete natural farming (21.1% LFDL) as compared to T1-control (39.8% LFDL) at 65 DAT. A similar trend was observed from 75 DAT – 115 DAT with the incidence of 15.5 – 19.9% in T5 and 42.1 – 67.1% in T1-control.

Table 2.5.2.6. Pest incidence in natural farming trial at Mandya, ***Kharif*** 2024

Treatments	%DH			%WE	%LFDL			
	45 DAT	65 DAT	75 DAT	Pre harvest	65 DAT	75 DAT	85 DAT	115 DAT
T1 = Control (No addition of any inputs)	32.7 (5.7)a	65.3 (8.0)a	57.6 (7.4)a	60.8 (7.7)a	39.8 (6.2)a	53.8 (7.2)a	42.1 (6.5)a	67.1 (8.1)a
T2 = Complete Natural Farming (NF)	23.4 (4.6)ab	29.2 (5.4)bc	22. 7(3.7)bc	27.6 (5.2)bc	21.1 (4.5)abc	26.9 (5.0)ab	27.3 (5.3)b	31.5 (5.6)bc
T3 = AI-NPOF package	24.3 (4.8)ab	45.0 (6.7)ab	34.1 (5.7)b	43.8 (6.4)ab	33.5 (5.6)ab	41.6 (6.2)ab	36.2 (6.1)a	47.9 (6.9)ab
T4 = Integrated Crop Management with NF	17.0 (4.0)ab	26.1 (5.0)bc	13.3 (3.7)cd	25.2 (5.0)bc	14.9 (3.9)bc	21.8 (4.6)b	24.7 (5.0)b	30.5 (5.6)bc
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	11.6 (3.3)b	15.4 (3.9)c	8.9 (3.0)d	17.3 (4.2)c	12.2 (3.5)c	15.5 (4.0)b	16.1 (4.0)c	19.9 (4.5)c
HSD (0.05)	1.92	1.83	1.60	2.18	1.84	2.36	0.79	1.48
CV (%)	27.90	20.50	21.10	24.99	25.47	28.53	9.54	15.75

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

7. Maruteru

At this location, the incidence of stem borer, gall midge, leaf folder, whorl maggot, hispa, BPH and WBPH was recorded in all the treatments in the MTU 1064 variety (**Table 2.5.2.7**). Gall midge incidence was significantly lower in T2-complete natural farming (11.3% SS) compared to all other treatments, which were at par with each other (14.9 – 17.3% SS) at 60 DAT. However, at 75 DAT, the incidence, though high, was at par in all the treatments, including control (11.4 – 15.7% SS). BPH population was significantly low in the T3-AI-NPOF package (15/5 hills) and was at par with T5-ICM with need-based pesticides (17/5 hills) and T4-ICM with NF (17.8/5 hills) at 60 DAT. BPH population was significantly higher in T1-control (63/5 hills) and was at par with T2– complete natural farming (52.3/ 5 hills) at 60 DAT. However, at 75 DAT, BPH numbers were significantly lower in the T3-AI-NPOF package (4.5/5 hills) and were at par with T4-ICM with NF (9/5 hills). The BPH population was significantly high in T2-complete natural farming (104/5 hills) compared to the T1-control (55.5/5 hills) at 75 DAT. Low incidence of dead hearts (<3% DH), white ears (<3% WE), leaf folder (<6% LFDL), whorl maggot (<9% WMDL), hispa (<10% HDL) and WBPH (<5/5 hills) was observed in all the treatments.

Table 2.5.2.7. Pest incidence in natural farming trial at Maruteru, ***Kharif*** 2024

Treatments	%DH	%WE	%SS		%LFDL	%WMDL	%HDL	BPH (No/ 5 hills)		WBPH (No/5 hills)	
	45 DAT	Pre harvest	60 DAT	75 DAT	45 DAT	30 DAT	30 DAT	60 DAT	75 DAT	60 DAT	75 DAT
T1 = Control (No addition of any inputs)	2.7 (1.7)a	0.0 (0.7)b	15.7 (4.0)a	15.7 (4.0)a	3.7 (2.0)a	8.2 (2.9)a	9.0 (3.0)a	63.0 (7.9)a	55.5 (7.5)b	4.8 (2.3)a	4.8 (2.2)a
T2 = Complete Natural Farming (NF)	0.0 (0.7)b	2.5 (1.7)a	11.3 (3.4)b	12.6 (3.6)a	5.4 (2.4)a	6.0 (2.5)ab	9.6 (3.1)a	52.3 (7.2)a	104.0 (10.2)a	2.8 (1.8)b	12.3 (3.6)b
T3 = AI-NPOF package	0.0 (0.7)b	0.0 (0.7)b	16.8 (4.1)a	11.4 (3.4)a	3.6 (2.0)a	5.3 (2.4)ab	8.8 (3.0)a	15.0 (3.9)b	4.5 (2.1)d	0.0 (0.7)c	0.0 (0.7)c
T4 = Integrated Crop Management with NF	0.0 (0.7)b	0.0 (0.7)b	14.9 (3.9)a	15.4 (4.0)a	3.2 (1.9)a	3.4 (1.8)b	8.4 (3.0)a	17.8 (4.2)b	9.0 (3.0)d	0.0 (0.7)c	0.0 (0.7)c
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	0.0 (0.7)b	0.6 1.0)b	17.3 (4.2)a	15.1 (3.9)a	3.9 (2.1)a	5.8 (2.5)ab	0.0 (0.7)b	17.0 (4.2)b	17.0 (4.2)c	0.0 (0.7)c	0.0 (0.7)c
HSD (0.05)	0.5	0.4	0.4	0.8	0.6	0.9	0.8	0.9	1	0.4	0.3
CV (%)	38.8	23.9	7.2	13.4	18.2	23.9	19.2	11.2	11.9	18.7	13.6

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

8. Moncompu

The incidence of stem borer, gall midge, leaf folder, whorl maggot, hispa, thrips, BPH and WBPH was observed in all the treatments in the Uma (MO 16) variety at this location (**Table 2.5.2.8**). The incidence of dead hearts was significantly higher in T1-Control (11.4% DH) compared to T5-ICM with need-based pesticides (2.6% DH), which was on par with other treatments. White ears were significantly lower in T1-control (4.2% WE) and were at par with T5-ICM with need-based pesticides (8.8% WE) and T4-ICM with NF (8.9% WE) as compared to T2-Complete NF (15.9% WE) and T3–AI–NPOF package (14.5% WE). Silver shoots caused by gall midge were significantly lower in all the treatments (< 1% SS) as against T4-ICM with NF (10.2% SS). The incidence of leaf folder was significantly higher in the T1-control (11.4% LFDL) compared to other treatments that recorded low damage at 25 DAT.

Thrips damage was significantly higher in T2-complete natural farming (38.8% THDL) compared to the T1-control (14.3% THDL). The damage was at par in all other treatments. BPH population was significantly low in all the treatments (<6/5 hills) as against T1-control (57-66/5 hills). Low incidence of whorl maggot (<3% WMDL), hispa (<2% HDL) and WBPH (<11/5hills) was observed in all the treatments.

Table 2.5.2.8. Pest incidence in natural farming trial at Moncompu, ***Kharif*** 2024

Treatments	%DH	% WE	%SS	%LFDL	%WMDL	%HDL	%THDL	BPH (No./5 hills)		WBPH (No./ 5 hills)	
	45 DAT	Pre harvest	45 DAT	25 DAT	35 DAT	35 DAT	15 DAT	85 DAT	95 DAT	75 DAT	95 DAT
T1 = Control (No addition of any inputs)	11.4 (3.4)a	4.2 (2.1)b	0.8 (1.0)b	11.4 (3.3)a	2.7 (1.7)a	1.6 (1.3)a	14.3 (3.4)b	56.5 (7.5)a	66.0 (8.1)a	10.5 (3.3)a	9.0 (3.0)a
T2 = Complete Natural Farming (NF)	6.7 (2.5)abc	15.9 (4.0)a	0.7 (1.0)b	4.2 (2.0)ab	2.3 (1.6)a	0.0 (0.7)b	38.8 (6.2)a	25.0 (5.0)b	24.3 (4.9)b	1.0 (1.1)c	7.0 (2.7)a
T3 = AI-NPOF package	8.1 (2.9)ab	14.5 (3.9)a	0.8 (1.0)b	3.7 (1.8)b	2.0 (1.6)a	0.0 (0.7)b	21.7 (4.6)ab	22.3 (4.7)bc	31.0 (5.6)b	6.5 (2.6)ab	6.0 (2.5)a
T4 = Integrated Crop Management with NF	3.2 (1.8)bc	8.9 (3.0)ab	10.2 (2.9)a	3.5 (1.9)b	0.0 (0.7)b	0.0 (0.7)b	31.8 (5.7)ab	23.5 (4.9)bc	21.3 (4.6)b	5.0 (2.2)b	6.0 (2.5)a
T5 = Integrated Crop Manage-ment (50 % organic and 50% inorganic sources) with need-based pesticides	2.6 (1.6)c	8.8 (2.7)ab	0.8 (1.0)b	5.1 (2.2)ab	0.0 (0.7)b	0.0 (0.7)b	17.8 (3.9)ab	12.3 (3.5)c	10.5 (3.3)c	3.8 (2.0)b	2.5 (1.7)b
HSD (0.05)	1.3	1.3	0.9	1.4	0.3	0.5	2.5	1.4	1.2	0.9	0.7
CV (%)	35.8	27.9	42.6	40.4	17.2	41.6	34.8	17.2	15.3	25.7	18.8

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

9. Pantnagar

The incidence of stem borer (<6% DH), leaf folder <3% LFDL), whorl maggot (<3% WMDL) and hispa (<3% HDL) was low in all the treatments to draw valid conclusions in Pant Dhan -4 variety grown at this location (**Table 2.5.2.9**).

Table 2.5.2.9. Pest incidence in natural farming trial at Pantnagar, ***Kharif*** 2024

Treatments	%DH			%WE	%LFDL		%WMDL	%HDL
	30 DAT	60 DAT	90 DAT	Pre harvest	30 DAT	45 DAT	30 DAT	45 DAT
T1 = Control (No addition of any inputs)	3.5 (1.7)a	4.3 (2.2)a	2.8 (1.8)a	0.5 (0.9)a	2.0 (1.5)ab	2.3 (1.6)a	2.5 (1.7)a	2.3 (1.7)ab
T2 = Complete Natural Farming (NF)	0.0 (0.7)a	0.0 (0.7)b	1.2 (1.2)ab	1.4 (1.3)a	1.3 (1.2)ab	0.3 (0.8)b	2.3 (1.5)a	2.2 (1.6)ab
T3 = AI-NPOF package	4.8 (2.2)a	3.7 (2.1)a	2.7 (1.7)a	1.4 (1.3)a	3.1 (1.9)a	2.4 (1.7)a	0.9 (1.1)a	0.8 (1.1)b
T4 = Integrated Crop Management with NF	0.0 (0.7)a	1.9 (1.3)ab	1.2 (1.2)ab	2.0 (1.5)a	1.9 (1.5)ab	1.3 (1.2)ab	1.4 (1.3)a	2.7 (1.8)a
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	5.1 (2.0)a	0.8 (1.0)b	0.0 (0.7)b	1.6 (1.3)a	1.0 (1.1)b	1.6 (1.5)a	2.7 (1.7)a	0.9 (1.1)ab
HSD (0.05)	1.61	0.97	0.80	0.98	0.84	0.55	0.79	0.65
CV (%)	22.10	23.90	19.46	20.11	18.13	16.36	14.80	19.66

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

10. Pattambi

At this location, Aiswarya variety was grown, and no significant difference in the incidence of dead heart at 35 DAT, gall midge at 35 & 45 DAT, leaf folder, and caseworm was observed between the treatments (**Table 2.5.2.10**). Dead heart (%) at 15 DAT was significantly low in T5-ICM with need-based pesticides as compared to other NF treatments but at par with control.

Table 2.5.2.10. Pest incidence in natural farming trial at Pattambi, ***Kharif*** 2024

Treatments	%DH			%SS		%LFDL	%WMDL	%CWDL
	15 DAT	25 DAT	35 DAT	35 DAT	45 DAT	65 DAT	25 DAT	25 DAT
T1 = Control (No addition of any inputs)	7.2 (2.8)a	1.3 (1.2)c	4.1 (2.0)a	21.2 (4.6)a	22.4 (4.8)a	7.8 (2.9)a	16.1 (4.1)a	0.6 (1.0)a
T2 = Complete Natural Farming (NF)	15.8 (4.0)a	6.6 (2.5)a	3.4 (2.0)a	23.2 (4.9)a	24.3 (5.0)a	6.6 (2.7)a	12.2 (3.6)ab	0.3 (0.9)a
T3 = AI-NPOF package	17.1 (4.2)a	6.6 (2.7)a	6.4 (2.6)a	27.2 (5.3)a	28.3 (5.4)a	7.6 (2.8)a	11.7 (3.5)b	1.0 (1.2)a
T4 = Integrated Crop Management with NF	15.2 (4.0)a	4.8 (2.3)ab	5.2 (2.3)a	28.1 (5.3)a	32.6 (5.6)a	26.8 (4.5)a	13.6 (3.8)ab	0.5 (0.9)a
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	9.9 (3.1)ab	1.8 (1.5)bc	6.8 (2.7)a	20.0 (4.5)a	32.7 (5.7)a	5.5 (2.5)a	13.8 (3.8)ab	0.5 (1.0)a
HSD (0.05)	1.1	0.9	0.9	0.9	1.1	2.3	0.4	0.5
CV (%)	20.6	27.6	25.6	12.3	13.4	18.2	6.5	13.3

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

11. Raipur

The incidence of stem borer, leaf folder, caseworm, hispa and whorl maggot was observed in all the treatments in the Chhattisgarh Deobhog variety at this location (**Table 2.5.2.11**). The incidence of white ears was very high and significantly lower in T5-ICM with need-based pesticides (24.4% WE) and was at par with T4-ICM with NF (26.1% WE), T3-AI-NPOF package (28.2% WE) and T2-complete natural farming (29% WE) compared to T1-control (33.4% WE). Low incidence of dead hearts (<6% DH), leaf folder (<6% LFDL), caseworm (<1% CWDL), hispa (<9% HDL) and whorl maggot (<8% WMDL) was observed in all the treatments. Natural enemies like spiders and coccinellids were also recorded in different treatments.

Table 2.5.2.11. Pest incidence in natural farming trial at Raipur, ***Kharif*** 2024

Treatments	%DH	%WE	%LFDL	%CWDL	%HDL	%WMDL	Spiders	Coccinellids
	60 DAT	Pre harvest	30 DAT	60 DAT	30 DAT	30 DAT	30 DAT	90 DAT
T1 = Control (No addition of any inputs)	3.0 (1.4)a	33.4 (5.8)a	3.3 (1.8)a	0.7 (1.0)a	8.0 (2.9)a	7.0 (2.5)a	1.8 (1.5)a	1.3 (1.3)a
T2 = Complete Natural Farming (NF)	4.2 (1.8)a	29.0 (5.4)ab	2.8 (1.6)a	0.0 (0.7)b	5.4 (2.3)a	2.7 (1.7)a	1.3 (1.3)ab	1.5 (1.4)a
T3 = AI-NPOF package	5.6 (2.3)a	28.2 (5.3)b	5.3 (2.4)a	0.3 (0.9)ab	5.7 (2.5)a	4.2 (2.2)a	0.5 (1.0)b	1.3 (1.3)a
T4 = Integrated Crop Management with NF	0.0 (0.7)a	26.1 (5.2)b	2.7 (1.6)a	0.4 (0.9)ab	6.1 (2.6)a	5.1 (2.4)a	1.3 (1.3)ab	1.0 (1.2)a
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	3.1 (1.4)a	24.4 (5.0)b	2.5 (1.6)a	0.4 (0.9)ab	6.4 (2.6)a	5.5 (2.4)a	1.5 (1.4)a	0.8 (1.1)a
HSD (0.05)	1.62	0.49	1.36	0.32	1.05	1.16	0.41	0.43
CV (%)	19.00	5.99	20.03	24.23	26.92	23.89	20.74	22.30

Values in parentheses are square-root transformed values; Means followed by the same letter in a column are not significantly different from each other

12. Titabar

Ketaki Joha variety was grown in this location. The incidence of stem borer, leaf folder and whorl maggot was reported (**Table 2.5.2.12**). Dead heart incidence was significantly low in T2-complete natural farming (2.9% DH) as compared to T1-control (8.4% DH), which was at par with T4-ICM with NF (8.4% DH). Dead heart incidence was at par in T3-AI-NPOF (5.3% DH) and T5-ICM with need-based pesticide treatments at 45 DAT. A similar trend was observed for dead hearts at 65 DAT. White ear incidence was significantly lower in the T3-AI-NPOF package (2.7% WE) compared to the T1-control (8.7% WE). The incidence was at par in the rest of the treatments. The incidence of leaf folder (<7% LFDL) and whorl maggot (<7% WMDL) was low in all the treatments.

Table 2.5.2.12. Pest incidence in natural farming trial at Titabar, ***Kharif*** 2024

Treatments	%DH			%WE	%LFDL	%WMDL	
	25 DAT	45 DAT	65 DAT	Preharvest	75 DAT	65 DAT	75 DAT
T1 = Control (No addition of any inputs)	12.1 (3.5)a	8.4 (2.9)a	13.4 (3.7)a	8.7 (3.0)a	6.2 (2.6)a	3.5 (2.0)b	6.3 (2.6)a
T2 = Complete Natural Farming (NF)	7.0 (2.2)a	2.9 (1.7)b	1.6 (1.3)d	5.0 (2.3)bc	3.2 (1.9)b	1.8 (1.5)c	1.1 (1.2)bc
T3 = AI-NPOF package	8.6 (2.8)a	5.3 (2.4)ab	3.7 (2.0)bc	2.7 (1.8)d	2.9 (1.8)b	2.5 (1.7)bc	1.5 (1.3)b
T4 = Integrated Crop Management with NF	12.1 (3.5)a	8.4 (2.9)a	7.8 (2.8)b	5.9 (2.5)ab	6.2 (2.6)a	5.9 (2.5)a	0.0 (0.7)c
T5 = Integrated Crop Management (50 % organic and 50% inorganic sources) with need-based pesticides	7.9 (2.6)a	5.3 (2.4)ab	4.2 (2.1)bc	3.2 (1.9)cd	2.9 (1.8)b	2.5 (1.7)bc	1.5 (1.3)b
HSD(0.05)	2.12	0.97	0.68	0.57	0.59	0.39	0.61
CV (%)	17.10	23.00	18.40	16.00	17.92	13.69	17.91

Across the locations, the incidence of dead hearts caused by stem borer was low in T5-ICM with need-based pesticides (%% DH) followed by T4-ICM with NF (9.1% DH), which was at par with T2-Complete NF (9.5% DH). The incidence was high in T1-control (17.1% DH), followed by T3-AI-NPOF (12.4% DH) (**Figure 2.5.1**). White ears caused by stem borer were low in T5-ICM with need-based pesticides (7.5% WE), followed by T4-ICM with NF (10.6% WE) and T2-complete NF (11.9% WE). White ear damage was maximum in T1-control (21.5% WE), followed by T3-AI-NPOF (13.9% WE). Gall midge incidence was high in T4-ICM with NF (20.2% SS), followed by T3-AI-NPOF (17.9% SS) and T2-Complete NF (17.4% SS), as compared to T1-Control (15% SS) and T5-ICM with need-based pesticides (15.7% SS).

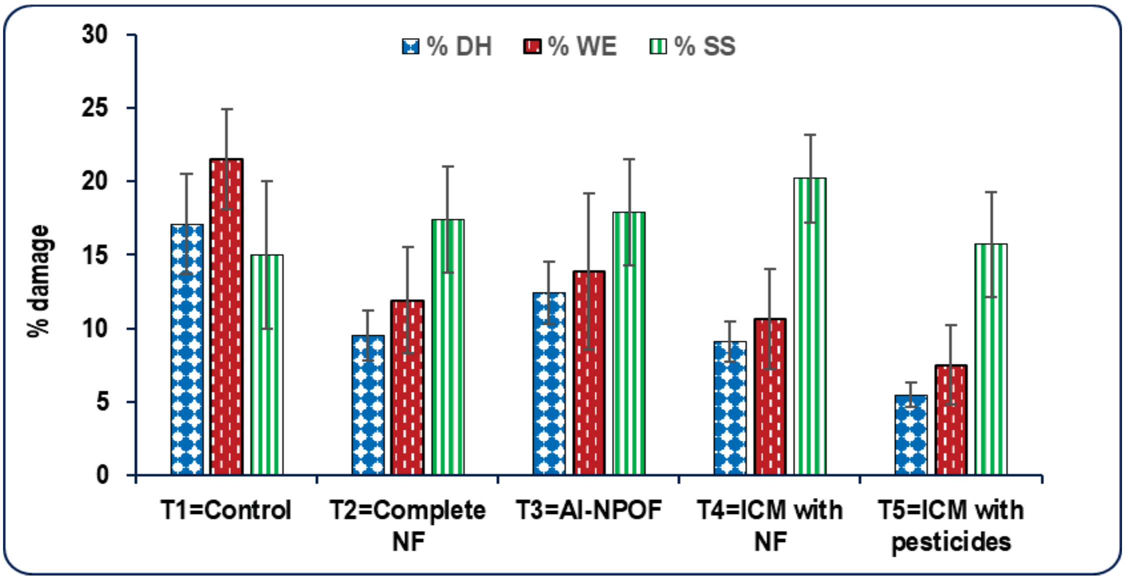


Figure 2.5.1. Incidence of stem borer and gall midge in different treatments across locations

Among the foliage feeding insects, leaf folder incidence was low in T5-ICM with need-based pesticides (7.3% LFDL), followed by T2-complete NF (9.8% LFDL). High leaf folder damage was observed in T1-control (17.1% LFDL), followed by T3-AI-NPOF (12.9% LFDL) and T4_-ICM with NF (10.5% LFDL) (**Figure 2.5.2**). Thrips damage was observed only at Moncompu and was high in T2-Complete NF (38.8% THDL), followed by T4-ICM with NF (31.8% THDL) and T3-AI-NPOF (21.7% THDL) compared to T1-control (14.3% THDL) and T5-ICM with need-based pesticides (17.8% THDL). Grasshopper damage was reported only from Khudwani. Grasshopper incidence was almost similar in all the treatments. Low incidence of whorl maggot (<7% WMDL), hispa (<6% HDL) and caseworm (<1% CWDL) was observed across the locations.

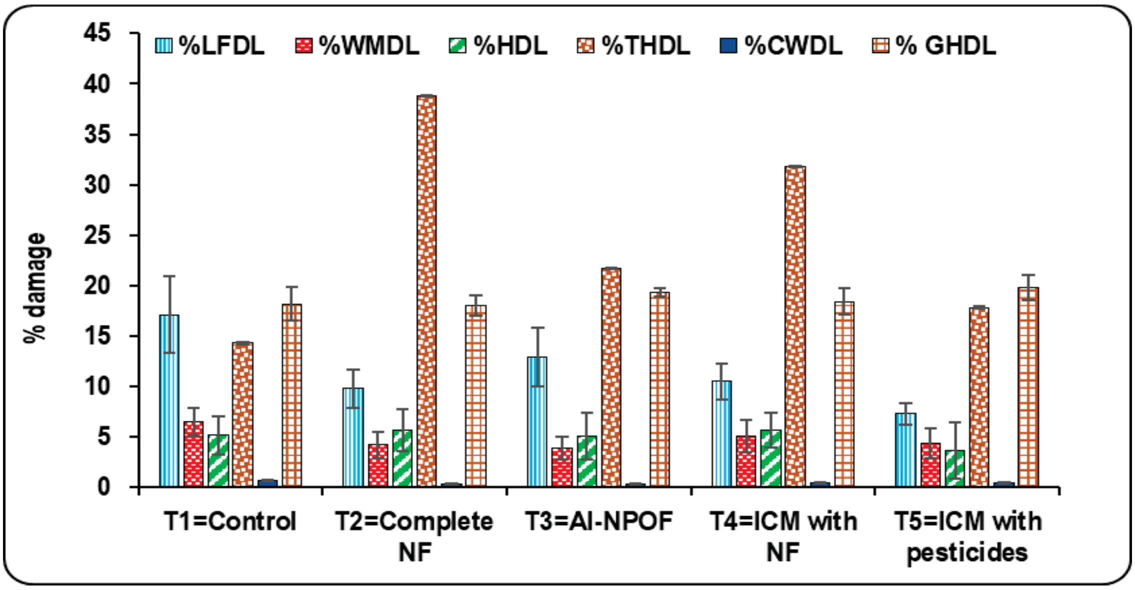


Figure 2.5.2. Incidence of foliage feeding insects in different treatments across locations

Among the sucking pests, BPH incidence was low in T5-ICM with need-based pesticides (31/5 hills) followed by T4-ICM with NF (35/5 hills) and T3-AI-NPOF (35/5 hills). BPH population was high in T1-control (122/5 hills), followed by T2-complete NF (61/5 hills). WBPH incidence *per se* was low in all the treatments across locations (**Figure 2.5.3**).

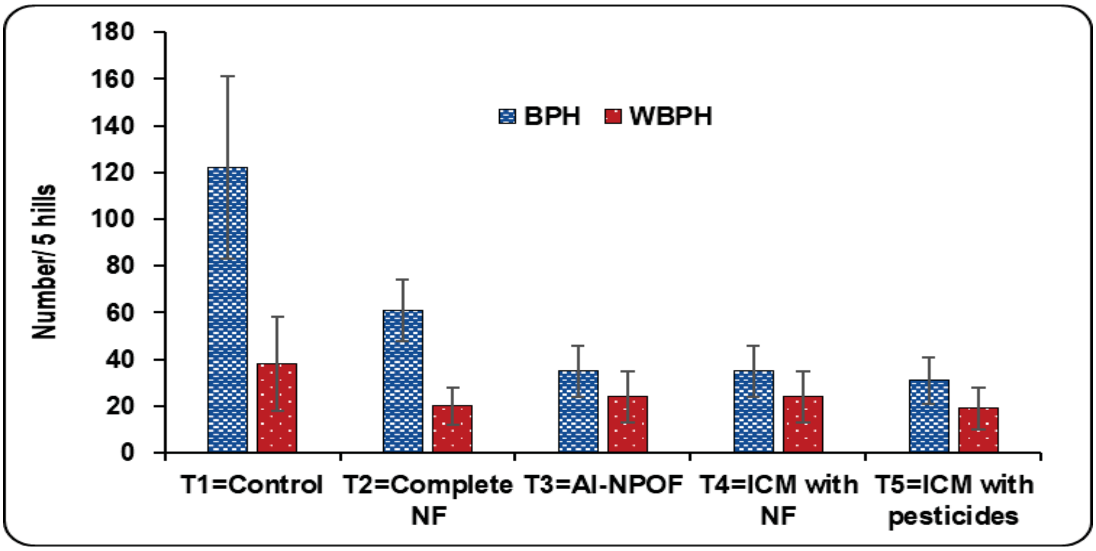


Figure 2.5.3. Incidence of sucking pests in different treatments across locations

***Summary**: Pest Incidence in Natural Farming (PINF), a collaborative trial with Agronomy, was initiated this year during Kharif 2024. The trial was conducted at 12 locations. The incidence of stem borer, gall midge, leaf folder, whorl maggot, hispa, thrips, caseworm, grasshopper, BPH, and WBPH was observed in all the treatments across locations. The thrips damage was observed only at Moncompu and the grasshopper damage was observed only at Khudwani. Overall, the incidence of dead hearts, white ears, leaf folder, whorl maggot, hispa and BPH was observed low in T5-Integrated crop management with need-based pesticides, followed by T4-Integrated crop management with natural farming, and T2-complete natural farming compared to other treatments, T3-AI-NPOF and T1-control.*

2.5.3. Evaluation of Pheromone blends for Insect Pests of rice (EPBI)

Monitoring insect pests is essential for developing effective Integrated Pest Management (IPM) strategies in rice cultivation. Pheromones hold significant potential for the surveillance and control of rice insect pests. Since they are species-specific and do not harm natural enemies, pheromones complement other IPM approaches. This ongoing trial focuses on evaluating normal and slow-release sex pheromone formulations to manage two major rice pests, *viz.*, the yellow stem borer and the leaf folder.

The trial was conducted at 13 locations in *Kharif* 2024 and two locations during *Rabi* 2023-2024. The field trial was constituted with two formulations, *viz.*, normal and slow-release formulations for yellow stem borer (YSB), *Scirpophaga incertulas* and rice leaf folder (RLF), *Cnaphalocrocis medinalis*. All the lures were placed randomly in delta traps, and installed in the field and each formulation was replicated three times. Observations were recorded on adult catches in each trap at weekly intervals after the installation of the traps till harvest. Simultaneously, field population counts were taken through visual count for yellow stem borer, disturb and count method (DCM) for leaf folder, sweep net catches and light trap (LT) catches for both the pests. The results of the study during *Kharif* 2024 are presented pest wise:

Yellow stem borer (YSB)

The cumulative catches of yellow stem borer in the season were significantly higher in the slow-release pheromone formulation compared to the normal formulation at 11 locations. Across locations, the mean cumulative catch was significantly higher in traps having the slow-release pheromone formulation at Jagtial (94/trap), followed by Pusa (81/trap) and Pattambi (41/trap) compared to traps with normal pheromone formulation, 73/trap at Jagtial; 40/trap at Pusa and 37/trap at Pattambi) (**Figure 2.5.3.1**). Similarly, mean sweep net catches were significantly higher at Jagtial (82/sweep), followed by Pusa (49/ sweep), while the visual count was significantly higher at Pusa (50/plot), followed by Jagtial (37/plot). Though the cumulative catches in the season were numerically low *per se*, the trap catch was significantly higher in the slow-release pheromone formulation compared to the normal formulation at 9 locations *viz.*, Pattambi, Chinsurah, Coimbatore, Jagdalpur Ludhiana, Maruteru, Navsari, Raipur and Titabar (**Figure 2.5.3.1**).

Though the catches were low in the trial at 2 locations, they were relatively high in normal formulations *viz.*, Moncompu (8.6/trap) and Rajendranagar (2.3/trap), as against slow-release formulations (7.2 & 0.3, respectively). At two locations, Aduthurai and Karaikal, the catch was nil in traps with both the formulations.

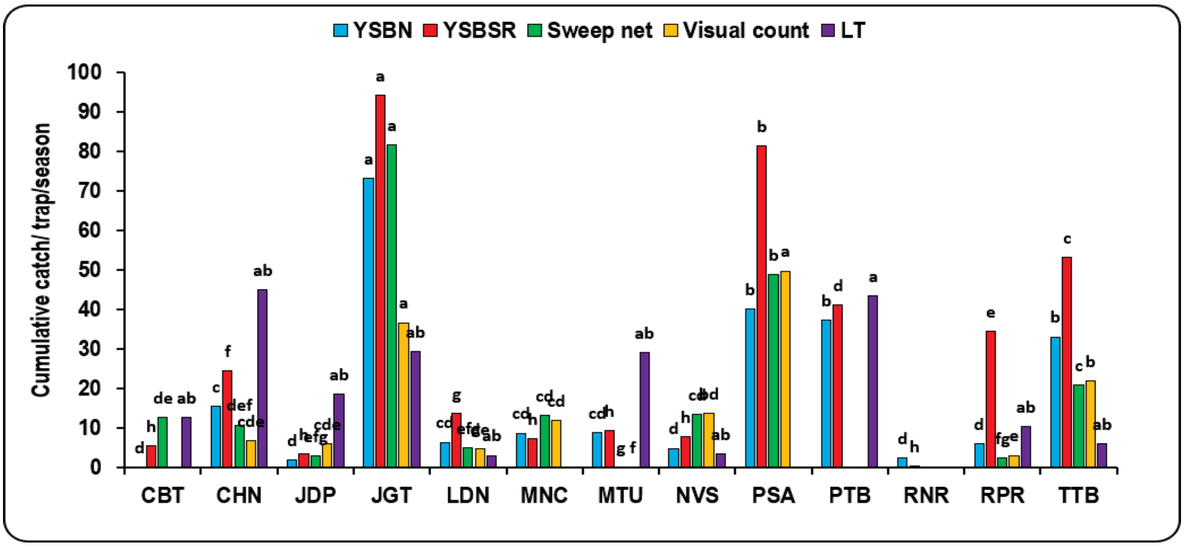


Figure 2.5.3.1. Evaluation of Yellow stem borer pheromone formulations at different locations, ***Kharif*** 2024

Rice Leaf folder (RLF)

The leaf folder catches were significantly higher in slow-release pheromone formulations at 7 locations *viz*, Raipur, Pusa, Chinsurah, Titabar, Navsari, Jagdalpur and Jagtial, whereas catches were high in normal formulations at 3 locations *viz*.,Ludhiana, Moncompu and Maruteru (**Figure 2.5.3.2**). In Pattambi and Rajendranagar, the catches were low in traps with both normal and slow-release formulations. At two locations, Aduthurai and Karaikal, the trap catch was nil in both formulations. Leaf folder cumulative catches were significantly high in the slow-release formulation at Raipur (32/trap), followed by Pusa (28/trap) and Chinsurah (21/trap), compared to the normal formulations (21, 11, 12 at respective locations). Leaf folders mean numbers were very high at Raipur in sweep net catches (99/sweep) followed by Moncompu (66/sweep), Ludhiana (40/ sweep) and Pattambi (37/sweep). In the Disturb and Count Method (DCM), maximum number of leaf folder adults were found at Raipur (84/ plot) followed by Moncompu (75/plot).

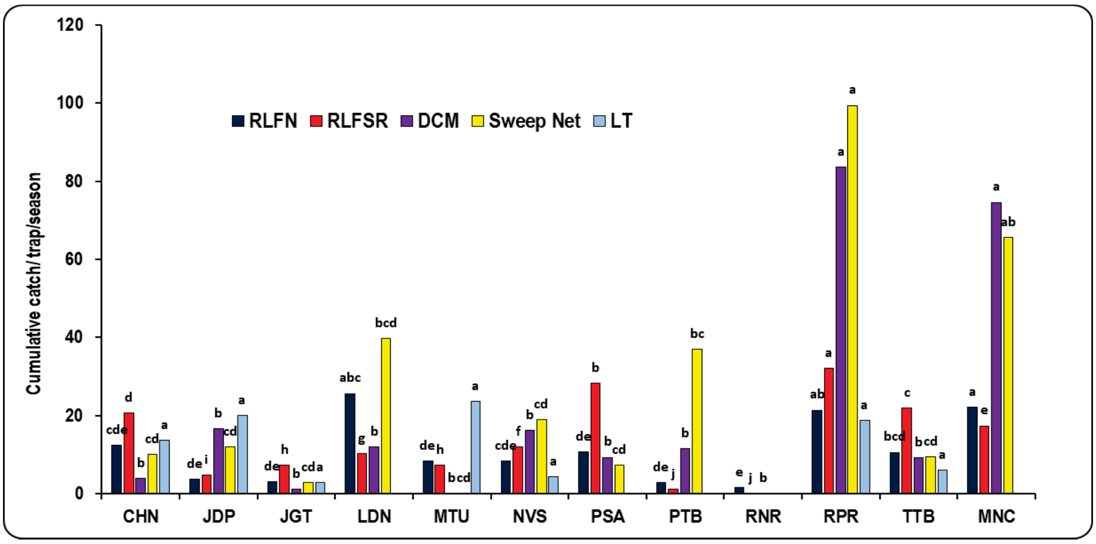


Figure 2.5.3.2. Evaluation of leaf folder pheromone formulations at different locations, ***Kharif*** 2024

The reasons for variability in the trap catches for each of the pests at various locations needs a further in-depth analysis looking into various factors, which is beyond the scope of this progress report.

Evaluation of pheromone blends for insect pests of rice (EPBI) trial was conducted at 13 locations during Kharif 2024 and two locations during rabi 2023-24. The field trial was conducted with normal and slow-release sex pheromone formulations of yellow stem borer and rice leaf folder. Across locations, slow-release formulations recorded maximum cumulative catches in a season compared to the normal formulations in the case of the yellow stem borer and the leaf folder in a season. The cumulative catches of yellow stem borer were high in slow-release pheromone formulation at Jagtial (94/trap), followed by Pusa (81/trap) and Pattambi (41/trap) as compared to normal pheromone formulations with 73, 40 and 37 catches, respectively. Similarly, leaf folder catches were high in Raipur (32/trap) followed by Pusa (28/trap). Simultaneously, field population counts were taken through visual count for yellow stem borer, disturb and count method (DCM) for leaf folder, sweep net catches and light trap (LT) catches for both the pests.

2.6 INTEGRATED PEST MANAGEMENT STUDIES

2.6.1 Integrated Pest Management in Direct Seeded Rice (IPM DSR)

Rice is a staple crop in India, contributing significantly to food security and livelihoods. Traditionally, rice is grown using the transplanted puddled rice (TPR) system, which involves raising seedlings in nurseries and then transplanting them into flooded fields. However, this method is highly labour-intensive, requires excessive water, and contributes to soil degradation. In response to these challenges, Direct-Seeded Rice (DSR) has emerged as an alternative method that reduces water consumption, labour requirements, and production costs.

DSR involves the direct sowing of rice seeds into the field, through either dry seeding, wet seeding, or drum seeding, without the need for transplantation. While the method offers several advantages, it also presents challenges, such as weed infestation, increased vulnerability to pests, and the need for precise nutrient and water management. India has witnessed a gradual shift towards DSR, particularly in states facing labour shortages and water scarcity. Keeping this in mind, the present trial was formulated in collaboration with plant pathologists and agronomists to validate Integrated Pest Management (IPM) practices from a range of choices and demonstrate to farmers how to manage pests (such as insects, diseases, and weeds) holistically and economically.

During *Kharif* 2024, the IPM DSR trial was conducted in nine locations in 16 farmers' fields. The details of pest management practices followed and pest incidence zone-wise are discussed below:

Zone II – Northern areas

The IPM DSR trial was conducted at Kaul and Ludhiana in this zone. At Kaul, the trial was conducted in Sri. Mahender Singh field at Rasina village in Pundri mandal, Kaithal district, Haryana. At Ludhiana, the trial was conducted at the research farm, PAU, Ludhiana. The IPM DSR practices and farmers' practices followed are given below:

Practices followed in IPM DSR trial in Zone II (Northern areas), ***Kharif*** 2024

	IPM Practices	Farmer Practices (FP)
Area	1 acre	1 acre
Variety	PB 1847	PB 1847
Main Field	• Application of 25 kg DAP, 80 kg Urea, Zinc sulphate (21%) 10 kg • Application of pre-emergence weedicide, Pendimethalin @ 1300 ml/ acre • At 20-30 DAS, applied Nominee gold (Bispyribac sodium) @ 100ml/ acre	• Application of 50 kg DAP, 120 kg Urea, Zinc sulphate (21%) 10 kg • Application of pre-emergence weedicide, Pendimethalin @ 1300 ml/ acre • Application of Nominee gold (Bispyribac sodium) @ 100ml/ acre • At 30 – 60 DAS, sprayed Amistar top @ 200 ml/ acre

	• At 30 – 60 DAS, sprayed Samarth (Carbendazim + Mancozeb) @ 400 ml/ acre for leaf blast and brown spot control • Applied urea @ 40 kg as top dressing • Release of *Trichogramma chilonis* @ 40000/ acre, 3-4 times • Installation of bamboo bird perches @ 10/ acre • Sprayed 0.5% FeS + 2.5% N • At 60-90 DAS, sprayed Flubendiamide 20 WG @ 50 g/ acre • Sprayed Hexaconazole @ 400 ml/ acre At 90 DAS to harvest, sprayed Incipio (Isocycloyrum 18.1%) @ 220 ml/ acre for stem borer management. • Sprayed copper oxychloride for grain discolouration	• Application of cartap hydrochloride 50 SP @ 400 g/ acre • Applied urea @ 40 kg as top dressing • At 60-90 DAS, sprayed Flubendamide @ 50 g/acre + Lamda cyhalothrin @30 ml/acre • Applied urea @ 40 kg as top dressing • Applied Pexalon (Triflumezopyrim 10% SC) @ 100 ml/ acre • Sprayed copper oxychloride for grain discolouration

Incidence of stem borer, leaf folder, BPH, WBPH, leaf blast, neck blast, sheath blight, brown spot and bacterial blight was observed at Kaul in both IPM and FP plots in the wet DSR system (**Table 2.6.1.1**). In general, the incidence of insect pests was low in both treatments. Grain yield was higher in the IPM plot (5722 kg/ ha) as compared to the FP plot (5650 kg/ ha), resulting in higher gross returns and a higher BC ratio (3.14) (**Table 2.6.1.2**)

Table 2.6.1.1. Insect pest incidence in IPMDSR trial at Kaul in Zone II (Northern areas), ***Kharif 2024***

Treatments	% DH		% WE	%LFDL	%LFDL	%LFDL	BPH No/5 hills	WBPH No/5 hills	Yield
	90 DAS	104 DAS	Pre har.	69 DAS	83 DAS	97 DAS	118 DAS	111 DAS	Kg/ ha
IPM	0.2 ± 0.2	2.6 ± 0.4	4.0 ± 0.4	0.3 ± 0.1	0.8 ± 0.1	0.5 ± 0.1	1.0 ± 0.6	0.6 ± 0.4	5722 ± 88
FP	0.6 ± 0.4	1.0 ± 0.6	4.8 ± 0.4	0.3 ± 0.1	1.0 ± 0.2	1.3 ± 0.3	2.6 ± 0.7	1.2 ± 0.6	5650 ± 126

Table 2.6.1.2. Returns and BC ratio in IPMs trial in Zone II (Northern), ***Kharif*** 2024

Location	Farmer's Name	Treatments	Yield (q/ha)	Gross Returns (Rs.)	Cost of Cultivation (Rs)	Net Returns (Rs.)	BC Ratio
KUL	Sri Mahender Singh	IPM	57.22	154494	49175	105319	3.14
		FP	56.50	152550	66125	86425	2.31

Price of paddy at KUL = Rs. 2700/q

At Ludhiana, PR 126 variety was grown in dry DSR. Low incidence of stem borer, leaf folder, BPH and WBPH was observed in both IPM and FP plots in the dry DSR system (**Table 2.6.1.3**).

Table 2.6.1.3. Insect pest incidence in IPMDSR trial at Ludhiana in Zone II (Northern areas), ***Kharif 2024***

Treat-ments	% DH			% WE	%LFDL			BPH No/hill	WBPH No/hill
	60 DAS	77 DAS	97 DAS	Pre har.	60 DAS	77 DAS	97 DAS	77 DAS	77 DAS
IPM	2.6 ± 0.4	3.0 ± 0.4	2.0 ± 0.1	2.3 ± 0.1	3.5 ± 0.2	4.3 ± 0.4	3.5 ± 0.3	0.9 ± 0.1	1.6 ± 0.1
FP	2.2 ± 0.0	2.4 ±0.0	3.7 ± 0.1	3.6 ± 0.0	3.1 ± 0.1	3.9 ± 0.2	5.6 ± 0.1	0.8 ± 0.1	1.4 ± 0.1

At Kaul, the adoption of IPM practices was found to reduce the progression of diseases, *viz.*, leaf blast (IPM – 4.2; FP-7.0), neck blast (IPM – 1.05; FP-1.4), sheath blight (IPM – 9.45; FP-11.97) and bacterial blight (IPM – 4.2; FP-7.0). However, with respect to brown spot, the AUDPC value was high in the IPM Practices adopted field compared to Farmer Practices due to the prevalence of drought conditions in the IPM field (**Table 2.6.1.4**).

Table 2.6.1.4. AUDPC values of rice diseases in IPM DSR at Kaul, Kharif 2024

Treatment	Kaul				
	AUDPC Values				
	LB	NB	SHB	BB	BS
IPM	4.2	1.1	9.5	33.1	47.4
FP	7.0	1.4	12.0	51.2	30.2

LB- Leaf Blast; NB- Neck Blast; BB- Bacterial Blight; BS – Brown spot; SHB- Sheath Blight

The weed problem, in general, at Kaul was negligible in both IPM and FP plots with a yield advantage of 1.22% (**Table 2.6.1.5**). At Ludhiana, the weed population and weed biomass at Panicle Initiation stage in IPM plots were lower than farmers practice by 20 and 27%, respectively. The mean grain yield advantage was 0.94% in IPM-adopted plots.

Table. 2.6.1.5. Weed parameters in Zone II (Northern areas) in IPM DSR, ***Kharif*** 2024

Location	Treatments	Weed population (No/m^2)		Weed dry biomass (g/m^2)	
		30 DAS	45 DAS	30 DAS	45 DAS
Kaul	IPM	1.00(1.10)			
	FP	1.00(1.13)			
	Exp. mean	1.11			
	CD(0.05)	0.51			
Ludhiana	IPM		3.20(1.80)		20.03
	FP		4.00(2.01)		27.66
	Exp. mean		1.91		23.85
	CD(0.05)		0.41		8.96

Zone VI – Western areas

In this zone, the IPM DSR trial was conducted only at Karjat in two farmers' fields, *viz.,* Sri Nilikesh Dalvi of Vadap village and Sri Rohit Somane of At Ukrul village, Post Chinchavali, Karjat mandal, Raigad district. The package of practices followed in wet DSR in IPM and FP plots is given in the following table:

Package of practices followed in IPM DSR trial at Karjat in Zone VI (Western), ***Kharif*** 2024		
	IPM practices	Farmers practices
Area	1 acre	1 acre

Varieties	F1- Sri Nilikesh Dalvi - Karjat 7 F2 – Sri Rohit Somane – karjat 7	
Seed treatment	Seed treatment with Trichoderma @ 10 g/ kg seed	
Main field	• Deep ploughing • Removal and destruction of stubbles • Application of FYM 7.5 T, Suphala 333 Kg, Urea 110 Kg • Pre-emergence herbicide Bispyribasodium (Nomini gold). 250ml/ha + hand weeding • Pheromone traps @ 8 / acre • Use of bird perches in the field • Use Vaibhav sickle for harvesting • Application of Cartap hydrochloride 18 kg/ha (one application)	• Application of FYM 4 T, Urea 180 kg, Suphala 75 kg • Preemergence herbicide Bispyribasodium (Nomini gold). 250ml/ha + hand weeding • Application of Cartap hydrochloride 18 kg/ha

The incidence of stem borer and leaf folder was observed in both IPM and FP plots in both the farmers' fields (**Table 2.6.1.6**). Across the farmers, stem borer incidence was significantly higher in FP plots (7.3% DH) compared to IPM plots (4.8% DH). Similarly, leaf folder incidence was significantly lower in IPM plots (2.5% LFDL) compared to FP plots (17.9% LFDL). Grain yield was significantly higher in IPM plots (4652 kg/ ha) as compared to FP plots (3974 kg/ ha).

Table 2.6.1.6 Insect Pest incidence in IPM DSR trial in Zone VI (Western areas), ***Kharif*** 2024

Treatments			%DH/WE	% LFDL	Yield kg/ha
KJT	F1- Sri Nikilesh Dalvi	IPM	5.0(2.2)a	1.3(1.3)b	4572(67.6)a
		FP	7.3(2.6)a	16.0(4.0)a	3920(62.6)b
LSD (0.05, 20)			0.55	0.32	2.8
KJT	F2 - Sri Rohit Somane	IPM	4.6(2.2)b	3.6(1.9)b	4732(68.7)a
		FP	7.3(2.8)a	17.9(4.3)a	4028(63.4)b
LSD (0.05, 20)			0.41	0.19	3.5
Treatments					
T1 = IPM			4.8(2.2)b	2.5(1.6)b	4652(68.2)a
T2 = FP			7.3(2.7)a	17.0(4.2)a	3974(63.0)b
LSD (0.05,40)			0.33	0.18	1.87
DAS					
D1 = 29 DAS					
D2 = 36 DAS			4.4(2.1)b		
D3 = 50 DAS			6.7(2.6)a		
D4 = 71 DAS			7.0(2.6)a		
D5 = 85 DAS				9.1(3.0)a	
D6=99 DAS				10.0(2.9)a	
D7=113 DAS				10.1(2.7)a	
LSD (0.05,20)			0.41	0.22	

Between the two farmers, grain yield was higher in Sri Rohit Somane's field compared to Sri Nikilesh Dalvi's field in both the treatments. Higher grain yield in IPM plots resulted in higher gross returns. Higher net returns in IPM plots accompanied by a low cost of cultivation resulted in a higher BC ratio in IPM plots compared to FP plots (**Table 2.6.1.7**).

Table 2.6.1.7. Insect Pest incidence in IPM DSR trial in Zone VI (Western areas), ***Kharif*** 2024

Location	Farmer's Name	Treatments	Yield (q/ ha)	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net returns (Rs.)	BC ratio
KJT	F1- Sri Nikilesh Dalvi	IPM	45.72	105156	75901	29255	1.39
		FP	39.20	90160	70598	19562	1.28
KJT	F2 - Sri Rohit Somane	IPM	47.32	108836	75901	32935	1.43
		FP	40.28	92644	70598	22046	1.31

Price of paddy = Rs. 2300/q

Zone VII – Southern areas

IPM DSR trial was conducted in 13 farmers' fields at 5 locations during *Kharif* 2024. The details of farmers and villages are given below:

Zone VII				
S. No	Location	State	Village, district	Farmer Name
1	Aduthurai	Tamil Nadu	Sreekandapuram, Thanjavur	Sri Ramalingam
2	Aduthurai	Tamil Nadu	Nakkambadi, Thanjavur	Sri Ramanathan
3	Aduthurai	Tamil Nadu	Sithamalli, Thanjavur	Sri Ravichandran
4	Bapatla	Andhra Pradesh	Jammulapalem, Bapatla	Sri Raghava Rao
5	Bapatla	Andhra Pradesh	Ilavaram, Bhattiprolu	Sri Seeta Ramaiah
6	Coimbatore	Tamil Nadu	Kumaralingam (West), Tirupur	Sri A Gopalakrishnan
7	Coimbatore	Tamil Nadu	Pappankulam, Tirupur	Sri Sivakumar
8	Coimbatore	Tamil Nadu	Kumaralingam, Tirupur	Sri Nagaraj
9	Gangavathi	Karnataka	Yardona, Kartagi, Koppal	Sri Siddanagouda Malipatil
10	Gangavathi	Karnataka	Hosalli camp, Gangavathi, Koppal	Sri Devendrappa
11	Gangavathi	Karnataka	SB camp, Gangavathi, Koppal	Sri Suryarao
12	Mandya	Karnataka	Gaanadaalu, Mandya	Sri Chikkonu, S/O Girlu Bommegouda
13	Mandya	Karnataka	Habbada maranahally, Mandya	Sri Shivanna S/O Late Eraiah

At all the locations, wet DSR was followed except at Gangavathi, wherein Dry DSR was followed. The package of practices followed in both IPM and FP plots by various farmers are given in the table below:

Package of practices followed in IPM DSR trial in Zone VII (Southern), ***Kharif*** 2024

Practices followed in IPM DSR trial at Aduthurai, ***Kharif*** 2024		
	IPM practices	Farmers practices
Area	1 acre	1 acre
variety	IR 20	IR 20
Before sowing	Seed treatment with Trichoderma @ 10g/ kg	
Fertilizers	Applied 75kg of N and 50kg of P	Applied 75kg of N and 50kg of P
Main field	• Within 3 – 5 DAS, applied Pyrazosulfuron ethyl 20 g ai/ha • Grown blackgram as a bunds crop	• Applied Carbofuran 3SG @ 25 kg/ ha • Chloripyriphous 20EC 1000ml/ha applied

	• At 20 DAS, installed pheromone traps with 5 mg lure @ 3 traps/acre for yellow stem borer monitoring • Released of *Trichogramma japonicum* adults against yellow stem borer and *Trichogramm chilonis* against leaf folder. • At 25 DAS, Fipronil 0.3G @ 10 kg/ acre was applied • At 30 DAS- carbendazim + mancozeb (@ 2-2.5 gm/lit) was applied • At 30 – 60 DAS, installation of bamboo perches of 2-3 ft height in the field @ 15 to 20 per acre at the vegetative stage to serve as resting/ landing sites for birds • At 61-90 DAS, one prophylactic spray of cartap hydrochloride 50 WP/SP @ 400 g/ acre	• At 25 DAS, triafamone + ethoxysulfuron @67.5 g/ ha was applied • At 30 DAS- carbendazim + mancozeb (@ 2-2.5 gm/lit) was applied • At 30-60 DAS, Sprayed chlorantraniliprole 18.5 SC @ 60ml/acre • At 61-90 DAS, Dinotefuran 12%+ Pymetrozine 45% wg @ 80g/ acre was applied for Brown Plant hopper
Practices followed in IPM DSR trial at Bapatla, Kharif 2024		
Sri Raghava Rao, Jammulapalem, Bapatla mandal, Andhra Pradesh		
Area	4000 sqm	4000 sqm
Variety	BPT 5204	BPT 5204
Fertilizers	NPK @ 90-60-40 kg/ha	NPK @ 120-80-40 kg/ha
Before sowing	• Seed Treatment with Trichoderma @ 10g/ kg seed	
Main field	• Formation of alleyways of 30 cm for every 2 m • Applied Oxidiagryl (Top star) @ 80-100 ai/ha at 3 DAS • Installed pheromone traps @ 8 traps/ ha for stem borer monitoring. • Applied Triafomone + Ethoxysulfuron 30%WG (Council Active) @ 90 g/acre • Release of egg parasitoid, *T. chilonis* @ 40000/acre from 30 DAS, 3 times in 15 days interval • Applied carbandazim + Mancozeb @ 2.0 g/lit was applied • Manual weeding at 45 DAS • Applied Neemazal 3 ml/ lit at 45 DAS • One spray of chlorantraniliprole @ 0.3 ml/l at 60 DAS • Applied Triflumezopyrim 10% SC (pexalon)@ 94 ml per acre at 70 DAS • Applied Pymetrozine @ 0.6 g/lit for BPH at 90 DAS • Spraying of Hexaconazole against sheath blight @ 100 DAS • Applied cartap hydrochloride @ 2 g/lit at 100 DAS	• Formation of alleyways of 30 cm for every 2 m • Application of Londax power @4 kg/acre • Applied Hexaconazole @ 2.0 ml /lit was applied • Manual weeding • Applied Carbofuran granules @ 4 kg/acre 45 DAS • One spray Ampligo (Chlorantraniliprole 10% + Lambda-cyhalothrin 5% ZC @ 0.5 ml/l at 60 DAS • Applied Triflumezopyrim 10% SC (pexalon)@ 94 ml per acre at 70 DAS • Spraying of hexaconazole and azoxystrobin +difenoconazole (amistar top) against sheath blight • Applied Dinotefuron @0.4 g/lit for BPH at 90 DAS • Spraying of Propiconazole @ 1.0 ml/lit at 100 DAS • Spraying of Indoxacarb for leaf folder, stem borer & Profenophos for leaf & panicle mite at 100 DAS
Sri Seeta Ramaiah, Ila Varam, Bhattiprolu mandal, Andhra Pradesh		
Area	4000 sqm	4000 sqm
Variety	BPT 5204	BPT 5204
Fertilizers	NPK @ 90-60-40 kg/ ha	NPK @ 120-80-40 kg/ha
Before sowing	Seed Treatment with Trichoderma @ 10g/ kg seeds	Seed treated with Beejamrutam @ 5 ml/kg seed (Natural farming practice)
Main field	• Applied Oxidiargyl (Top star) @ 80-100 a.i/ha at 3 DAS • Formation of alleyways of 30 cm for every 2 m • Installed pheromone traps @ 8 traps/ ha for stem borer monitoring. • Triafomone + Ethoxysulfuron 30%WG (Council Active) @ 90 g/acre applied	• Applied Pendimethalin 38.7 SC @1.7 lit/ha • Formation of alleyways of 30 cm for every 2 m • Manual weeding @ 30 DAS • Applied Rynaxypyr @ 0.3 ml/lit • Applied Hexaconazole @ 2.0 ml /lit was applied

	• Release of egg parasitoid, *T. chilonis* @ 40000/acre from 45 DAS, 3 times in 15 days interval • Manual weeding at 45 DAS • Applied Nemazole 3 ml/lit at 45 DAS • Fipronil 0.3 G Granules @4 kg/acre @ 60 DAS • Applied Triflumezopyrim 10% SC (pexalon)@ 94 ml per acre at 70 DAS • Spraying of tricyclazole @ 0.6 g/l against leaf blast @ 70 DAS • Applied cartap hydro chloride @ 2 g/lit at 90 DAS • Applied Pymetrozine @ 0.6 g/lit for BPH at 90 DAS • Spraying of Hexaconazole against sheath blight @ 100 DAS • Applied Dinotefuran @0.4 g/lit for BPH at 100 DAS	• Manual weeding @ 45 DAS • Applied *Neemastram* @ 2 lit /acre at 45 DAS • Carbofuran 3 SG granules @ 6 Kg./acre • Applied Pymetrozine @ 0.6 g/lit for BPH at 70 DAS • Applied Sour butter along with leaf extract as natural farming practice • Applied Dinotefuran @0.4 g/lit for BPH at 90 DAS • Spraying of Indoxacarb for leaf folder, stem borer & Profenophos for leaf & panicle mite at 90 DAS • Spraying of Propiconazole @ 1.0 ml/lit at 100 DAS
Practices followed in IPM DSR trial at Coimbatore, Kharif 2024		
F1 = Sri A Gopalakrishnan, Kumaralingam village, Tirupur mandal F2 = Sri Sivakumar, Pappankulam village, Tirupur mandal F3 = Sri Nagaraj, Kumaralingam village, Tirupur mandal		
Area	1 acre	1 acre
Variety	CR 1009	Cr 1009
Fertilisers	NPK @ 60, 20, 20 kg/ ha	NPK @ 70, 30, 20 kg/ ha
Before nursery	• Seed treatment with Trichoderma @ 10g/ kg seed	•
Main field	• Cowpea on bunds • At 3 – 5 DAS, application of Pyrazosulfuron ethyl 20 g ai/ha • Installation of pheromone traps @ 3 traps/acre for yellow stemborer monitoring at 20 DAS • Release of *Trichogramma japonicum* adults against yellow stem borer and *Trichogramma chilonis* against leaf folder 2 times @ 40, 000/ acre, starting from 15 days after transplanting • At 25-30 DAS, application of post-emergence herbicide triafamone + ethoxysulfuron @ 67.5 g a.i./ha (1 field) / hand weeding (2 fields) • Nitrogen(N) top dressing as per protocol • Blanket spray of NeemAzal @ 3 ml/ liter water at 40 – 45 DAS • One prophylactic spray of Chlorantraniliprole (Coragen) 18.5 SC @ 60 ml/ acre	• Applied Thiamethoxam25 WG 100g/ha , Cartap hydro chloride 10kg/ha, Chlorantraniliprole 18.5 EC 100ml/ ha • Sprayed Copper oxy chloride, Mancozeb+ carbendazim (saaf), Propicanozole
Practices followed in IPM DSR trial at Gangavathi, Kharif 2024		
F1 = Sri Siddangouda, Malipali; F2 = Sri Devendrappa; F3 = Sri Suryarao		
Area	1 acre	1 acre
Variety	RNR 15048	RNR 15048
Fertilisers	NPK @ 60:30:30 kg/ha	NPK @ 120:60:60 kg/ha
Before sowing	• Seed treatment with Chlorantaniliprole 50% FS @ 4 ml/kg seeds	
Main field	• Forming alleyways of 30 cm after every 2 m • Installation of pheromone traps @ 3 traps/ acre for monitoring at 20 DAS • Growing marigold and cowpea on bunds • Application of Fipronil 0.6G @ 4 kg/ acre at 20-25 DAS • Release of *Trichogramma japonicum* (egg cards), 4 times @ 40,000/ acre starting from 20 DAS • Sprayed Triflumezopyrim 10% SC @ 94 ml/ acre for planthopper management at 65 DAS	• Sprayed Chlorpyrifos 20 EC @ 400 ml/ acre at 15 DAS • Application of Fipronil 0.3G @ 10 kg/ acre at 25 DAS • Spraying of Carbosulfan @ 400 ml/ acre at 35 DAS • Sprayed Triflumezopyrim 10% SC @ 94 ml/ acre for planthopper management at 50 DAS • Spraying of Pymetrozine @ 120 g/ acre at 60 DAS

	• Spraying of Cartap hydrochloride 50 SP @ 400g/ acre at 70 DAS	• Spraying of Cartap hydrochloride 50 SP @ 400g/ acre at 75 DAS • Spraying of Thiamethoxam 25 WG @ 100 g/ acre at 95 DAS
Practices followed in IPM DSR trial at Mandya, Kharif 2024		
Sri Chikkonu S/o Girlu Bommegowda, Ganadaalu village, Mandya district		
Area	1 acre	1 acre
Variety	RNR 15048	RNR 15048
Fertilisers	• Urea 45 kg/ acre, SSP 125 kg/ acre, MOP 35 kg/ acre, Top dressing 45 kg urea • Incorporated Zinc sulphate @ 8 kg/ acre during puddling	• Urea 50 kg/acre, 10:26:26 @ 100 kg/acre, MOP 25 kg/ acre
Before sowing	• Seed treatment with Carbandezim @ 4g / kg seed	
Main field	• Forming alleyways of 30 cm at every 2 m • Londax power @ 4kg/ac - herbicide + one hand weeding • Installation of pheromone traps for monitoring stem borer 5 mg lure @ 8 traps / ha • Sprayed Cartap hydrochloride 50SP @240g/ acre at 60 DAS • Sprayed Tricyclazole 75 WP @ 0.6g/ liter water at PI stage • Alternate wetting and drying followed	• Applied Pretilachlor 50EC @ 400ml/acre (Refit) + two hand weedings • Applied Fipronil 0.3G@10kg/acre • Sprayed Chlorantraniliprole @ 60 ml/acre • Applied Tebuconozole (Nativo)@0.4gr/lit • Applied Dinotefuron20%SG @ 250g/ha at 70DAS • Continuous irrigation
Sri Shivanna S/O Late Eraiah, Habbada Maranhally Village, Mandya district		
Area	1 acre	1 acre
Variety	Super amman	Super amman
Fertilisers	• Urea 45 kg/ acre, SSP 125 kg/ acre, MOP 35 kg/ acre, Top dressing 45 kg urea • Incorporated Zinc sulphate @ 8 kg/ acre during puddling	• Urea 100 kg/acre, 20:20:0:13 @ 50 kg/acre, 10:26:26 @ 50 Kg/ acre
Before sowing	• Seed treatment with Carbendazim @ 4g / kg seed	
Main field	• Forming alleyways of 30 cm at every 2 m • Londax power @ 4kg/ac - herbicide + one hand weeding • Installation of pheromone traps for monitoring stem borer 5 mg lure @ 8 traps / ha • Applied Chlorantraniliprole 0.4GR @ 4 kg/ acre 50SP @240g/ acre at 60 DAS • Sprayed Tricyclazole 75 WP @ 0.6g/ liter water at PI stage • Alternate wetting and drying followed	• Applied Butachlor @ 400 ml/ acre + two hand weedings • Applied Fipronil 0.3G@10kg/acre • Sprayed Cartap hydrochloride 50SP @ 400g/ acre • Applied Azoxystrobin + Difenconazole (amistar top)@1ml/lit • Applied Buprofezin25SC@1.4ml/lit at 70DAS • Continuous irrigation

Incidence of stem borer, gall midge, leaf folder, whorl maggot, hispa, thrips, BPH and WBPH was observed at various farmers' fields in both IPM DSR and FP plots at this zone (**Table 2.6.1.8**). Across locations, stem borer incidence was relatively high at Aduthurai and Mandya in all five farmers' fields. At Aduthurai, dead hearts caused by stem borer were significantly high in FP plots (17.2-18.7% DH) in two farmers' fields (F1 & F3), while it was at par in both the treatments in F2 farmer field (14.6-22.6% DH). Similarly, at Mandya, dead hearts were significantly low in the IPM plot (8.9% DH) in Sri Shivanna's field compared to the FP plot (16.7% DH), while it was at par in both IPM and FP plots at Sri Chikkonu's field. Stem borer incidence was low in all the farmers' fields at Bapatla, Coimbatore and Gangavathi.

Gall midge incidence was relatively high in FP plots (15.9 – 23.1% SS) in all three farmers' fields at Aduthurai but was at par statistically with incidence in IPM plots (9.4 – 14.1% SS). At Gangavathi, silver shoots were significantly high in IPM plots (18.5 – 21.8% SS) compared to FP plots (6.2 – 8.4% SS) in all three farmers' fields. The gall midge incidence was low and at par in both the treatments at two farmers' fields at Bapatla.

Leaf folder incidence was significantly low in IPM plots (10.7-12.1% LFDL) compared to FP plots (14.2-19.2% LFDL) in two farmers' fields (F2 & F3) at Aduthurai, while the damage was at par in both the treatments in F1 farmers' field. The leaf folder damage was low (<6% LFDL) in all the other farmers' fields at other locations in both the treatments.

Whorl maggot damage was significantly lower in one farmer's field (F2) at Aduthurai in the IPM plot (10.9% WMDL) compared to the FP plot (16.3% WMDL). Though the damage was high in both the treatments (10.9 – 14.1% WMDL in IPM plots & 12.6-17.8% WMDL in FP plots) in the other two farmers' fields at Aduthurai, they were at par with each other. The whorl maggot damage was low (<5% WMDL) in all three farmers' fields at Gangavathi.

Hispa damage was significantly lower in one farmer's field (F3) in the IPM plot (10.6% HDL) compared to the FP plot (15.7% HDL) at Gangavathi, while the damage was at par in both the treatments in the other two farmers' fields (F1 & F2). The hispa damage was low (<% HDL) in both the farmers' fields at Bapatla and three farmers' fields at Gangavathi.

Thrips damage was relatively high in all three farmers' fields at Aduthurai but was at par in both IPM (8.8 – 17.2% THDL) and FP plots (12.1-21.1% THDL). Thrips damage was low (<6% THDL) in both the treatments in all three farmers' fields at Coimbatore.

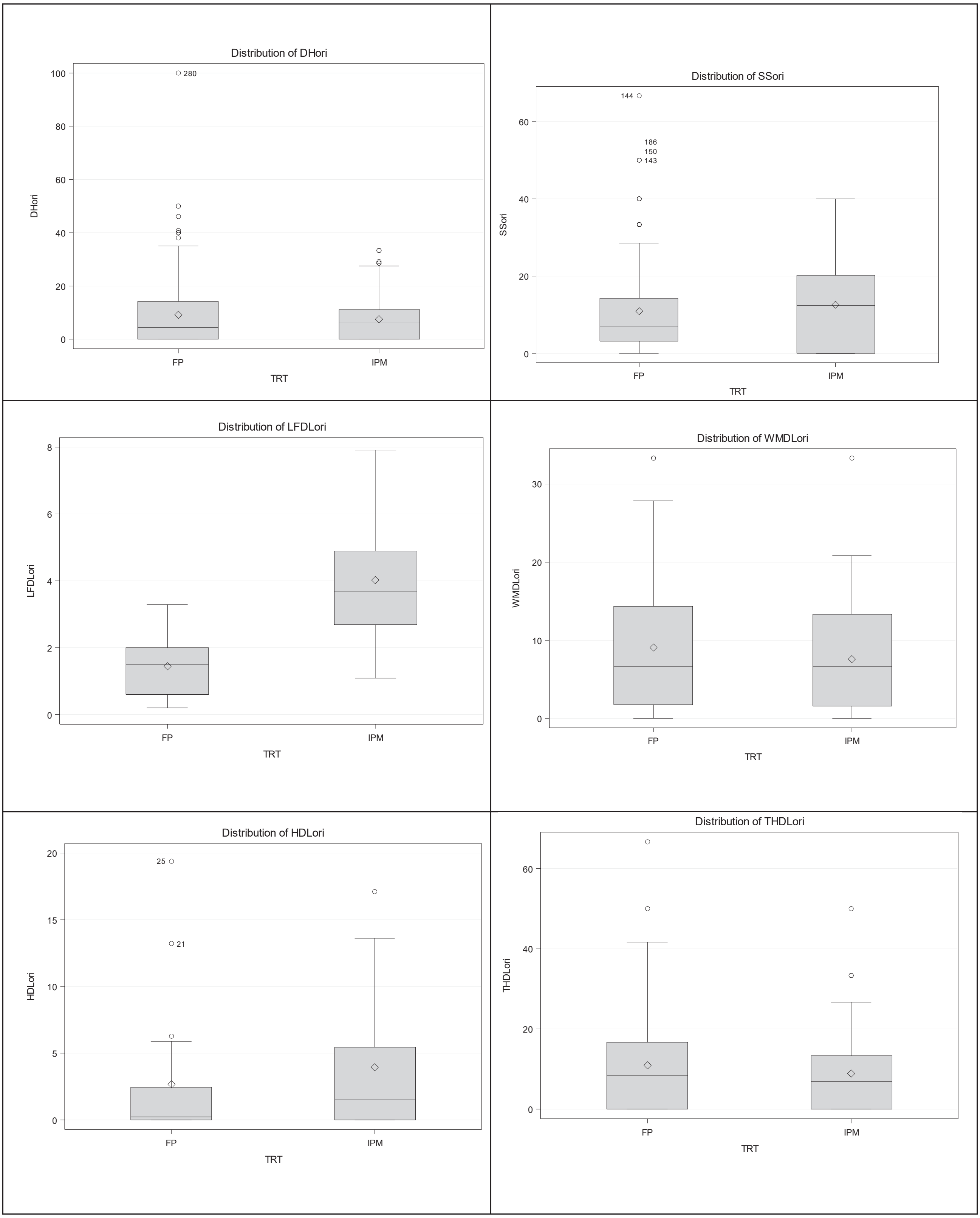
BPH incidence was observed at Bapatla (2 farmers' fields), Coimbatore (3 farmers' fields) and Mandya (2 farmers' fields) in both IPM and FP plots (<17/5 hills). At Gangavathi, the population was significantly lower in FP plots (6.0 – 7.3/5 hills) compared to IPM plots (35.5-41.2/5 hills) in all three farmers' fields.

Similarly, WBPH incidence was low in both the treatments in all the farmers' fields in Bapatla (<16/5 hills), Coimbatore (<2/5 hills) and Gangavathi (< <10/5 hills).

Table 2.6.1.8. Insect Pest incidence in IPM DSR trial in Zone VII (Southern), ***Kharif*** 2024

Location	Farmer Name	Treatments	%DH/WE	% SS	% LFDL	% WMDL	% HDL	%THDL	BPH (No/5 hills)	WBPH (No/5 hills)	Yield kg/ha
ADT	F1 = Sri Ramalingam	IPM	11.4(3.0)b	14.1(3.2)a	12.6(3.5)a	10.9(3.2)a	11.6(3.3)a	17.2(4.0)a			16800(127.6)a
		FP	17.2(4.0)a	19.6(4.2)a	14.2(3.8)a	12.6(3.5)a	12.4(3.4)a	21.1(4.5)a			15360(123.4)a
LSD (0.05,36)			0.84	1.40	0.36	0.53	0.80	0.86			32.00
ADT	F2 = Sri Ramanathan	IPM	14.6(3.5)a	12.4(3.0)a	10.7(3.3)b	10.9(3.2)b	11.5(3.3)a	15.1(3.5)a			15360(122.8)a
		FP	22.6(4.4)a	23.1(4.3)a	14.2(3.8)a	16.3(4.0)a	14.8(3.8)a	22.1(4.3)a			12160(109.8)a
LSD (0.05,36)			1.07	1.46	0.38	0.68	0.65	1.20			18.30
ADT	F3 = Sri Ravichandran	IPM	10.3(2.7)b	9.4(2.5)a	12.1(3.4)b	14.1(3.7)a	10.6(3.2)b	8.8(2.9)a			18000(133.8)a
		FP	18.7(3.9)a	15.9(3.4)a	19.2(4.3)a	17.8(4.2)a	15.7(3.9)a	12.1(3.3)a			16000(126.2)b
LSD (0.05,36)			1.18	1.41	0.42	0.74	0.58	0.79			2.70
BPT	F4 = Sri Raghava Rao	IPM	0.7(1.0)b	3.2(1.6)a	4.4(2.1)b		4.0(1.8)a		16.5(3.9)a	15.2(3.6)a	6840(82.6)a
		FP	2.2(1.4)a	3.7(1.9)a	6.2(2.5)a		2.7(1.4)b		9.8(3.1)b	8.7(3.0)a	6715(81.8)a
LSD (0.05,36)			0.30	0.52	0.26		0.34		0.54	1.32	1.40
BPT	F5 = Sri Seeta Ramaiah	IPM	2.6(1.6)b	3.5(1.8)a	5.2(2.3)b		0.2(0.8)b		13.3(3.6)a	12.5(3.5)a	6700(81.8)a
		FP	5.9(2.2)a	4.1(2.0)a	7.6(2.7)a		2.7(1.5)a		10.8(3.3)a	6.0(2.5)b	6520(80.6)a
LSD (0.05,36)			0.47	0.51	0.26		0.26		0.36	0.82	1.60
CBT	F6 = Sri A Gopalakrishnan	IPM	5.4(2.0)a		1.5(1.3)a	3.7(1.6)a		4.6(1.8)a	0.9(1.1)a	0.4(0.89)a	5100(71.4)a
		FP	5.5(2.1)a		0.8(1.1)a	1.6(1.3)a		3.0(1.5)a	0.7(1.1)a	0.6(0.98)a	4256(65.2)b
LSD (0.05,36)			0.83		0.30	0.43		0.67	0.19	0.30	1.60
CBT	F7 = Sri Sivakumar	IPM	5.2(2.0)a		1.0(1.1)a	3.1(1.7)a		5.7(2.2)a	0.9(1.2)a	0.5(0.94)a	4720(68.8)a
		FP	4.1(1.7)a		0.9(1.1)a	3.2(1.7)a		4.0(1.8)a	1.1(1.1)a	1.1(1.2)a	4304(65.8)b
LSD (0.05,36)			0.70		0.27	0.58		0.63	0.18	0.40	1.96
CBT	F8 = Sri Nagaraj	IPM	5.9(2.0)a		0.6(1.0)a	2.8(1.6)a		2.6(1.5)a	0.6(1.0)a	0.4(0.89)a	4920(70.2)a
		FP	4.9(1.8)a		0.9(1.1)a	3.0(1.7)a		3.6(1.8)a	0.4(0.89)a	0.8(1.1)a	4400(66.4)b
LSD (0.05,36)			0.78		0.21	0.51		0.57	0.19	0.43	2.54
GNV	F9 = Sri Siddangouda	IPM	6.0(2.5)a	18.5(4.3)a	3.9(2.0)a		1.3(1.3)a		35.5(5.8)a	3.4(1.9)b	5616(74.8)a
		FP	2.3(1.6)b	6.2(2.6)b	1.7(1.5)b		1.4(1.2)a		7.3(2.6)b	9.1(3.0)a	5677(75.2)a
LSD (0.05,36)			0.25	0.39	0.12		0.17		0.32	0.43	2.26
GNV	F10 = Sri Devendrappa	IPM	7.0(2.7)a	18.5(4.3)a	4.0(2.1)a		2.9(1.7)a		39.7(6.1)a	5.0(2.3)a	5693(74.6)a
		FP	1.3(1.3)b	6.3(2.5)b	1.4(1.4)b		1.9(1.5)b		7.0(2.6)b	6.7(2.6)a	5576(75.4)a
LSD (0.05,36)			0.25	0.42	0.15		0.15		0.23	0.41	2.97
GNV	F11 = Sri Suryarao	IPM	8.9(3.0)a	21.8(4.6)a	4.1(2.1)a		0.8(1.0)b		41.2(6.3)a	5.0(2.3)b	5885(76.6)a
		FP	1.7(1.4)b	8.4(3.0)b	1.0(1.2)b		2.1(1.6)a		6.0(2.5)b	9.3(3.1)a	5628(75.0)a
LSD (0.05,36)			0.25	0.31	0.1		0.19		0.22	0.29	2.17
MND	F12 = Sri Chikkonu	IPM	10.7(3.2)a		1.7(1.4)a				2.5(1.6)a		7171(84.6)a
		FP	16.6(3.9)a		2.2(1.5)a				3.0(1.8)a		5375(73.0)a
LSD (0.05,36)			0.69		0.18				0.22		13.5
MND	F13 = Sri Shivanna	IPM	8.9(2.9)b		2.8(1.6)b				8.3(2.7)a		6534(80.4)a
		FP	16.7(3.9)a		4.7(2.1)a				3.0(1.8)b		4665(68.2)b
LSD (0.05,36)			0.74		0.29				0.31		8.65
Treatments											
T1 = IPM			7.9(2.5)a	12.7(3.2)a	5.0(2.1)a	7.6(2.5)a	5.3(2.0)a	9.0(2.6)a	16.0(3.3)a	5.3(2.0)a	8402(88.5)a
T2 = FP			7.2(2.6)a	10.9(3.0)a	5.8(2.1)a	9.1(2.7)a	6.7(2.3)b	11.0(2.9)a	4.9(2.1)b	5.3(2.2)a	7443(83.5)b
LSD (0.05,468)			0.19	0.32	0.07	0.22	0.15	0.32	0.09	0.21	2.26
DAS											
D1 = 36 DAS/15			7.3(2.4)b	11.5(3.0)c		7.0(2.4)b	6.7(2.2)a	4.8(1.7)b			
D2 = 43 DAT/22			8.1(2.5)a	12.7(3.2)a		8.0(2.5)b	5.1(2.1)a	11.6(3.1)a	5.0(2.0)e		
D3 = 50 DAS/57/29			8.3(2.7)a	13.5(3.4)a	4.4(2.0)b	10.0(2.9)a	6.3(2.2)a	13.6(3.5)a	7.8(2.4)d		
D4 = 64 DAS/85			6.4(2.4)b		6.0(2.3)a		6.0(2.1)a		15.4(3.2)a	5.6(2.1)a	
D5 = Pre har/99/71			7.8(2.7)a		5.5(2.0)c				11.3(2.8)c	5.0(2.1)a	
LSD (0.05,468)			0.24	0.45	0.15	0.27	0.21	0.4	0.14	0.2	

Across locations, box plots depict the incidence of stem borer, gall midge, leaf folder, whorl maggot, thrips, BPH, and WBPH in IPM and FP plots (**Figure 2.6.1.1**).



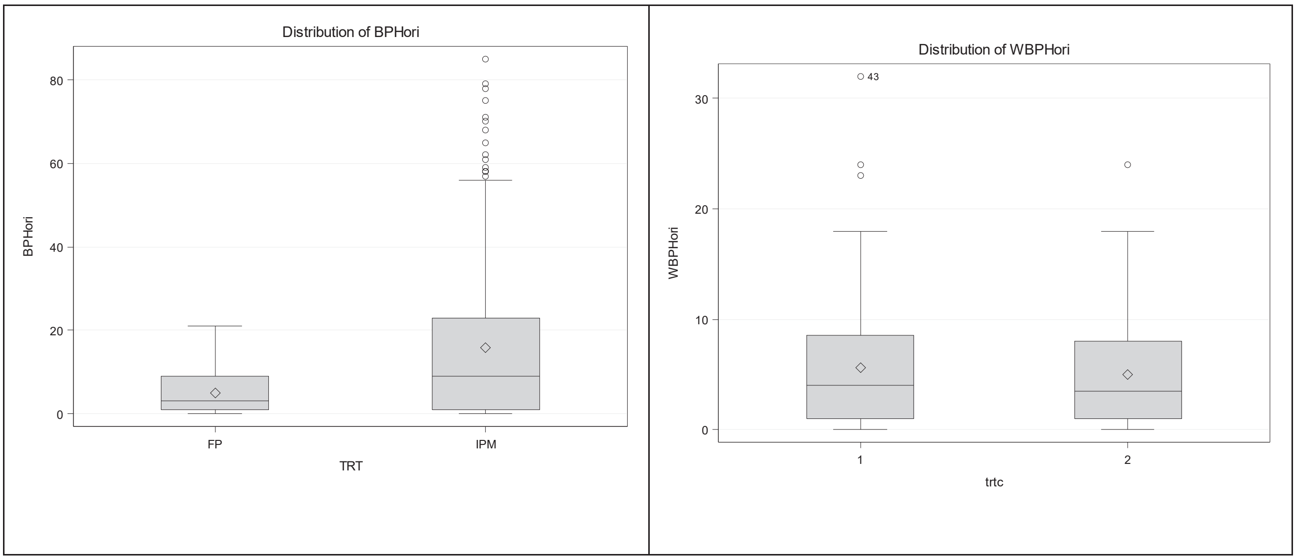


Figure 2.6.1.1. Box plots of the Incidence of dead hearts (DH), silver shoots (SS), leaf folder damaged leaves (LFDL), whorl maggot damaged leaves (WMDL), hispa damaged leaves (HDL), thrips damaged leaves (THDL), BPH and WBPH in IPM and FP plots across locations in Zone VII (Southern areas)

At Aduthurai, the IPM DSR trial was conducted for the management of leaf and neck blast, bacterial blight and false smut diseases in three farmers' fields. Adoption of IPM practices reduced the progress of all the diseases at all the three farmers' fields. The IPM practice included, *viz.*, spraying of broad-spectrum fungicide like propiconazole @ 1 ml/lt and the number of sprays were restricted to one. The AUDPC values of leaf blast was significantly low as compared to farmer practices (F1 = IPM – 40.6; FP- 60.9; F2 = IPM – 28; FP – 70; F3 = IPM – 31.5; FP – 50.4). Similarly, the neck blast disease severity also reduced effectively in the IPM practices adopted field compared to farmer's practices (F1 = IPM – 22.4; FP-56.7; F2 = IPM – 34.3; FP – 61.6; F3 = IPM – 35; FP – 59.5). For bacterial blight, the application of the recommended dose of fertilisers (N-100 kg, P-75 kg, and K-50 kg) compared to the farmer's practices (100 kg, 100 kg, and 70 kg) and spraying of copper oxychloride reduced disease progression **(Table 2.6.1.9)**.

Table 2.6.1.9. AUDPC values based on disease severity (%) at Aduthurai, ***Kharif*** 2024

Farmer	Treatment	AUDPC Values			(DI %)
		LB	NB	BB	FS
F1	IPM	40.6	22.4	28	6.3
	FP	60.9	56.7	224.7	16.1
F2	IPM	38.5	23.1	47.6	8.4
	FP	62.3	56	53.9	13.3
F3	IPM	31.5	35	35.7	22.8
	FP	50.4	59.5	60.9	34.3

IPM – Integrated Pest Management Practices; FP- Farmer Practices; LB- Leaf Blast; NB- Neck Blast; BB- Bacterial blight; SHB- Sheath Blight; BS- Brown spot; FS- False smut; DI- Disease Incidence

At Gangavathi, the adoption of IPM practices reduced the disease progression of leaf blast (IPM-162, FP-122), neck blast (IPM-97, FP-216), and bacterial blight (IPM–724, FP-819). However, progression of sheath blight incidence was similar in both the practices (IPM-734, FP-707). In case of brown spot, the AUDPC values were higher in IPM practice than the Farmer practices (IPM-1093, FP-747) (**Table 2.6.1.10**)

At Mandya, IPM practices were evaluated against leaf and neck blast and sheath blight. IPM practices *viz.*, adoption of seed treatment with carbendazim @ 4 gm/kg seed, zinc sulphate @ 8kg/acre at the time of puddling operation, and spraying of tricyclazole 75% WP (Beam) @ 0.6 gm/lit during the 5% panicle emergence stage were adopted for the disease management. In the IPM practices adopted field, the disease progress was reduced significantly as compared to farmer practices in all three diseases (LB - IPM-24.5, FP-74.2; NB – 39.2; IPM-177; SHB - IPM-154, FP-462) (**Table 2.6.1.10**).

Table 2.6.1.10. AUDPC values based on disease severity (%) at Gangavathi and Mandya, ***Kharif*** 2024

Treatment	AUDPC Values							
	Gangavathi					Mandya		
	LB	NB	BB	SHB	BS	LB	NB	SHB
IPM	162	97	724	734	1093	24.5	39.2	154
FP	122	216	819	707	747	74.2	177	462

IPM – Integrated Pest Management Practices; FP- Farmer Practices; LB- Leaf Blast; NB- Neck Blast; BB- Bacterial blight; SHB- Sheath Blight; BS- Brown spot

The weed population at Aduthurai, at Active Tillering, was lower than farmers' practice by 49.62%, respectively. The weed dry biomass at the Active Tillering stage in IPM plots was lower than farmers' practice by 33.82 %, respectively and contributed to the mean grain yield advantage of 13.67 % in IPM adopted plots (**Table 2.6.1.11**). At Coimbatore, the weed population at Active Tillering and Panicle Initiation was lower than farmers' practice by 4.23 and 10.00%, respectively. The weed dry biomass in IPM plots was lower than farmers' practice by 34.34% and 9.38%, respectively and contributed to the mean grain yield advantage of 12.02 % in IPM adopted plots. At Gangavathi, the weed population at the Active Tillering and Panicle Initiation stages in IPM plots was lower than farmers' practice by 59.70 and 28.58%, respectively, and the weed dry biomass was lower than farmers' practice by 40.19 and 29.05%. The mean grain yield advantage of 28.20 % was recorded in IPM-adopted plots. At Mandya, the weed population at Active Tillering and Panicle Initiation stages in IPM plots was lower than farmers' practice by 68.42 and 82.39%, respectively (**Table 2.6.1.12**). The weed dry biomass in IPM plots was lower by 72.00 and 82.87%, respectively and contributed to the mean grain yield advantage of 24.97 %.

Table 2.6.1.11. Weed parameters in Zone VII (Southern areas) in IPM DSR ***Kharif*** 2024

Location	Treatments	Weed population (No./m^2)		Weed dry biomass (g/m^2)	
		30 DAS	45 DAS	30 DAS	45 DAS
Aduthurai	IPM	13.30(3.70)		13.50	
	FP	26.40(5.17)		20.40	
	Exp. mean	4.44		16.95	
	CD(0.05)	0.38		3.24	
Coimbatore	IPM	29.93(5.50)	10.80(3.35)	4.34	5.12
	FP	31.27(5.63)	12.00(3.53)	6.61	5.65
	Exp. mean	5.57	3.44	5.47	5.38
	CD(0.05)	0.29	0.23	5.26	1.42
Gangavathi	IPM	18.33(4.22)	19.44(4.37)	44.72	65.78
	FP	45.56(6.64)	27.22(5.22)	74.78	92.72
	Exp. mean	5.43	4.79	59.75	79.25
	CD(0.05)	1.53	1.09	40.58	23.04
Mandya	IPM	3.60(1.92)	5.00(2.33)	1.35	3.26
	FP	11.40(3.43)	28.40(5.35)	4.98	19.04
	Exp. mean	2.67	3.84	3.17	11.15
	CD(0.05)	0.56	0.59	1.75	2.84

Table 2.6.1.12. Reduction in weed parameters in IPM DSR, ***Kharif*** 2024

Zones	Centers	Weed Population (% reduction in IPM)		Weed dry biomass (% reduction in IPM)	
		30 DAS	45 DAS	30 DAS	45 DAS
Zone-VII	Aduthurai	49.62	-	33.82	-
	Coimbatore	4.23	10.00	34.34	9.38
	Gangavathi	59.70	28.58	40.19	29.05
	Mandya	68.42	82.39	72.00	82.87

Grain yield in IPM plots was significantly higher than in FP plots across locations, resulting in higher gross returns (**Table 2.6.1.13**). The low cost of cultivation accompanied by higher net returns resulted in a higher BC ratio in IPM plots (2.81) compared to FP plots (2.02) at all the locations in Zone VII.

Table 2.6.1.13. Returns and BC ratio in IPM DSR trial at Zone VII (Southern), ***Kharif*** 2024

Location	Farmer Name	Treatments	Yield (q/ ha)	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net returns (Rs.)	BC ratio
ADT	F1 = Sri Ramalingam	IPM	168.00	312480	82313	230167	3.80
		FP	153.60	285696	109750	175946	2.60
ADT	F2 = Sri Ramanathan	IPM	153.60	285696	84313	201383	3.39
		FP	121.60	226176	113950	112226	1.98
ADT	F3 = Sri Ravichandran	IPM	180.00	334800	83313	251487	4.02
		FP	160.00	297600	111775	185825	2.66
BPT	F4 = Sri Raghava Rao	IPM	68.40	143640	77065	66575	1.86
		FP	67.15	141120	77528	63592	1.82
BPT	F5 = Sri Seeta Ramaiah	IPM	67.00	140700	74065	66635	1.90
		FP	65.20	136920	73135	63785	1.87
CBT	F6 = Sri A Gopala krishnan	IPM	51.00	112200	47750	64450	2.35
		FP	42.56	93632	57250	36382	1.64
CBT	F7 = Sri Sivakumar	IPM	47.20	103840	44500	59340	2.33
		FP	43.04	94688	55250	39438	1.71
CBT	F8 = Sri Nagaraj	IPM	49.20	108240	44375	63865	2.44
		FP	44.00	96800	55000	41800	1.76
GNV	F9 = Sri Siddangouda	IPM	56.16	134784	47102	87682	2.86
		FP	56.77	136248	61326	74922	2.22
GNV	F10 = Sri Devendrappa	IPM	56.93	136632	47102	89530	2.90
		FP	55.76	133824	61326	72498	2.18
GNV	F11 = Sri Suryarao	IPM	58.85	141240	47102	94138	3.00
		FP	56.28	135072	61326	73746	2.20
MND	F12 = Sri Chikkonu	IPM	71.71	150591	52750	97841	2.85
		FP	53.75	112875	60625	52250	1.86
MND	F13 = Sri Shivanna	IPM	65.34	150282	53400	96882	2.81
		FP	46.65	107295	61250	46045	1.75
IPM			8.40	173471	60396	113075	2.81
FP			7.44	153688	73807	79881	2.02

Price of Paddy: F1, F2 & F3 = Rs. 2250/q; F4, & F5 = Rs. 2100/q; F6,F7 & F8 = Rs. 2200/q; F9, F10 & F11 = Rs.2400/q; F12= Rs. 2100/q; F13 = 2300/q

Across locations, in Zone-II (Northern areas), incidence of dead hearts caused by stem borer and leaf folder damage was low in both IPM and FP plots (**Table 2.6.1.14**). In Zone VI (Western areas), dead hearts were low in IPM plots (4.8% DH) as compared to FP plots (7.0% DH). Leaf folder incidence was high in FP plots (17% LFDL) compared to IPM plots (2.5% LFDL). The WBPH population was low in both FP plots (22/5 hills) and IPM plots (16/5 hills). In Zone VII (Southern areas), gall midge incidence was very high in IPM plots (12.7% SS) compared to FP plots (10.9% SS). Similarly, stem borer damage was also high in IPM plots (7.9% DH) as compared to FP plots (7.2% DH). However, the incidence of leaf folder, whorl maggot, hispa and thrips was low in IPM plots as compared to FP plots. BPH and WBPH incidence was low in both IPM and FP plots.

The adoption of IPM practices reduced the disease progression of leaf blast, neck blast, sheath blight and bacterial blight in Zone II. However, with respect to brown spot, AUDPC values were high in IPM-adopted fields compared to farmers' practices. In Zone VI, IPM practices reduced the disease development of sheath blight and sheath rot. In Zone VII, the AUDPC values of leaf blast, neck blast, and bacterial blight were low in IPM plots compared to FP plots, indicating that the IPM practices were effective in managing these diseases. However, in the case of brown spot, AUDPC values were higher in IPM plots than in FP plots. Sheath blight incidence was similar in both IPM and FP plots at Gangavathi.

Weed population and weed dry biomass were significantly lower in IPM plots as compared to FP plots across the locations.

Table 2.6.1.14. Incidence of pests (insects, diseases and weeds) in IPM DSR trial at various zones

Zones	Treatments	% DH/WE	% SS	% LFDL	% WMDL	%HDL	% THDL	BPH	WBPH
Zone II	IPM	3		3.5				1	0.6
	FP	2.4		5.6				2.6	1.2
Zone VI	IPM	4.8		2.5					16
	FP	7.3		17					22
Zone VII	IPM	7.9	12.7	5	7.6	5.3	9	16	5.3
	FP	7.2	10.9	5.8	9.1	6.7	11	5	5.3

Zones	Treatments	LB	NB	SHB	BB	FS	BS	Weed popln	Weed biomass
Zone II	IPM	4.2	1.1	9.5	33.1		47.4	3.2	20.03
	FP	7	1.4	12	51.2		30.2	4	27.66
Zone VI	IPM								
	FP								
Zone VII	IPM	162	97	734	724	22.8	1093	18.33	44.72
	FP	122	216	707	819	34.3	747	45.56	74.78

Zones	Treatments	Yield (kg/ha)	BC ratio
Zone II	IPM	5722	3.14
	FP	5650	2.31
Zone VI	IPM	4652	1.43
	FP	3974	1.31
Zone VII	IPM	8402	2.81
	FP	7443	2.02

***Summary**: Integrated Pest Management in Direct Seeded Rice (IPM DSR) trial was conducted with zone-wise practices at 9 locations in 16 farmers' fields during Kharif 2024. Across locations, in Zone-II (Northern areas), the incidence of dead hearts caused by stem borer and leaf folder damage was low in both IPM and FP plots. In Zone VI (Western areas), dead hearts were low in IPM plots (4.8% DH) as compared to FP plots (7.0% DH). Leaf folder incidence was high in FP plots (17% LFDL) compared to IPM plots (2.5% LFDL). The WBPH population was low in both FP plots (22/5 hills) and IPM plots (16/5 hills). In Zone VII (Southern areas), gall midge incidence was very high in IPM plots (12.7% SS) compared to FP plots (10.9% SS). Stem borer damage was not significantly different between IPM plots (7.9% DH) and FP plots (7.2% DH). BPH and WBPH incidence was low in both IPM and FP plots. However, the incidence of leaf folder, whorl maggot, hispa and thrips was low in IPM plots as compared to FP plots.*

The adoption of IPM practices reduced the disease progression of leaf blast, neck blast, sheath blight and bacterial blight in Zone II. However, with respect to brown spot, AUDPC values were high in IPM-adopted fields compared to farmers'

practices. In Zone VI, IPM practices reduced the disease development of sheath blight and sheath rot. In Zone VII, the AUDPC values of leaf blast, neck blast, and bacterial blight were low in IPM plots compared to FP plots, indicating that the IPM practices were effective in managing these diseases. However, in the case of brown spot, AUDPC values were higher in IPM plots than in FP plots. Sheath blight incidence was similar in both IPM and FP plots at Gangavathi.

Weed population and weed dry biomass were significantly lower in IPM plots as compared to FP plots across the locations. IPM implemented plots resulted in mean grain yield advantage of 1.08%, 21.29% and 17.18% respectively in Zone- II, VI and VII over the FP plots. In IPM-adopted fields, the mean weed population reduction across the Zones ranged from 4.23 % in Zone-VII to 76.92% in Zone-VI at the Active Tillering stage and from 10.00 to 82.39% in Zone-VII at the Panicle Initiation stage. The dry weed biomass recorded at both Active Tillering and Panicle Initiation stages were significantly reduced by 9.38 to 82.87% in Zone-VII.

Grain yields were significantly high in IPM-implemented plots, resulting in high gross returns. Overall, BC ratios of IPM plots (1.43 - 3.14) were superior as compared to those of FP (1.31-2.31), mainly due to better yields, lower input costs, and better returns.

2.7 ASSESSMENT OF INSECT PEST POPULATIONS DYNAMICS IN RICE ECOSYSTEMS

This chapter reports on the salient findings of the insect population dynamics in rice crop during *kharif* 2024 which was monitored and recorded across various zones in India along with the meteorological data through two major trials 1. Population dynamics of insect pests and natural enemies in rice ecosystem (PDPNE) where pest damage of major insect pests and natural enemies incidence were recorded and 2. Population dynamics of insect pests assessed through light trap collections. The details of the results are reported trial wise:

2.7.1 Population dynamics of insect pests and natural enemies in rice ecosystem (PDPNE)

Understanding the population dynamics of insect pests in relation to weather variations, crop growth stages, growing seasons, and cropping systems is crucial for developing ecologically sustainable and economically viable pest management strategies. Additionally, knowledge of pest population trends at specific locations is essential for implementing location-based Integrated Pest Management (IPM) strategies and precision agriculture technologies.

In India, rice is cultivated across diverse agro-climatic zones and under various cropping systems. The population dynamics of major and minor insect pests of rice fluctuate under these varying conditions. Both abiotic factors such as temperature, humidity, sunshine hours, and rainfall, as well as biotic factors like natural enemies (parasites and predators), significantly influence pest populations. To track these variations, systematic monitoring of insect pests is conducted annually across multiple locations to assess short- and long-term trends in pest incidence.

Weekly insect pest data are collected from different monitoring centres alongside corresponding macro-weather parameters. The cumulative weekly abundance of key pests, along with weekly averages of rainfall, maximum and minimum temperatures, morning and evening relative humidity, and sunshine hours, are computed from daily observations and analysed with respect to standard meteorological weeks.

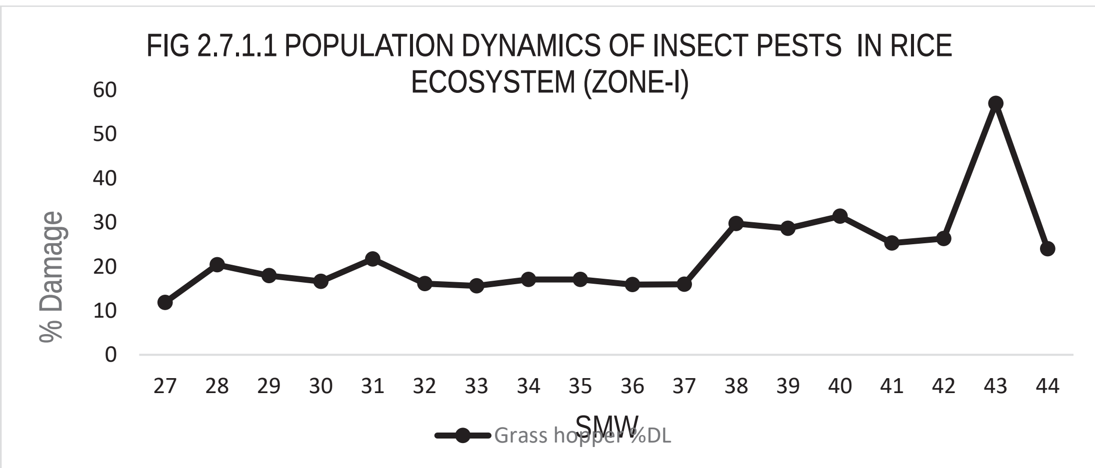
During the *Kharif* season of 2024-2025, insect pest and natural enemy data, along with weather parameters, were collected from 32 AICRPR centres across seven agro-climatic zones in India (locations listed in the table below). The data were processed to calculate zone-wise averages, including mean values of pest incidence, natural enemy populations and key weather variables such as rainfall, temperature and relative humidity and sunshine hours. These zone-wise averages provided a consolidated overview of pest dynamics and climatic conditions, enabling a clearer understanding of regional variations and trends

List of locations under study and the pest damage

Zone	Locations	Pest damages
Zone 1	Khudwani	Grasshoppers
Zone 2	New Delhi, Kaul, Pantnagar, Ludhiana	Stem borer, leaf folder, whorl maggot, rice hispa, Planthoppers
Zone 3	Chiplima, Ranchi, Ghaghraghat, Pusa, Masodha, Chinsurah	Gall midge, stem borer, leaf folder, whorl maggot, Planthoppers
Zone 4	Titabar	Gall midge, stem borer, leaf folder, hispa, whorl maggot, Planthoppers
Zone 5	Jagdalpur, Rewa, Raipur	Gall midge, stem borer, leaf folder, whorl maggot, Planthoppers
Zone 6	Nawagam, Karjat, Navsari	Stem borer and leaf folder
Zone 7	Aduthurai, Rajendranagar, Warangal, Bapatla, Jagital, Ragolu, Nellore, Maruteru, Moncompu, Gangavathi, Mandya, Coimbatore, Pattambi, Karaikal	Gall midge, stem borer, leaf folder, whorl maggot, rice hispa, Planthoppers

This report presents a zone wise summary of these observations and general trends in pest and natural enemy population dynamics.

Zone-I: Data from the Khudwani center in this zone showed that grasshopper incidence was recorded between the 27th and 44th Standard Meteorological Weeks (SMW). The highest grass hopper damage, at 56.91 per cent, was observed during the 43rd SMW, while the lowest, 11.88 per cent was recorded in the 27th SMW. A gradual increase in leaf damage was observed from the 38th SMW, peaking in the 43rd SMW, followed by a decline to 24.01per cent in the 44th SMW (Fig. 2.7.1.1). The population of natural enemies varied across different SMWs. Spiders fluctuated between 0.5 and 2.1 per hill, peaking in SMW 39. Coccinellids remained relatively low, with a maximum of 2.2 per hill in 42nd SMW. Dragonflies and damselflies were present in lower numbers, ranging from 0.4 to 0.7 per hill. The correlation between the incidence of grasshopper damage and various weather parameters was analysed. The Maximum temperature (r=-0.65**) and minimum temperature (r=-0.64**) showed a significant negative correlation. In contrast, rainfall (r=0.06), morning relative humidity (r=0.39), and evening relative humidity (r=0.37) exhibited a non-significant positive correlation with grass hopper damage at Khudwani in Zone-I (Fig. 2.7.1.2).



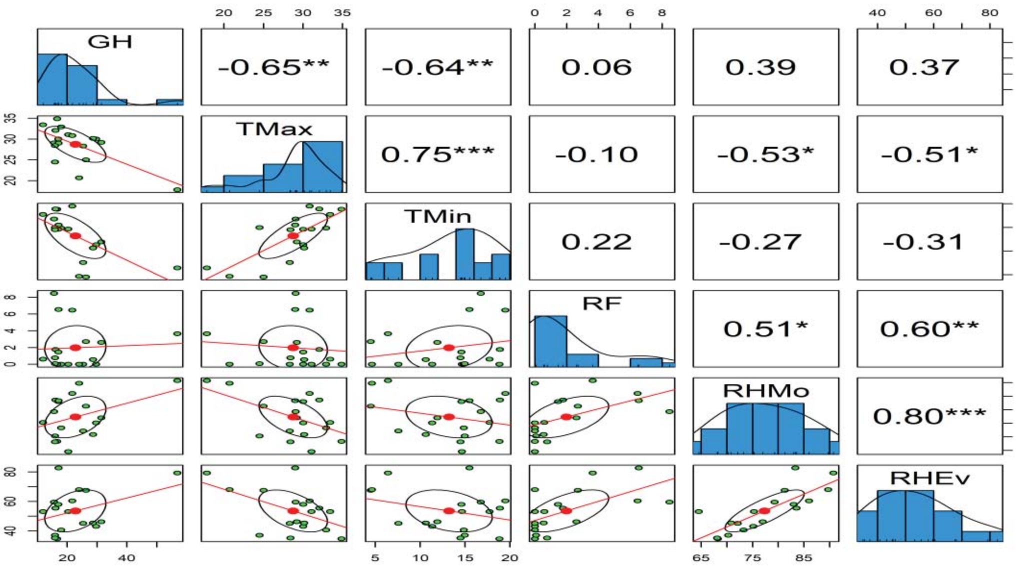


Fig: 2.7.1.2 Correlation matrix - field incidence of grass hopper & weather parameters at Khudwani in Zone-I, ***Kharif,*** 2024

Zone II: Pest incidence was reported from New Delhi, Kaul, Pantnagar, and Ludhiana. The data on the incidence of various pests, including stem borer, leaf folder, whorl maggot, rice hispa and planthoppers, was observed from the 32nd SMW onwards. Stem borer damage, indicated by dead hearts, peaked in the 35th SMW (9.66%) followed closely by the 38th SMW (9.27%) with the lowest incidence recorded in the 33rd SMW (4.44%). Leaf folder infestation persisted throughout the season, with the highest leaf damage observed in the 34th SMW (7.62%) and the lowest (0.28%) in the 42nd SMW. Whorl maggot incidence remained low, reaching a peak of 6.36 per cent in the 34th SMW before declining to negligible levels by the 39th SMW. Rice hispa infestation was highest in the 34th SMW (7.18%), with no further incidence recorded in the later weeks. The planthopper population steadily increased from the 32nd SMW, peaking at 70.70 individuals per hill in the 42nd SMW before declining to 41.80 individuals per hill in the 43rd SMW. White ear heads appeared in the late season, with the highest damage recorded in the 46th SMW (22.70%) and the lowest incidence observed in the 40th SMW (8.70%) (Fig: 2.7.1.3A, 3B and 3C). The population of natural enemies varied across different SMWs. Spiders ranged from 0.87 to 7.40 per hill, with the highest count in 34th SMW. Mirid bugs showed a significant increase, reaching a peak of 33.04 per hill in 49th SMW. Dragonflies and damselflies were present in lower numbers, with a maximum of 0.12 and 0.24 per hill, respectively. Braconid parasitoids exhibited a gradual rise, peaking at 18.00 per hill in 37th SMW. The incidence of Stem Borer Dead Hearts (SBDH) showed a non-significant positive correlation with maximum temperature (r=0.45), minimum temperature (r=0.33), morning relative humidity (r=0.45) and evening relative humidity (r=0.18). However, rainfall (r=-0.11) exhibited a non-significant negative correlation. For Leaf Folder Damaged Leaves (LFDL), a non-significant positive correlation was observed with maximum temperature (r=0.23), minimum temperature (r=0.55), morning relative humidity (r=0.29) and evening relative humidity (r=0.25). Rainfall (r=0.00) showed a neutral correlation. The occurrence of Whorl Maggot (WM) demonstrated a non-significant positive correlation with maximum temperature (r=0.43), minimum temperature (r=0.06), rainfall (r=0.41) and morning relative humidity (r=0.29). However, evening relative humidity (r=0.63*) showed a significant positive correlation. In the case of Hispa, a non-significant positive correlation was recorded with maximum temperature (r=0.21), rainfall (r=0.21), morning relative humidity (r=0.10) and evening relative humidity (r=0.38). Conversely, the minimum temperature (r=-0.06) exhibited a non-significant negative correlation. For Planthoppers (PH), maximum temperature (r=-0.52) showed a non-significant negative correlation, whereas rainfall (r=-0.61*), morning relative humidity (r=-0.66*) and evening relative humidity (r=-0.91***) displayed a highly significant negative correlation. Minimum temperature (r=0.07) recorded a non-significant positive correlation(Fig.2.7.1. 4).

FIG 2.7.1.3A POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-II)

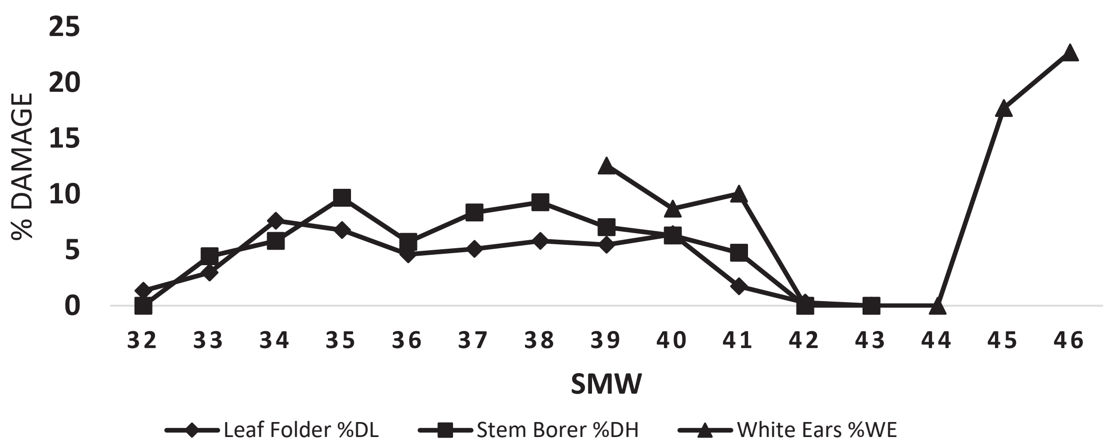
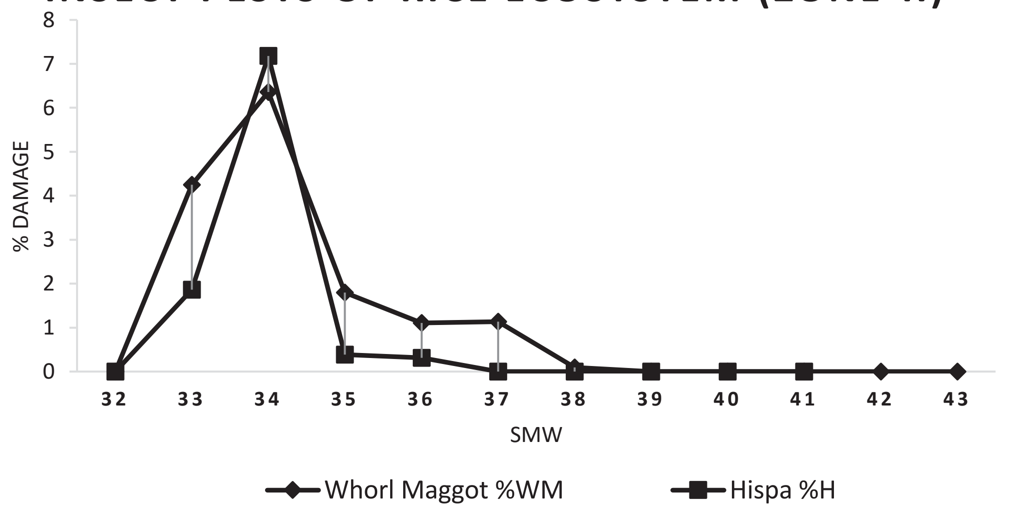
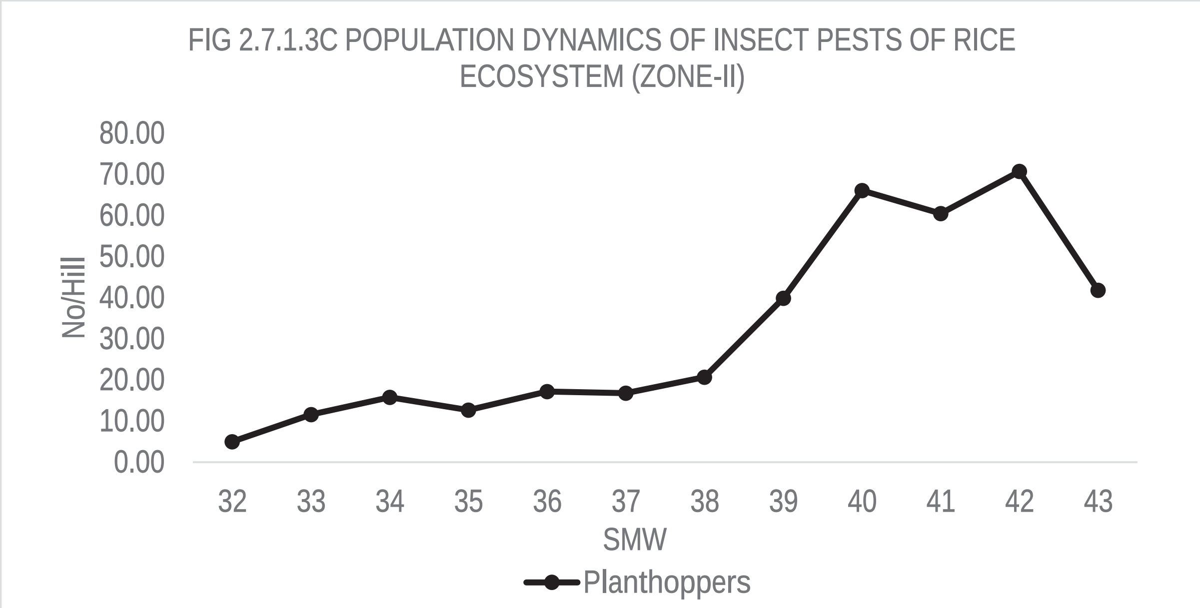


FIG 2.7.1.3B POPULATION DYNAMICS OF INSECT PESTS OF RICE ECOSYSTEM (ZONE-II)





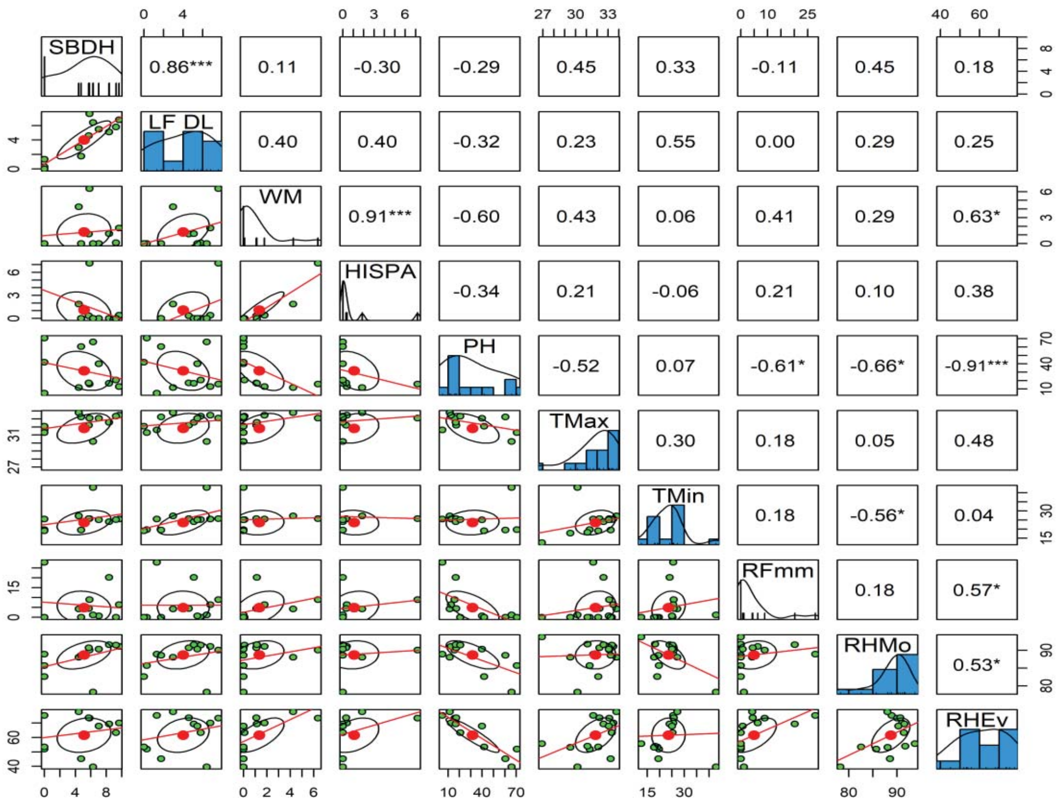
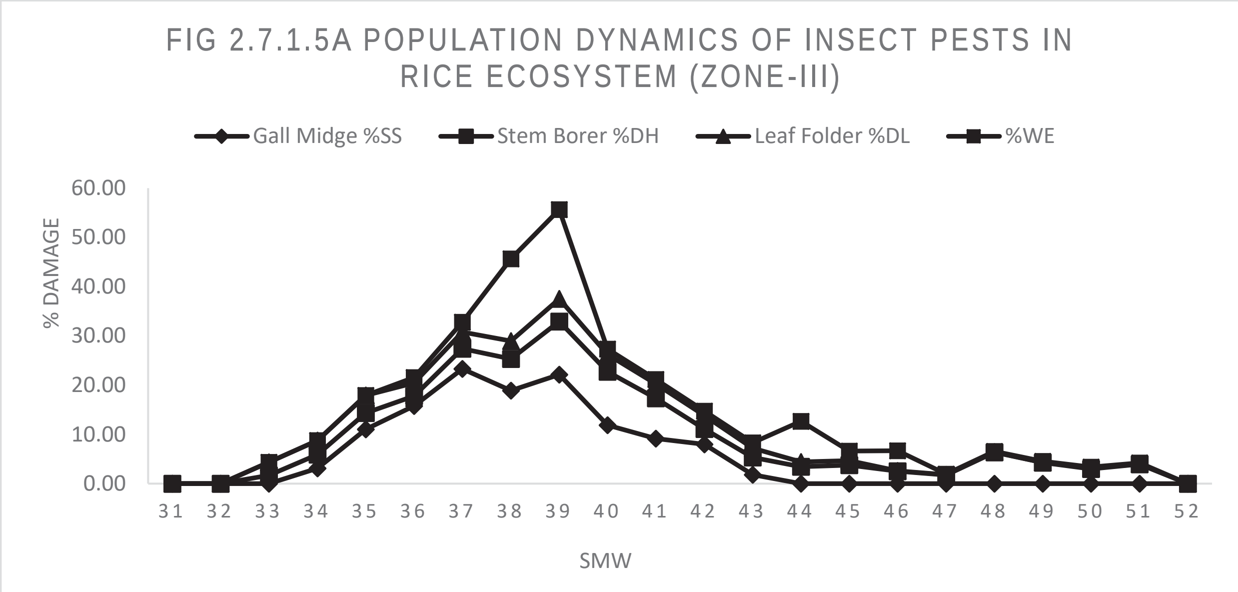
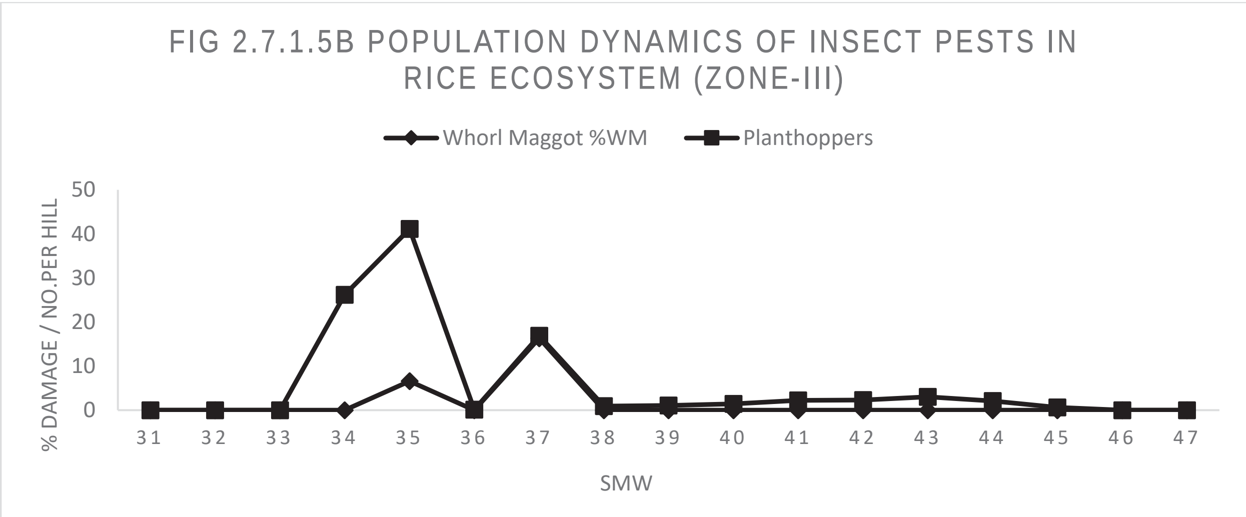


Fig: 2.7.1.4 Correlation matrix - field incidence of insect pest's ***vis-à-vis*** weather parameters in Zone-II, ***Kharif,*** 2024

Zone III: Pest incidence was reported from Chiplima, Ranchi, Ghaghraghat, Pusa, Masodha and Chinsurah. The major pests observed were gall midge, stem borer, leaf folder, whorl maggot and Planthoppers (BPH and WBPH). Gall midge incidence was recorded from the 34th to the 43rd SMW, with the the highest incidence (23.30%) in the 37th SMW followed by lowest silver shoot damage (1.81%) in the 43rd SMW after which the infestation declined. Stem borer damage, characterized by dead hearts, was observed from the 33rd SMW, with the lowest damage (1.67%) recorded in the 33rd SMW and the highest (10.82%) in the 39th SMW. Leaf folder infestation was present from the 33rd SMW, with the lowest damage of 0.01 per cent in the 49th SMW and the highest (4.57%) in the 39th SMW. White ear incidence was recorded from the 33rd SMW (% WE) to 48th SMW (0.14%) with a peak in 40th SMW (18.13%) (Fig. 2.7.1.5A). Whorl maggot damage occurred briefly, starting in the 35th SMW with an incidence of 6.58 per cent and peaking at 16.34 per cent in the 37th SMW, after which it was no longer recorded. Planthopper populations were observed from the 34th SMW, with the lowest number per hill (0.55) in the 37th SMW and the highest (34.54 per hill) in the 35th SMW (Fig 2.7.1.5B). Spider populations varied between 4.4 and 13.5 per hill, peaking in SMW 36. Coccinellids ranged from 0.2 to 8.0 per hill, with the highest density in SMW 36. Mirid bugs showed fluctuating numbers, reaching a maximum of 12.0 per hill in SMW 33 and 42 but declining to 0.1 in SMW 45. The per cent silver shoot by gall midge exhibited a significant positive correlation (r=0.68**) with minimum temperature. It also showed a positive but non-significant correlation with maximum temperature (r=0.17), rainfall (r=0.03), and evening relative humidity (r=0.20). In contrast, it had a non-significant negative correlation with morning relative humidity (r=-0.08). The incidence of Stem Borer Dead Hearts (SBDH) showed a non-significant positive correlation with maximum temperature (r=0.04), minimum temperature (r=0.11) and morning relative humidity (r=0.06). However, it exhibited a non-significant negative correlation with evening relative humidity (r=-0.16) and rainfall (r=-0.28). Leaf Folder Damaged Leaves (LFDL) demonstrated a highly significant positive correlation with maximum temperature (r=0.55**), minimum temperature (r=0.73***), morning relative humidity (r=0.59**) and evening relative humidity (r=0.43*). Additionally, it showed a non-significant positive correlation with rainfall (r=0.16). For Planthoppers (PH), rainfall (r=-0.24) and evening relative humidity (r=-0.10) exhibited a non-significant negative correlation, whereas morning relative humidity (r=0.88), minimum temperature (r=0.11) and maximum temperature (r=0.44) recorded a non-significant positive correlation. Regarding White Ears (WE), only rainfall (r=-0.12) showed a non-significant negative correlation. Meanwhile, maximum temperature (r=0.31), minimum temperature (r=0.41), morning relative humidity (r=0.23) and evening relative humidity (r=0.08) recorded a non-significant positive correlation (Fig. 2.7.1.6).





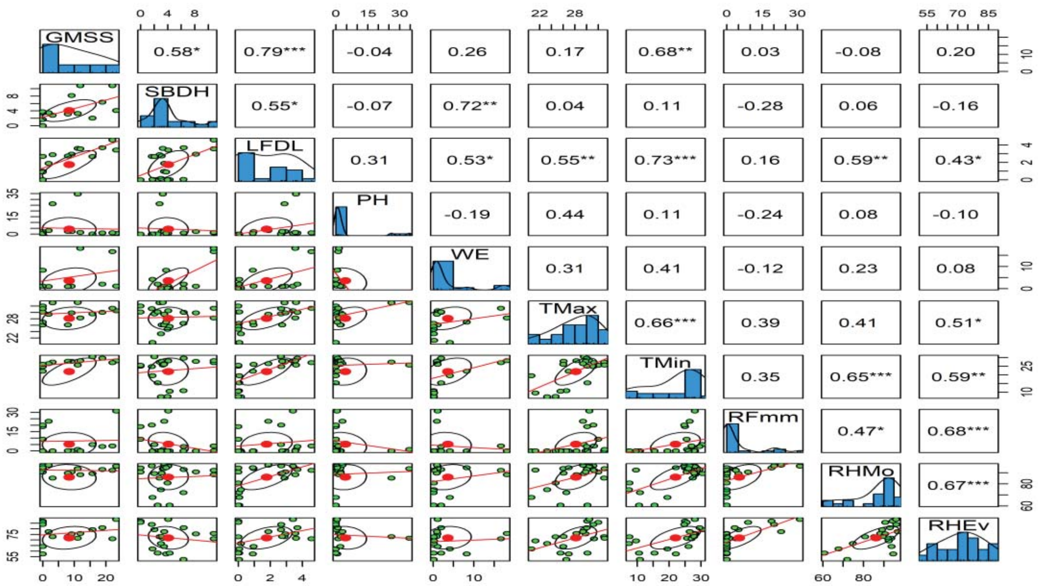
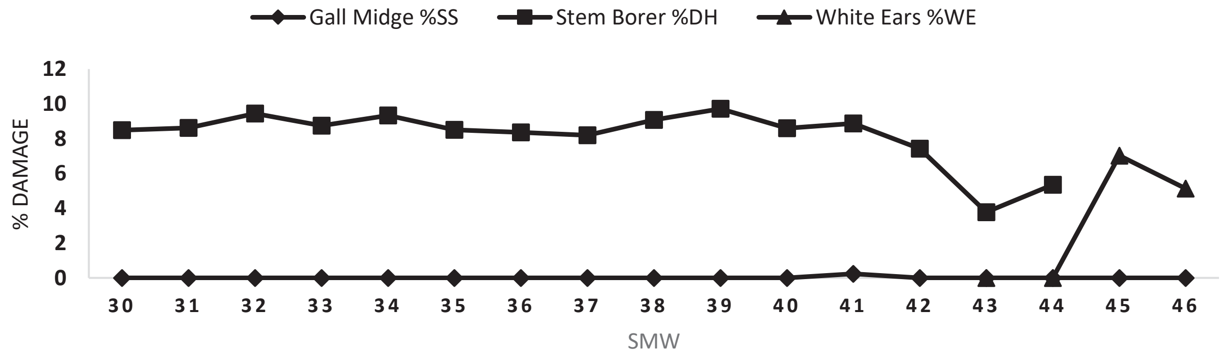
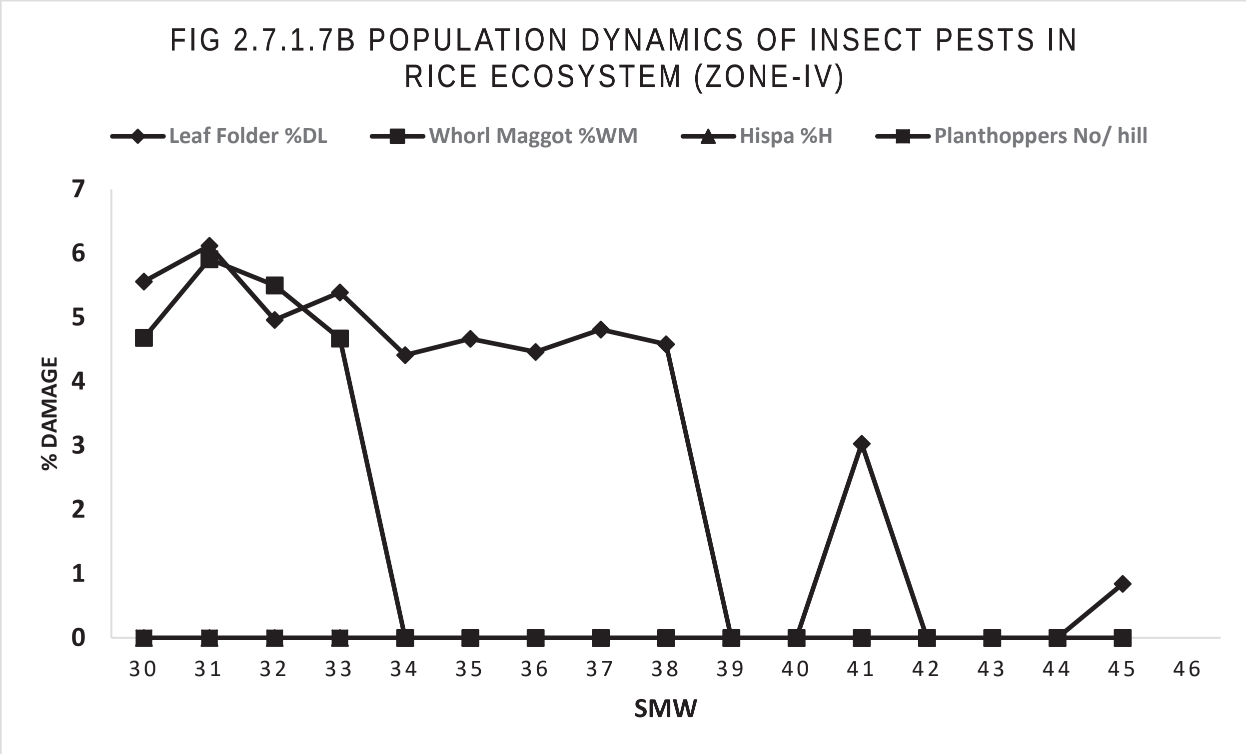


Fig: 2.7.1.6 Correlation matrix - field incidence of insect pest's ***vis-à-vis*** weather parameters in Zone-III, ***Kharif,*** 2024

Zone IV: Pest incidence was reported from Titabar. The incidence of insect pests was observed from the 30th SMW onwards. Gall midge infestation remained negligible, with a slight occurrence recorded only in the 41st SMW (0.24% silver shoots). Stem borer infestation, indicated by dead hearts, was recorded throughout the season, with the highest incidence in the 39th SMW (9.72%) and the lowest in the 43rd SMW (3.78%). Leaf folder damage was consistently present, peaking at 6.12 per cent in the 31st SMW and declining to a minimum of 0.85 per cent in the 45th SMW. Whorl maggot infestation was observed from the 30th to 33rd SMW, with the highest incidence recorded in the 31st SMW (5.91%). White ears appeared late in the season, with 7.03 per cent recorded in the 45th SMW and 5.13 per cent in the 46th SMW. Rice hispa infestation was absent throughout the season. The planthopper population (BPH and WBPH) was also not recorded during this period at these location (Fig 2.7.1. 7A and 7B). Spider populations varied between 4.4 and 13.5 per hill, peaking in SMW 36 Coccinellids ranged from 0.2 to 8.0 per hill, with the highest density in SMW 36. Mirid bugs showed fluctuating numbers, reaching a maximum of 12.0 per hill in SMW 33 and 42 but declining to 0.1 in SMW 45. The incidence of Stem Borer Dead Hearts (SBDH) showed a highly significant positive correlation with maximum temperature (r=0.57*) and minimum temperature (r=0.86**). It also exhibited a non-significant positive correlation with rainfall (0.37) and evening relative humidity (0.60). In contrast, it demonstrated a non-significant negative correlation with morning relative humidity (r=-0.27) and sunshine hours (r=-0.15). Leaf Folder Damaged Leaves (LFDL) exhibited a highly significant positive correlation with maximum temperature (r=0.53*), minimum temperature (r=0.72***), rainfall (r=0.64**), and evening relative humidity (r=0.52*). However, it showed a non-significant negative correlation with morning relative humidity (r=-0.46) and sunshine hours (r=-0.31). The occurrence of Whorl Maggot (WM) displayed a non-significant positive correlation with maximum temperature (r=0.43) and minimum temperature (r=0.38). However, it showed a highly significant positive correlation with rainfall (r=0.64**). A significant negative correlation was observed with morning relative humidity (r=-0.55*), while sunshine hours showed a neutral correlation (Fig 2.7.1. 8).

FIG 2.7.1.7A POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-IV)





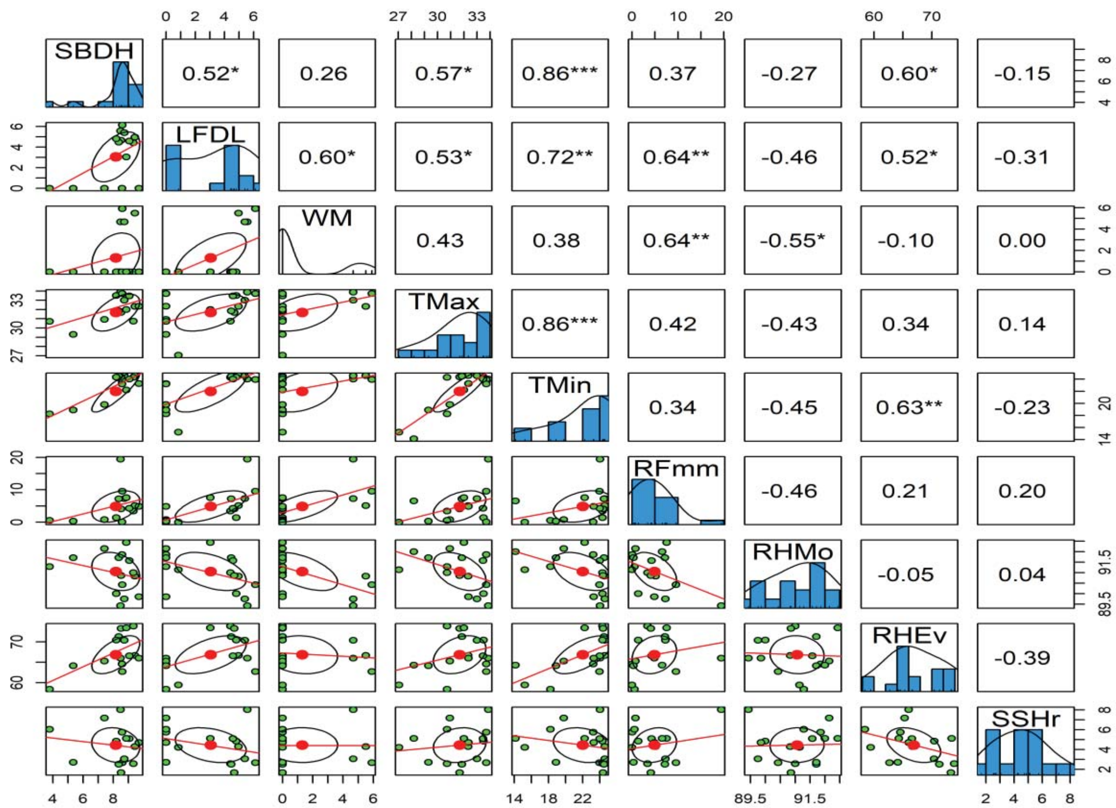


Fig: 2.7.1.8 Correlation matrix - field incidence of insect pest's ***vis-à-vis*** weather parameters in Zone-IV, ***Kharif,*** 2024

In Zone-V: Pest incidence was reported from Jagdalpur, Rewa and Raipur. The major pests observed were gall midge, stem borer, leaf folder, whorl maggot and

Planthoppers (BPH and WBPH). Pest incidence began in the 34th SMW and continued until the 47th SMW. The highest gall midge damaged plants were observed during the 36th SMW, with 88 per cent, while the lowest was recorded in the 44th SMW (16%). The percentage of silver shoots peaked at 19.86 per cent in the 36th SMW and declined to 0.93 per cent in the 44th SMW. Stem borer damage reached its maximum in the 42nd SMW, with 19.96 per cent dead hearts, whereas the lowest incidence was recorded in the 37th SMW (2.64%). Leaf folder damage was most severe in the 43rd SMW (10.57%) and lowest in the 37th SMW (3.18%). Whorl maggot infestation was notably high in the 34th SMW (10.65%) and gradually decreased, becoming negligible by the 45th SMW. Rice hispa infestation peaked at 7.07 % DL in the 34th SMW and was not recorded beyond the 43rd SMW. The planthopper (BPH and WBPH) populations showed a gradual increase, reaching its highest density of 3.85 individuals per hill in the 46th SMW. White ears were observed in the later part of the season, with the highest damage recorded at 17.5 per cent in the 46th SMW and 14.4 per cent in the 47th SMW (Fig 2.7.1.9A, 9B and 9C). The population of natural enemies fluctuated across the observation period. Spiders ranged from 1.0 to 20.0 per hill, peaking in 43rd SMW. Mirid bugs were mostly absent except for 43rd SMW (3.0), 44th (8.0), and 45th (20.0). Coccinellids varied between 0.0 and 3.0, with higher numbers in 42nd to 45th SMW. Ground beetles remained relatively stable, ranging from 1.0 to 3.0 per hill. The presence of natural enemies suggests a potential role in pest suppression. The incidence of Gall Midge Damaged Plants (GMDP) showed a non-significant positive correlation with maximum temperature (0.19), rainfall (0.42), morning relative humidity (0.16), evening relative humidity (0.54), and wind speed (0.33). Sunshine hours exhibited a neutral correlation, whereas minimum temperature (0.69**) showed a highly significant positive correlation with GMDP. The percentage of Gall Midge Silver Shoot (GMSS) exhibited a non-significant negative correlation with maximum temperature (-0.07) and sunshine hours (-0.16). In contrast, it showed a non-significant positive correlation with morning relative humidity (0.44) and wind speed (0.27). However, minimum temperature (0.58*), rainfall (0.68*), and evening relative humidity (0.69**) were highly significantly correlated with GMSS. The incidence of Stem Borer Dead Hearts (SBDH) exhibited a non-significant negative correlation with minimum temperature (-0.01), rainfall (-0.39), morning relative humidity (-0.34), evening relative humidity (-0.33), and wind speed (-0.48). However, maximum temperature (0.64*) showed a significant positive correlation, while sunshine hours (0.51) exhibited a non-significant positive correlation with SBDH. Leaf Folder Damaged Leaves (LFDL) displayed a non-significant negative correlation with minimum temperature (-0.24), rainfall (-0.47), morning relative humidity (-0.21), evening relative humidity (-0.43), and wind speed (-0.50). In contrast, it showed a non-significant positive correlation with maximum temperature (0.34) and sunshine hours (0.22). The incidence of Whorl Maggot (WM) exhibited a highly significant positive correlation with rainfall (0.67**), morning relative humidity (0.75**), evening relative humidity (0.87**), and wind speed (0.70**). However, it showed a significant negative correlation with sunshine hours

(-0.81**) and maximum temperature (-0.62*), while minimum temperature (0.21) recorded a non-significant positive correlation. For Hispa, a non-significant positive correlation was observed with minimum temperature (0.21), rainfall (0.30) and morning relative humidity (0.54), and evening relative humidity (0.49). However, it was highly significantly negatively correlated with sunshine hours (-0.74**) and non-significantly negatively correlated with maximum temperature (-0.61). Wind speed (0.56*) showed a significantly positive correlation with Hispa. Planthoppers (PH) exhibited a non-significant negative correlation with minimum temperature (-0.50), rainfall (-0.31), morning relative humidity (-0.41), evening relative humidity (-0.49), and wind speed (-0.42). In contrast, maximum temperature (0.19) showed a non-significant positive correlation, while sunshine hours (0.62*) had a significant positive correlation with Plant hoppers (Fig 2.7.1. 10).

FIG 2.7.1.9A POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-V)

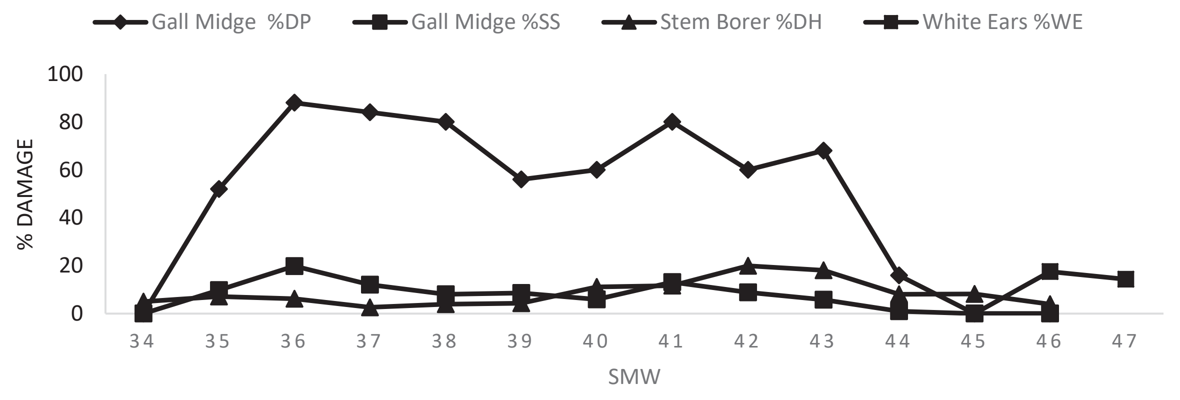
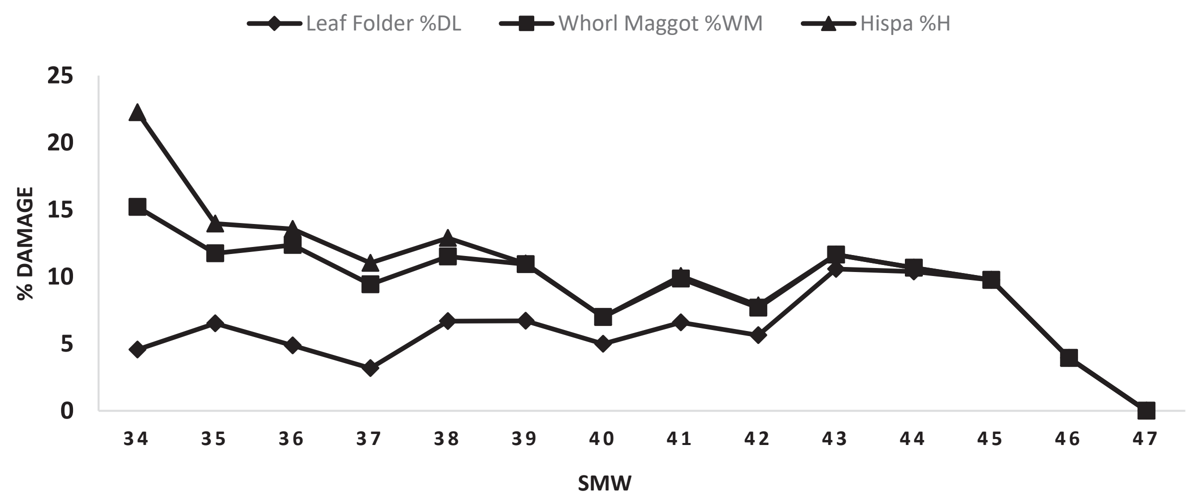
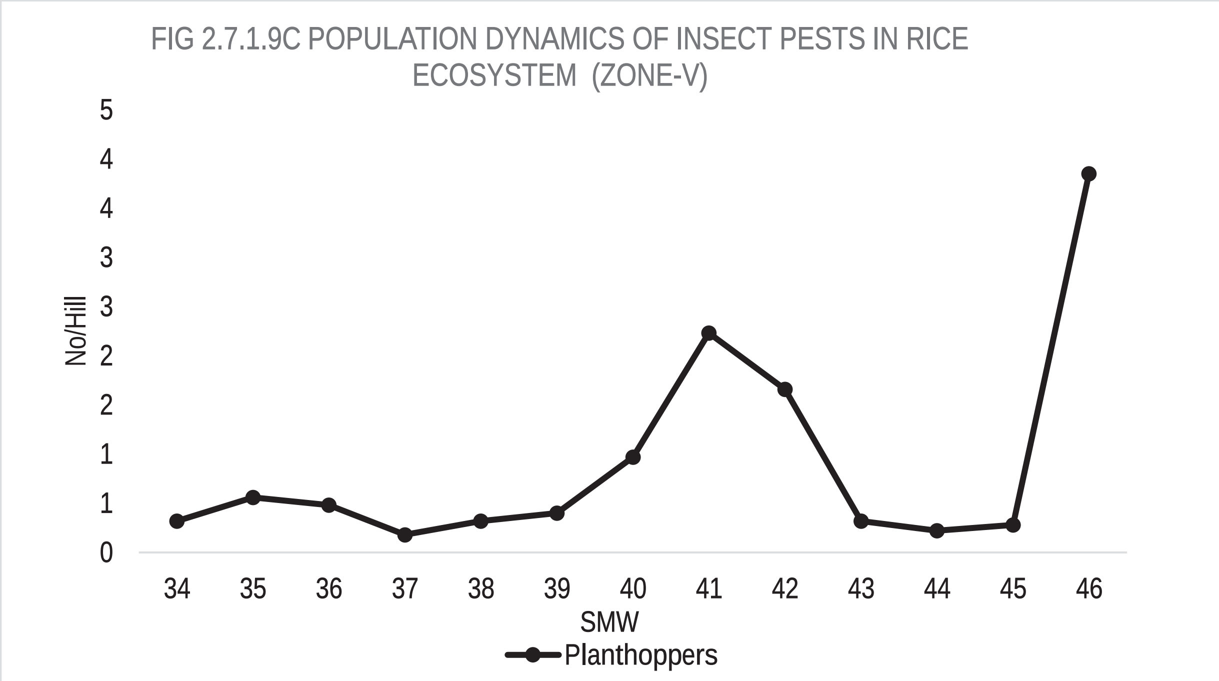


FIG 2.7.1.9B. POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-V)





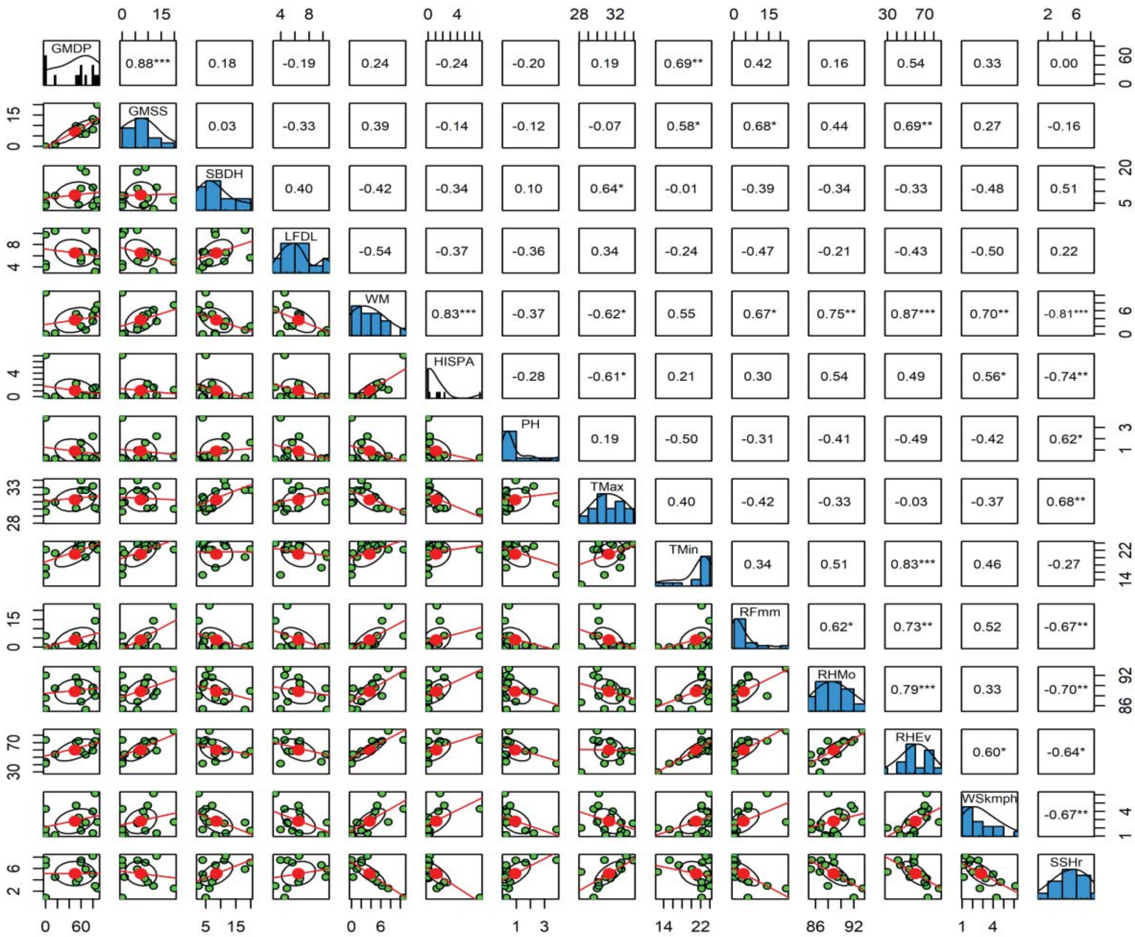
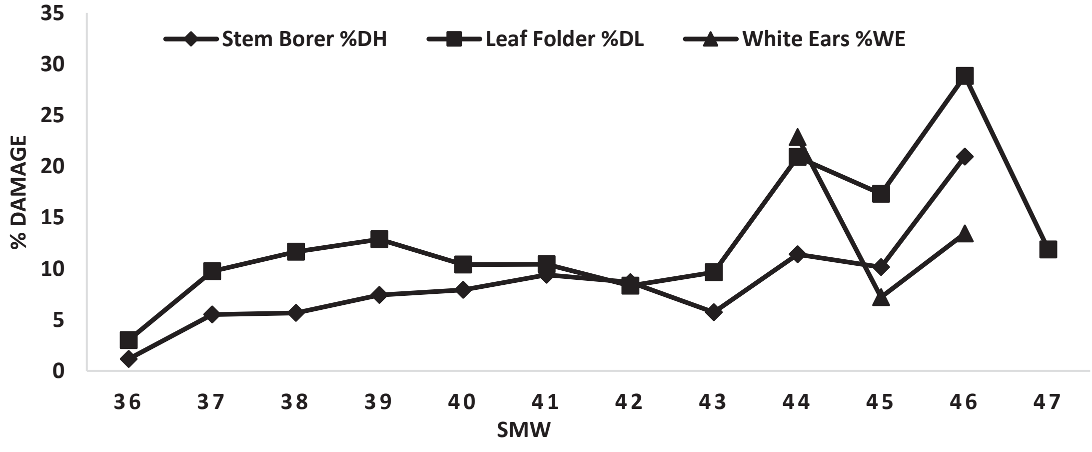


Fig: 2.7.1.10 Correlation matrix - field incidence of insect pest's ***vis-à-vis*** weather parameters in Zone-V, ***Kharif,*** 2024

Zone-VI: Pest incidence was reported from Nawagam, Navasari and Karjat. The major pests observed stem borer and leaf folder. Stem borer infestation was observed starting from the 36th SMW, while leaf folder incidence was recorded from the same period. The highest percentage of dead hearts due to stem borer was 20.95 per cent in the 46th SMW, whereas the lowest incidence was recorded in the 36th SMW (1.16%). Leaf folder damage peaked at 28.84 per cent in the 46th SMW, with the lowest incidence of 3.01 per cent in the 36th SMW. White ear damage was comparatively higher in this zone, with the highest damage of 22.9 per cent recorded during the 44th SMW and the lowest of 7.195 per cent during the 45th SMW (Fig 2.7.1.11). The population of spiders remained relatively stable throughout the observation period, fluctuating between 0.84 and 1.16 per hill. The lowest density (0.84) was recorded in 39th and 45th SMW, while the highest (1.16) was observed in 36th, 40th and 43rd SMW. Despite variations in pest infestation levels, spider populations did not show a significant variation. The incidence of Stem Borer Dead Hearts (SBDH) showed a non-significant negative correlation with minimum temperature (-0.33), rainfall (-0.36), morning relative humidity (-0.23), and evening relative humidity (-0.60). However, it exhibited a significant positive correlation with maximum temperature (0.60*). Leaf Folder Damaged Leaves (LFDL) displayed a non-significant negative correlation with minimum temperature (-0.52), rainfall (-0.35), morning relative humidity (-0.26), and evening relative humidity (-0.60). Additionally, evening relative humidity (-0.58) showed a significant negative correlation. However, maximum temperature (0.54) exhibited a non-significant positive correlation. For White Ears (WE), a non-significant negative correlation was observed with minimum temperature (r=-0.64), rainfall (r=-0.39), morning relative humidity (r=-0.57) and evening relative humidity (r=-0.54). However, maximum temperature (r=0.42) showed a non-significant positive correlation (Fig 2.7.1.12).

FIG 2.7.1.11 POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-VI)



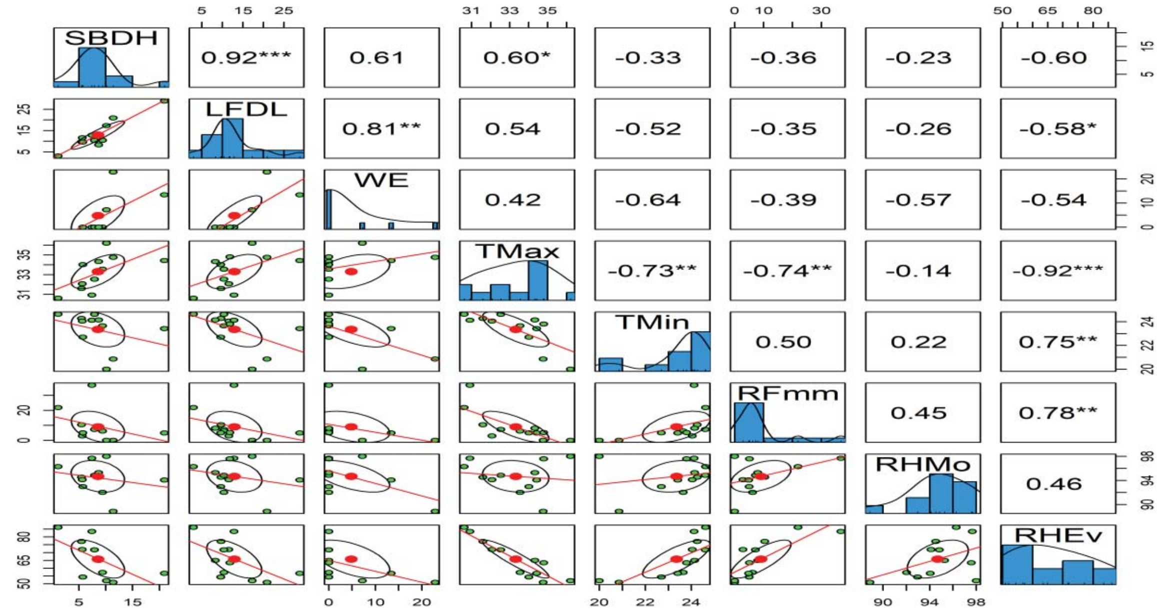


Fig: 2.7.1.12 Correlation matrix - field incidence of insect pest's ***vis-à-vis*** weather parameters in Zone-VI, ***Kharif,*** 2024

Zone-VII: Pest incidence was reported from Aduthurai, Rajendranagar, Warangal, Bapatla, Jagtial, Ragolu, Nellore, Maruteru, Moncompu, Gangavati, Mandya, Coimbatore, Pattambi and Karaikal. The major pests observed were gall midge, stem borer, leaf folder, whorl maggot, rice hispa and Planthoppers (BPH and WBPH). The gall midge infestation showed the highest plant damage at 48.0% during the 39th SMW and the lowest at 3.0% in the 34th SMW. A similar pattern was observed for silver shoot damage, which peaked at 11.80% in the 39th SMW and decreased to 0.79% in the 34th SMW. Stem borer infestation resulted in the highest dead heart percentage of 16.26 during the 29th SMW, while the lowest was 0.40 per cent in the 48th SMW. White ear damage was prominent in the later stages, with the highest incidence of 18.65 per cent in the 52nd SMW, while the lowest was observed in the 49th SMW (1.60%). Leaf folder damage was most severe in the 40th SMW (15.56%) and lowest in the 33rd SMW (0.55%). Whorl maggot incidence remained low, peaking at 4.46 per cent in the 33rd SMW and declining to 0.17 per cent in the 45th SMW. Rice hispa infestation was highest in the 50th SMW (3.74%) at Nellore and lowest in the 46th SMW (0.28%). The planthopper population (BPH and WBPH) increased gradually, reaching its highest density in the 45th SMW (24.71 individuals per hill), while the lowest was recorded in the 38th SMW (6.69 per hill). (Fig 2.7.1.13A, 13B and 13C). The population of natural enemies increased from 38th to 43rdSMW, with spiders peaking at 2.08/hill and mirids reaching 16.84/hill at 43rd SMW. Coccinellids remained low, with a maximum of 1.2/hill. The rise in natural enemies, especially mirids and spiders, coincided with higher planthopper densities, suggesting their role in pest regulation. The incidence of Gall Midge Damaged Plants (GMDP) showed a non-significant positive correlation with maximum temperature (r=0.16) and rainfall (r=0.13). In contrast, it exhibited a non-significant negative correlation with minimum temperature (r=-

0.05), morning relative humidity (r=-0.16), and evening relative humidity (-0.35). The percentage of Gall Midge Silver Shoot (GMSS) recorded a non-significant positive correlation with maximum temperature (0.17), minimum temperature (r=0.36), rainfall (r=0.009), morning relative humidity (0.14), and evening relative humidity (r=0.31). The incidence of Stem Borer Dead Hearts (SBDH) exhibited a non-significant positive correlation with maximum temperature (0.34) and rainfall (r=0.38). However, it showed a highly significant positive correlation with minimum temperature (0.42*), morning relative humidity (r=0.48*), and evening relative humidity (0.47*). Leaf Folder Damaged Leaves (LFDL) showed a non-significant positive correlation with maximum temperature (r=0.07), minimum temperature (0.24), and evening relative humidity (r=0.34). Rainfall exhibited a neutral correlation, whereas morning relative humidity (r=-0.38*) displayed a highly significant negative correlation. The occurrence of Whorl Maggot (WM) showed a highly significant positive correlation with maximum temperature (0.44*) and minimum temperature (r=0.43*). In contrast, it exhibited a non-significant negative correlation with morning relative humidity (r=-0.16) and evening relative humidity (r=-0.60). Rainfall (0.28) was non-significantly positively correlated. For Hispa, maximum temperature (r=-0.11) and rainfall (r=-0.07) showed a non-significant negative correlation. However, morning relative humidity (r=0.51*) and evening relative humidity (r=0.76***) exhibited a highly significant positive correlation. Finally, minimum temperature (r=0.32) recorded a non-significant positive correlation. Planthoppers (PH) showed a non-significant negative correlation with maximum temperature (r=-0.19) and rainfall (r=-0.43). However, minimum temperature (r=-0.47*) and evening relative humidity (r=-0.48*) exhibited a significant negative correlation, while morning relative humidity (r=0.11) recorded a non-significant positive correlation. For White Ears (WE), maximum temperature (r=-0.35), rainfall (r=-0.43), and morning relative humidity (r=-0.37) showed a non-significant negative correlation. However, evening relative humidity (r=0.02) exhibited a non-significant positive correlation. Finally, minimum temperature (r=-0.74**) showed a highly significant negative correlation (Fig 2.7.1.14).

FIG 2.7.1.13A POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-VII)

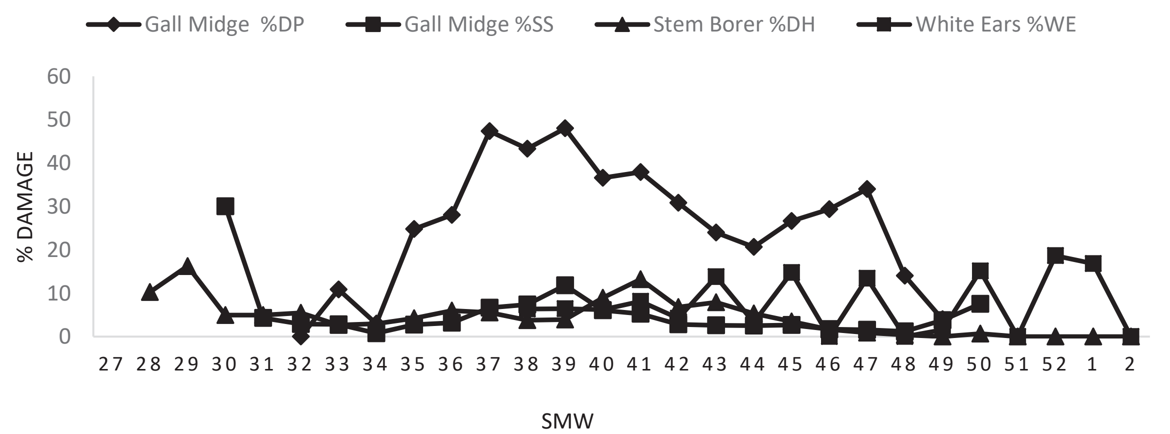


FIG 2.7.1.13B POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-VII)

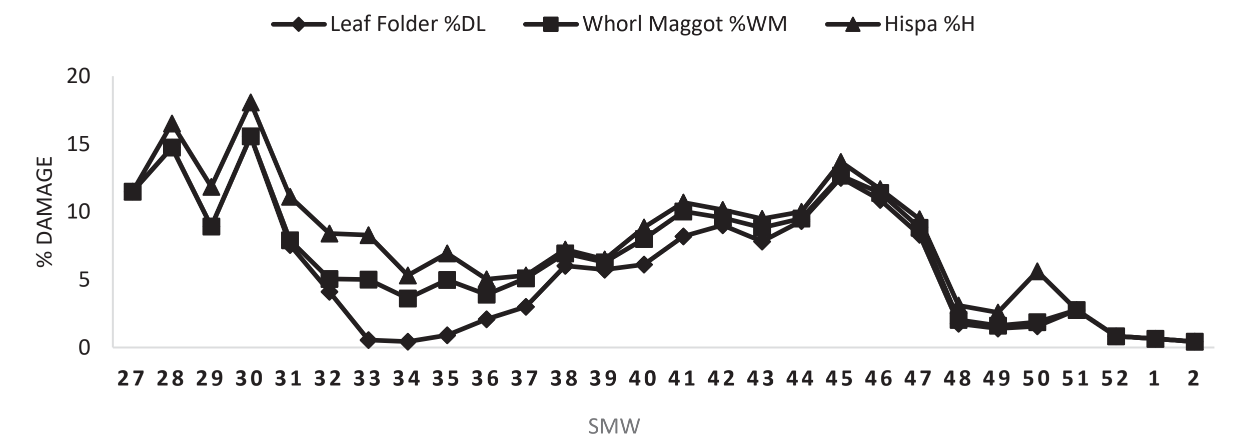
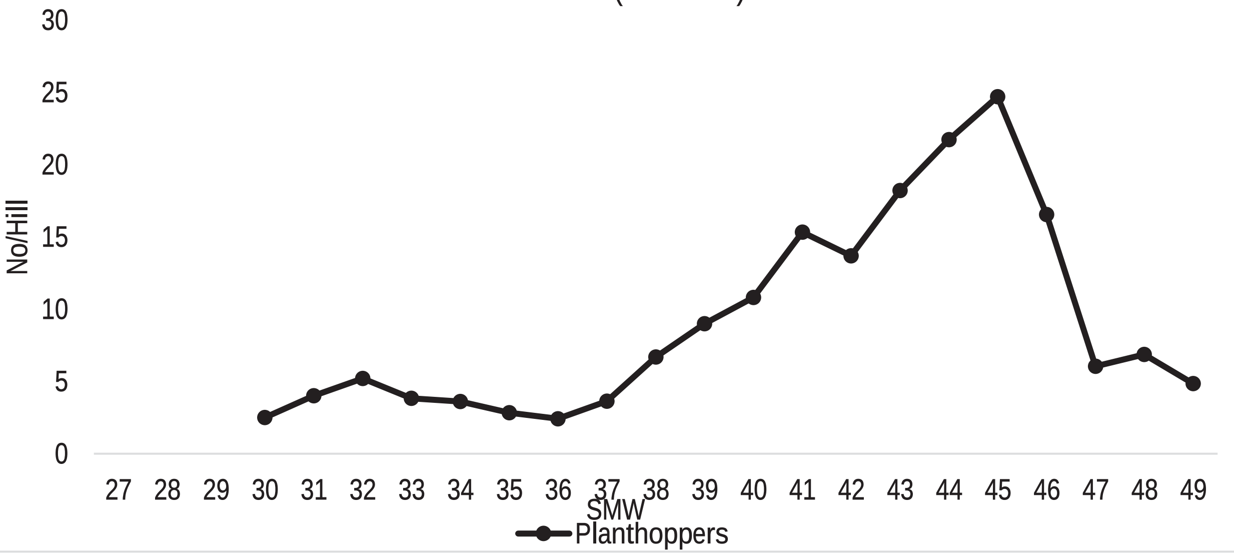


FIG 2.7.1.13C POPULATION DYNAMICS OF INSECT PESTS IN RICE ECOSYSTEM (ZONE-VII)



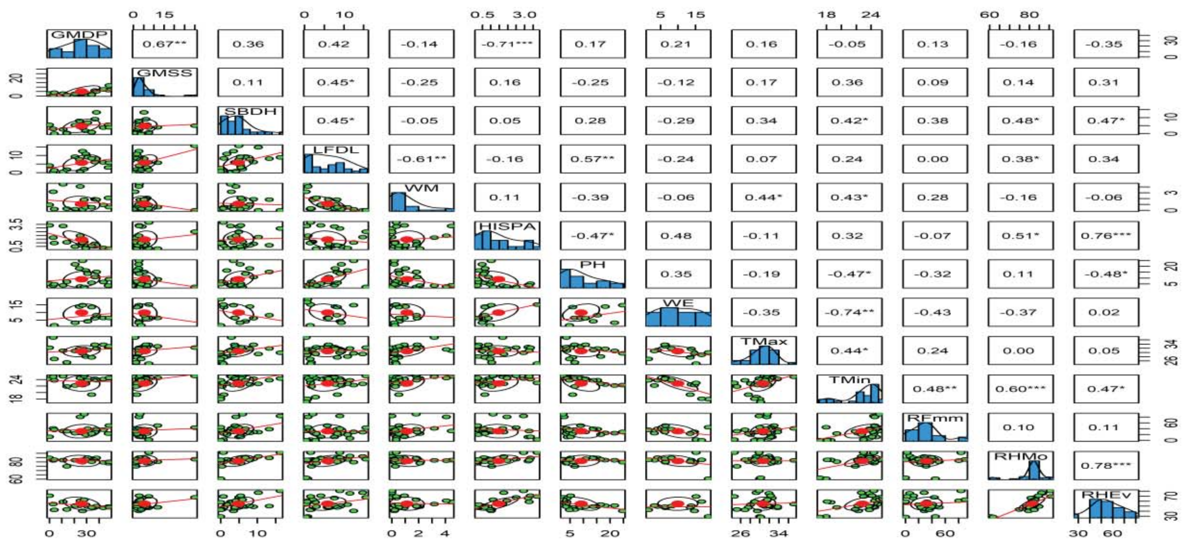


Fig 2.7.1. 14 Correlation matrix - field incidence of insect pest's ***vis-à-vis*** weather parameters in Zone-VII, ***Kharif,*** 2024

Summary: *Studies on Population dynamics of insect pests and natural enemies (PDPNE) in rice ecosystem was carried out at 32 locations in seven zones to study the dynamics of insect pests in relation to changes in weather parameters, crop phenology, growing season and cropping systems as it is vital for designing ecologically sound and economically viable pest management strategies. Yellow stem borer, Planthoppers, leaf folder and Gall midge were observed as the major pests of rice across the country during Kharif 2024. However, rice hispa and whorl maggot were also recorded as minor pests in rice ecosystem in different locations in India.*

*In Zone-I at Khudwani, grasshopper incidence was observed from the 27th to the 44th SMW, peaking at 56.91% in the 43rd SMW before declining. Natural enemy populations varied with spiders in 39th SMW and coccinellids in 42nd SMW, while dragonflies and damselflies remained low. Correlation analysis revealed a significant negative relationship between leaf folder damage and both maximum (r = -0.65**) and minimum temperatures (r = -0.64**).*

In Zone II, insect pest incidence began from the 32nd SMW, with stem borer damage peaking in the 35th SMW (9.66%) and leaf folder infestation highest in the 34th SMW (7.62%). Whorl maggot and rice hispa were most prevalent in the 34th SMW, while planthopper populations peaked in the 42nd SMW (70.70 number per hill). Peak white ear incidence was observed in the 46th SMW (22.70%). Natural enemy populations fluctuated, with spiders peaking in the 34th SMW and mirid bugs in the 40th SMW. A significant negative correlation for Planthopper populations with rainfall and humidity was observed.

In Zone III, major pests included gall midge, stem borer, leaf folder, whorl maggot and planthoppers. Gall midge incidence peaked in the 37th SMW (23.30%), while stem borer dead heart damage was highest in the 39th SMW (10.82%), white ear incidence peaked in the 40th SMW (18.13%). Leaf folder infestation reached its maximum (4.57%) in the 39th SMW and whorl maggot damage peaked in the 37th SMW (16.34%). Planthopper populations were highest in the 35th SMW (34.54 number per hill). Natural enemy populations varied, with spiders peaking in the 36th SMW and mirid bugs in the 33rd and 42nd SMWs. Correlation analysis showed significant positive relationships for gall midge incidence with minimum temperature and for leaf folder damage with temperature and humidity.

In Zone IV - reported from one location- Titabar. Insect pest incidence began in the 30th SMW. Gall midge infestation in 41st SMW (0.24%). Stem borer dead heart damage peaked in the 39th SMW (9.72%), while leaf folder infestation was highest in the 31st SMW (6.12%). White ear incidence was 7.03 per cent in the 45th SMW. Whorl maggot incidence was recorded from the 30th to 33rd SMW, peaking at 5.91% in the 31st SMW. Natural enemies, including spiders, coccinellids and mirid bugs showed fluctuating populations. Correlation analysis indicated that stem borer and leaf folder incidences had significant positive relationships with temperature, rainfall and evening humidity, while whorl maggot damage was positively correlated with rainfall but negatively with morning humidity.

In Zone-V, pest incidence was recorded from the 34th to the 47th SMW. Gall midge infestation peaked in the 36th SMW (88%DP) and declined to 16% by the 44th SMW. Stem borer dead heart damage was highest in the 42nd SMW (19.96%) and White ear in the 46th SMW (17.5%). Leaf folder infestation peaked in the 43rd SMW (10.57%DL), while whorl maggot and rice hispa were most prevalent in the 34th SMW. Planthopper populations were highest in the 46th SMW (3.85 number per hill). Natural enemies, including spiders, mirid bugs, coccinellids and ground beetles fluctuated throughout the season indicating potential for pest suppression. Correlation analysis showed significant relationships between temperature, humidity, rainfall and pest incidence, with notable positive correlations for gall midge and whorl maggot with humidity and rainfall, while sunshine hours negatively affected whorl maggot and hispa damage.

In Zone VI, only stem borer, leaffolder and white ear damage were recorded. Stem borer infestation began in the 36th SMW, peaking in the 46th SMW (20.95% DH) and 44th SMW (22.9%WE). Leaf folder damage was highest at 28.84% in the 46th SMW. White ear damage was significant reaching in the. Spider populations remained stable fluctuating between 0.84 and 1.16 numbers per hill. Correlation analysis showed a significant positive relationship between stem borer incidence and maximum temperature

In Zone VII, major pests included gall midge, stem borer, leaf folder, whorl maggot, rice hispa and planthoppers. Gall midge damage peaked at 48% in the 39th SMW, while stem borer dead heart incidence was highest in the 29th SMW (16.26% DH) and 52nd SMW (18.65% WE). Leaf folder damage reached 15.56% in the 40th SMW and planthopper populations peaked at 24.71 number per hill in the 45th SMW. Natural enemies, especially spiders and mirid bugs increased with planthopper density suggesting that population is dependent on pest density. Correlation analysis showed varying relationships between pest incidences and weather parameters with temperature and humidity significantly influencing pest populations.

2.7.2. Population dynamics of insect pests through Light Trap collections (LT)

The population dynamics of insect pests and their natural enemies vary with the geographic location and cropping system. Insect pest populations, during the crop season are always a function of abiotic and biotic factors. Besides biotic potential, to a large extent, abiotic factors like temperature, rainfall, relative humidity, sun shine hours, etc. and biotic factors such as predators, parasitoids, entomopathogenic organisms, etc. determine the abundance of insect pests in a crop ecosystem. Therefore, to design any effective location specific pest management strategies, knowledge of population dynamics of insect pests in relation to abiotic and biotic factors becomes vital. Since rice is grown in diverse agro-climatic zones in India, concerted efforts are being made under AICRPR to study the population dynamics of insect pests of rice at different locations across the country to understand short- and long-term changes in rice pest scenario.

During year 2024, insect populations in rice ecosystems were recorded daily, throughout the year using light traps (Chinsurah/Robinson type) in 31 locations. These locations are namely; ADT, CHN, CHP, BRH, GNV, KRK, KJT, KUL, LDN, MLN, MND, MTU, MSD, MNC, KHD, NVS, NWG, NLR, PNT, JGT, PTB, RNR, RPR, CBT, JDP, TTB, CHT, RGL, GGT, REW and WGL. Corresponding weather data on minimum temperature (MinT), maximum Temperature (MaxT), rainfall (RF), relative humidity (RH1 and RH2), sunshine hours, etc. were also collected. Weekly cumulative catches of major insect pests and weekly averages of weather parameters were worked out on standard meteorological week (SW) basis. The cumulative catches were square root transformed and presented in figures **2.7.1-2.7.8.** The salient findings and trends in the insect dynamics through light trap catches during the year 2024 are presented hereunder:

Yellow stem borer: Yellow stem borer was recorded in 26 locations. Annual cumulative catches were highest at WGL (24159), PTB (22781), followed by PNT (11201). Highest weekly catch also was at WGL followed by PTB, and PNT in 6th SW; 6th and 39th SW, respectively (**Table 2.7.2.1 and Fig. 2.7.2.1**). In the previous year 2023, annual cumulative catches were highest at MTU (22274) followed by GGT (14009) and GNV (12838). Whereas, the highest weekly catch was at MTU, GNV, and NLR in 16th, and 7th SW, respectively.

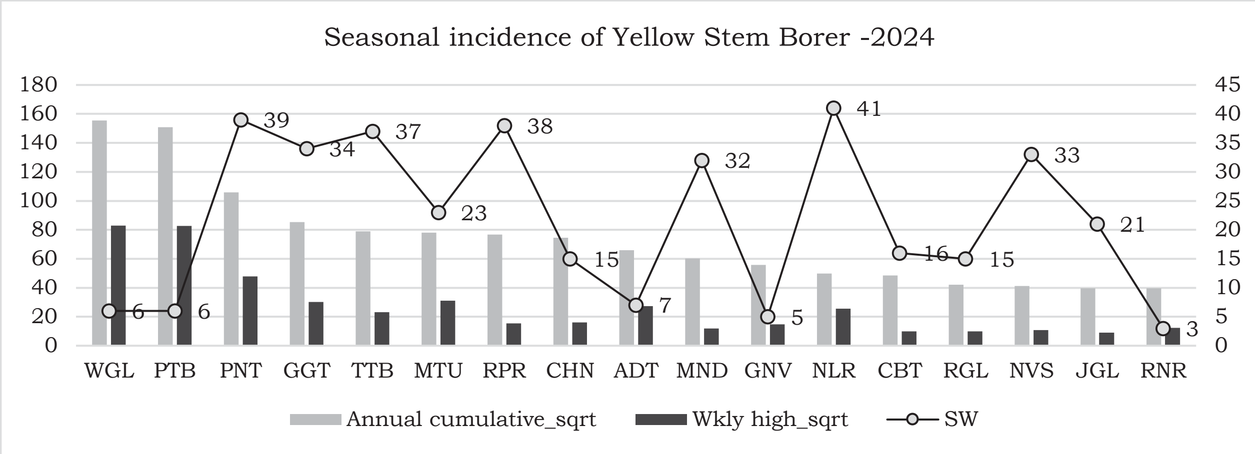


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Fig. 2.7.2.1. Seasonal incidence of yellow stem borer based on light trap catches

Table 2.7.2.1 Seasonal incidence of yellow stem borer based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT ºC	MinT ºC	RF mm	RH1 %	RH2 %
1	Zone-II North	PNT	11201	2299	39	32.8	24.7	1.8	89.6	72.9
2		KUL	481	44	40	34.9	21.8	1.4	95.6	57.6
3		LDN	159	42	38	33.8	25.5	0.1	86.9	56.3
4	Zone-III East	GGT	7280	918	34	26.9	33.0	143.0	NR	NR
5		CHP	997	185	46	30.5	15.2	0.0	88.6	48.7
6		CHN	5551	256	15	36.0	21.9	0.0	83.7	55.0
7	Zone-III N-East	TTB	6247	532	37	33.5	24.3	1.4	90.0	70.4
8	Zone V-Central	RPR	5883	236	38	31.9	24.7	1.6	87.6	65.9
9		JDP	687	24	44	31.6	19.4	1.3	93.4	54.0
10	Zone-VI Western	NWG	922	65	47	31.2	15.4	0.0	66.6	37.7
11		NVS	1692	116	33	29.8	24.8	13.0	96.5	85.3
12		KJT	361	15	40	33.6	25.1	3.4	91.4	62.6
13	Zone-VII: Sothern	PTB	22781	6852	6	35.5	20.1	0.0	67.6	37.1
14		MNC	350	29	51	33.4	24.6	0.0	82.8	68.5
15		ADT	4353	743	7	NR	NR	NR	NR	NR
16		KRK	358	37	1	29.6	22.9	92.7	78.4	5.1
17		CBT	2353	97	16	37.3	26.0	0.0	80.4	37.9
18		GNV	3106	221	5	32.9	17.5	0.0	71.4	21.4
19		BRH	170	15	38	30.9	21.7	13.1	93.0	79.0
20		MND	3633	140	32	28.7	21.1	3.6	84.4	58.3
21		RGL	1768	100	15	37.1	24.3	0.0	64.6	46.9
22		NLR	2486	655	41	33.4	24.1	0.9	71.7	52.9
23		MTU	6081	962	23	36.4	26.4	86.9	59.3	16.6
24		WGL	24159	6858	6	32.4	20.9	0.0	88.0	49.7
25		JGL	1576	81	21	41.2	27.0	0.8	64.1	35.6
26		RNR	1576	150	3	31.1	16.2	0.0	83.4	37.0

NR-Not reported

Gall midge: Gall midge occurrence was observed at 13 locations in 3 agroclimatic zones-zone III, V and VIII. Annual cumulative catches were highest in GNV (14628) followed by PTB (4919) and MTU (1940) and in terms of weekly cumulative catch, it was most active in GNV (2113) in 44th SW, followed by MTU (631) in 40st SW and PTB (573) in 38th SW (**Fig. 2.7.2.2** and **Table 2.7.2.2**). In the previous year 2023 also, the annual cumulative catches were highest in GNV (13330) followed by PTB (6849) and WGL (1424) and in terms of weekly cumulative catch, it was most active at GNV (2950) in 45th SW, followed by PTB (1234) in 41st SW and MTU (456) in 47th SW.

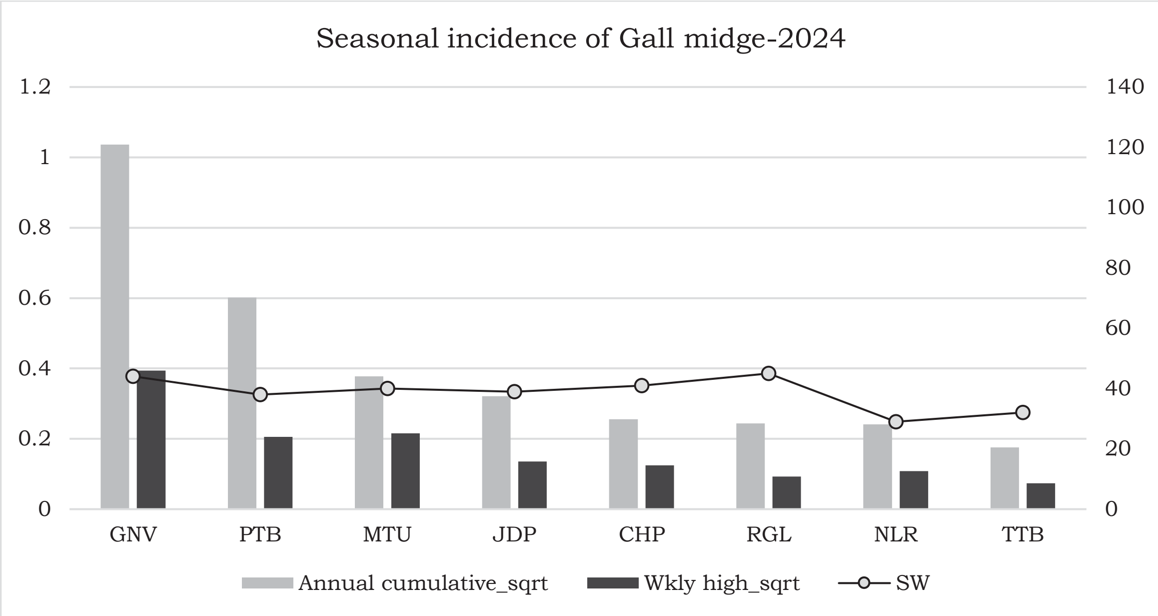

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Fig. 2.7.2. Seasonal incidence of gall midge based on light trap catches

Table 2.7.2.2 Seasonal incidence of gall midge based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT ºC	MinT ºC	RF mm	RH1 %	RH2 %
1	Zone-III East	CHP	888	211	41	32.31	23.2	0	87.89	75.02
2	Zone-III N-East	TTB	421	74	32	32.71	24.16	8.77	90.86	67.43
3	Zone V-Central	JDP	1401	249	39	30.89	22.6	2.86	90.86	74.57
4	Zone-VII: Sothern	KRK	35	8	46	30.97	24.66	4.46	91.29	86.86
5		GNV	14628	2113	44	32.16	22.53	0	87.57	67.71
6		BRH	340	56	33	31.54	23.03	2.06	92.43	81.71
7		RNR	4	2	45	31.29	17.14	0	84.86	39.29
8		PTB	4919	573	38	31.99	21.13	0.24	91.29	69.43
9		RGL	807	116	45	29.93	21.71	0.00	84.29	53.86
10		NLR	791	159	29	24.34	31.91	0.00	79.14	63.86
11		MTU	1940	631	40	33.43	26.14	0.90	88.86	80.71
12		JGL	149	15	42	35.97	29.79	0.00	90.71	60.86
13		WGL	313	69	38	32.50	23.43	4.34	91.00	72.86

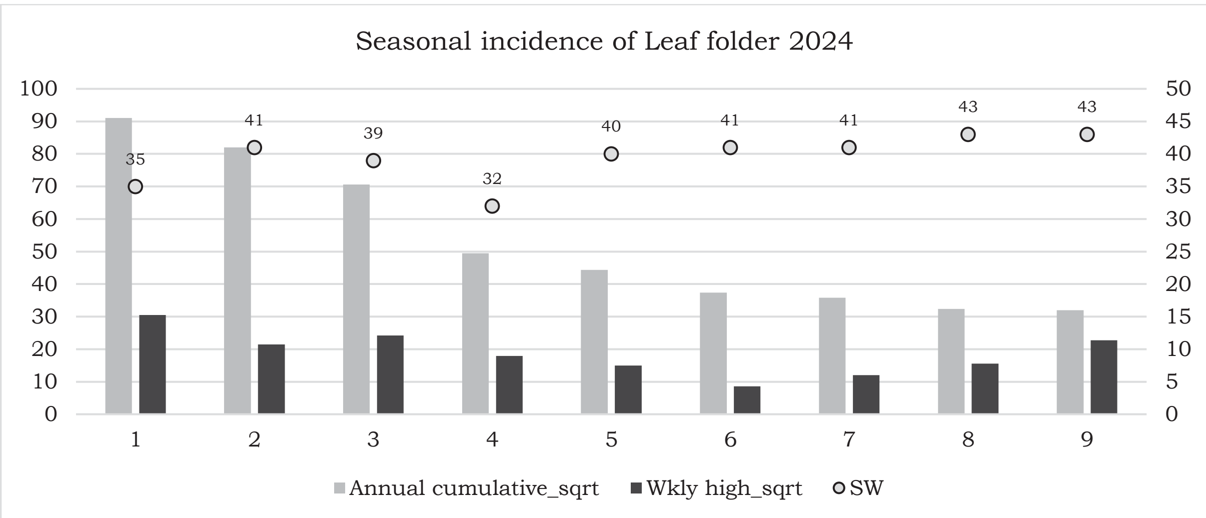
Leaf folder: Leaf folder was recorded at 28 locations across all the zones. Annual cumulative catches were highest at GGT (8293), MSD (6721), and LDN (4989). Whereas, weekly cumulative catches were highest in GGT (931), LDN (584) and MSD (462) in 35th, 39st and 41st SW, respectively (**Table 2.7.2.3 and Fig. 2.7.2.3**).

In the previous year 2023, annual cumulative catches were highest at GGT (8297), MSD (6637), and NLR (4589). Whereas, weekly cumulative catches were highest in NLR (2675), GGT (887), and LDN (517) in 34th, 34th and 39th SW, respectively.

Table 2.7.2.3. Seasonal incidence of leaf folder based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT ºC	MinT ºC	RF mm	RH1 %	RH2 %
1	Zone-I NW-Hills	CHT	273	26	41	32.8	17.63	0	86	48
					42	32.17	17.87	0	90	54
2		MLN	118	17	41	28.3	15.74	0	79.42	75.7
3	Zone-II North	PNT	804	154	40	32.7	22.79	0	88.14	60
4		KUL	402	68	37	32.17	23.86	4.63	95.14	80.14
5		LDN	4989	584	39	33.03	25.59	0.49	85.71	66.29
6	Zone-III East	MSD	6721	462	41	NR	NR	NR	NR	NR
7		GGT	8293	931	35	27.14	32.71	0	NR	NR
8		CHP	193	34	42	34.4	22.9	0.09	90.2	63.6
9		CHN	80	4	43	31.14	23.93	13.31	93.29	76.71
					44	32	23.29	0	97.71	69.43
10	Zone-III N-East	TTB	1968	224	40	33.71	23.21	0.09	91.86	64.57
11	Zone V-Central	RPR	911	153	45	31.66	19.36	0	84.86	40.57
12		JDP	565	72	39	30.89	22.6	2.86	90.86	74.57
13	Zone-VI Western	NVS	242	27	36	30.53	24.43	10.71	96.73	84.99
14		NWG	341	41	42	35.06	24.17	0.66	84.43	58.14
15		KJT	295	34	33	33.06	25.4	7.03	88.86	63.57
16	Zone-VII: Sothern	PTB	677	60	5	33.97	19.63	0	88.86	44
17		MNC	314	20	48	31.01	24.71	9.86	89.39	77.21
18		ADT	262	31	38	NR	NR	NR	NR	NR
19		KRK	114	16	44	33.54	25.6	5.54	92.71	78.71
20		CBT	501	26	26	30.11	23.83	2.99	86.57	64
21		GNV	1045	242	43	30.91	23.16	0	93.14	73.86
22		BRH	281	36	39	30.37	21.59	12.6	94.71	86.14
23		RGL	758	53	46	30.86	23.79	0	83.71	63.86
24		NLR	2445	320	32	26.37	35.03	2	67.86	75.71
25		MTU	1283	145	41	31.29	27	105	87.43	76.29
26		WGL	7	5	43	31.71	21.29	4.14	91.57	74.86
27		RNR	1025	517	43	31.86	19.5	0.63	85.43	44.29
28		MND	1400	73	41	29.57	20.57	8.57	86.75	60.6

NR- Not- received



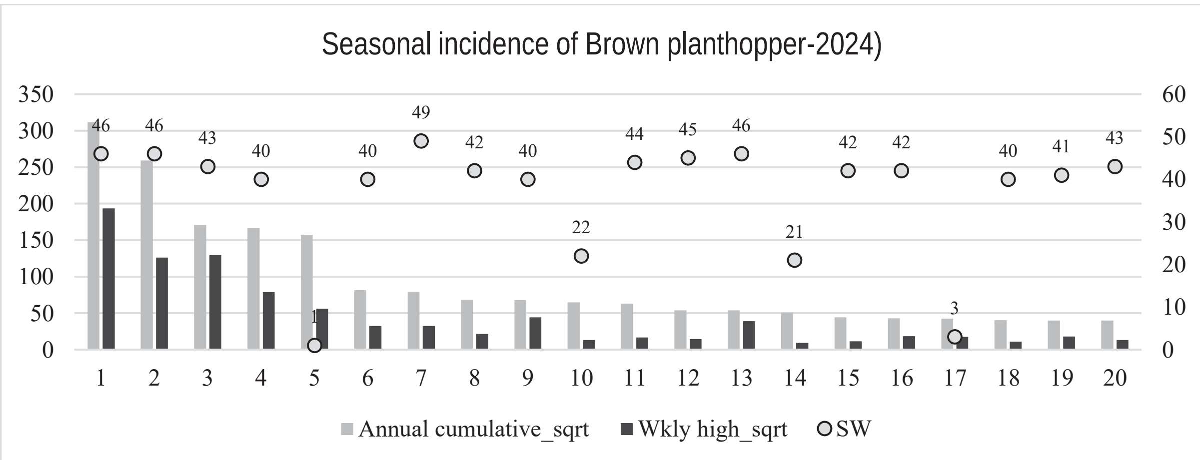
(Catches>1000)

Fig. 2.7.2.3. Seasonal incidence of leaf folder based on light trap catches

Brown planthopper: Brown planthopper was recorded in 23 locations. It was most abundant at RPR (97029), NLR (67080), and PNT (29171) on annual cumulative basis. Whereas, it was most active in 46th SW at RPR, NLR and in 43rd SW at PNT (**Table 2.7.2.4** and **Fig. 2.7.2.4**). In the previous year 2023, BPH was most abundant at RPR, PTB, and MTU on the annual cumulative basis. Whereas, the weekly catches were high in 18th SW at RPR, in 45 SW at PNT and in 41st SW at MTU.

Table 2.7.4. Seasonal incidence of brown planthopper based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT °C	MinT °C	RF mm	RH1 %	RH2 %
1	Zone-I NW-Hills	MLN	1604	319	41	28.3	15.7	0.0	79.4	75.7
2	Zone-II North	PNT	29171	16760	43	32.1	19.1	0.0	82.6	53.4
3		LDN	4633	1960	40	34.4	23.0	0.1	86.4	48.6
4		KUL	27813	6196	40	34.9	21.8	1.4	95.6	57.6
5	Zone-III East	CHP	1847	338	42	34.4	22.9	0.1	90.2	63.6
6		CHN	2897	210	45	30.9	21.0	0.0	97.7	66.1
7	Zone V-Central	JDP	3998	275	44	31.6	19.4	1.3	93.4	54.0
8		RPR	97029	37384	46	30.7	15.6	0.0	86.3	28.6
9	Zone-VI Western	NVS	142	37	43	34.5	22.5	0.6	95.3	54.1
10	Zone-VII: Sothern	CBT	4188	168	22	33.8	24.6	0.2	89.6	59.9
11		ADT	1790	307	3	NR	NR	NR	NR	NR
12		GNV	4686	470	42	28.5	23.7	5.4	100.0	88.3
13		MND	1964	127	42	28.3	20.7	4.1	84.5	55.8
14		BRH	575	43	31	28.2	21.2	62.0	97.4	91.4
15		MNC	1627	119	40	32.0	25.3	13.8	82.5	84.2
16		PTB	24755	3120	1	31.7	21.8	4.0	89.1	66.3
17		RGL	1583	175	43	31.9	24.7	88.6	72.9	0.0
18		NLR	67080	15900	46	21.3	27.7	4.6	93.0	80.1
19		MTU	6645	1050	40	33.4	26.1	0.9	88.9	80.7
20		RNR	2894	1505	46	30.6	20.0	0.0	73.9	48.9
21		WGL	6301	1053	49	31.1	22.3	0.0	93.0	76.9
22		KRK	74	17	46	31.0	24.7	4.5	91.3	86.9
23		JGL	2600	82	21	41.2	27.0	0.8	64.1	35.6



(Catches>1000)

Fig. 2.7.4. Seasonal incidence of brown planthopper based on light trap catches

White- backed planthopper: White- backed planthopper was recorded in 17 locations spread across all the zones. It was most abundant at NLR (41129), RPR (5337) and KUL (4523) in terms of annual cumulative catches. It was most active in 46th, 45th and 45th SW at MTU, RGL and WGL, respectively (**Table 2.7.2.5 and Fig. 2.7.2.5**). In the previous year 2023, it was most abundant at MTU, RGL, and NLR in terms of annual cumulative catches. It was most active at NLR (46th SW), PNT (43rd SW) and RPR (44thSW).

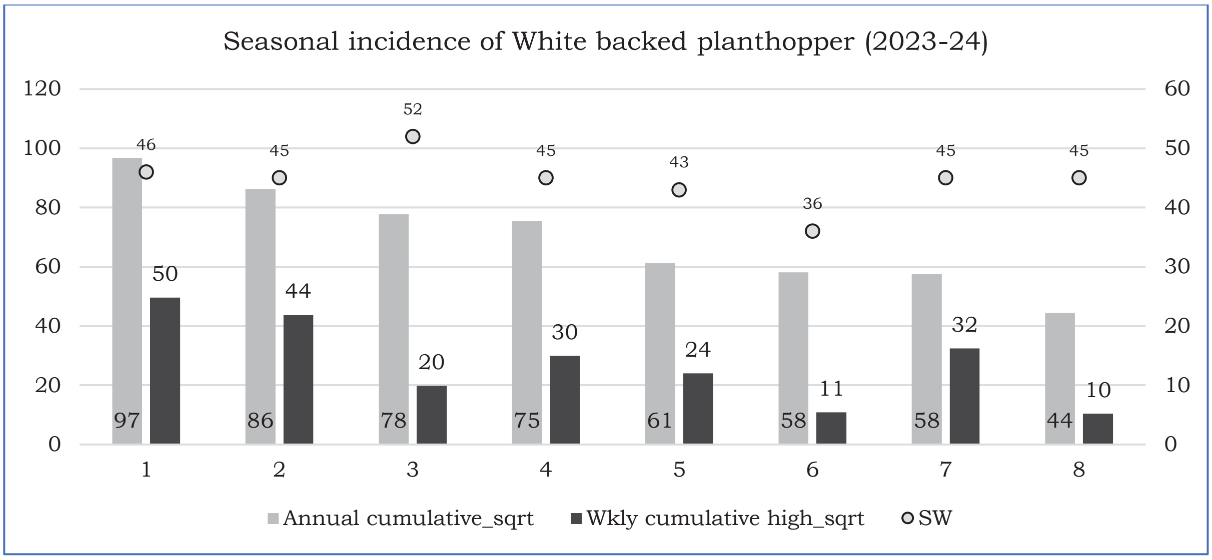


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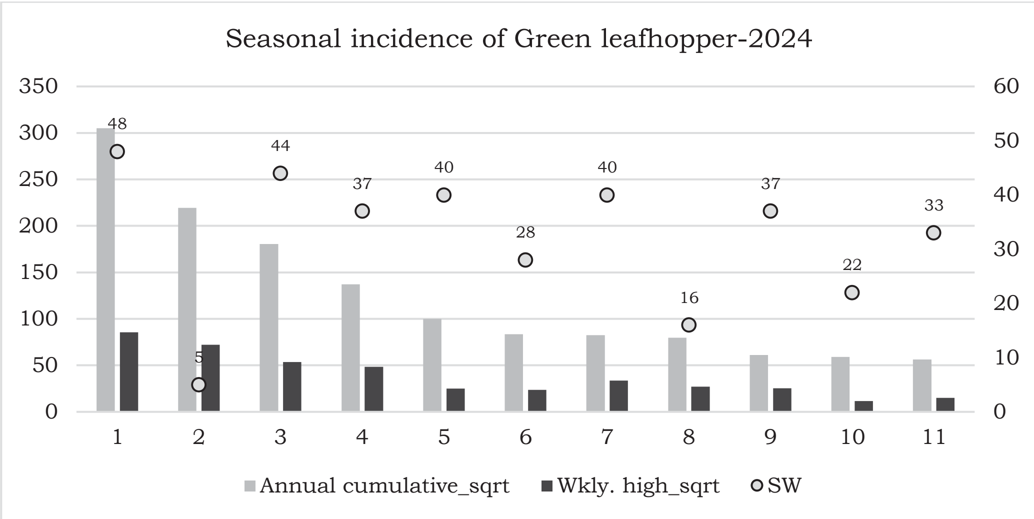
Fig. 2.7.2.5. Seasonal incidence of white backed planthopper based on light trap catches

Table 2.7.2.5. Seasonal incidence of white backed planthopper based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT ºC	MinT ºC	RF mm	RH1 %	RH2 %
1	Zone-I NW-Hills	MLN	313	44	39	28.4	17.7	9.11	84.3	79.7
2	Zone-II North	PNT	2643	1581	43	32.1	19.1	0	82.6	53.4
3		LDN	182	29	38	33.8	25.5	0.1	86.9	56.3
4		KUL	4523	1109	39	33.5	24.4	0.0	94.4	70.1
5	Zone-III East	CHP	475	110	44	33.2	21.8	0.0	94.4	68.0
6		CHN	118	6	50	24.5	8.9	0.0	95.3	56.4
7	Zone V-Central	JDP	1864	161	43	30.7	19.5	0.0	88.6	52.6
8		RPR	5337	1200	44	33.0	21.9	0.0	89.9	41.6
9	Zone-VI Western	NWG	339	66	48	31.2	14.5	0.0	62.6	32.0
10	Zone-VII: Sothern	CBT	3485	140	22	33.8	24.6	0.2	89.6	59.9
11		GNV	3479	323	42	28.5	23.7	5.4	100.0	88.3
12		BRH	71	6	43	32.3	21.4	0.0	89.1	69.7
13		MNC	94	13	39	32.1	25.2	1.5	78.3	62.7
14		RGL	1645	170	43	31.9	24.7	0.0	88.6	72.9
15		NLR	41129	15900	46	21.3	27.7	4.6	93.0	80.1
16		MTU	1894	402	43	32.8	25.5	0.0	86.3	73.7
17		KRK	222	34	52	31.4	24.3	3.8	94.9	79.8

Green leafhopper: Green leafhopper was recorded from 25 locations. The annual cumulative catches were highest in JDP (93071), PTB (48120) and GGT (32574). Whereas, it was most active in 48th, 5th and 44th SW at JDP, PTB, and GGT (Table 2.7.6 and Fig. 2.7.6). In the previous year 2023, GLH was predominant at JDP, PTB, and GGT in terms of annual cumulative catches but the weekly catches were high at JDP (44th SW), MTU (42ndSW) and PTB(45th SW).



(Catches>3000)

Fig. 2.7.2.6. Seasonal incidence of green leafhopper based on light trap catches

Table 2.7.2.6. Seasonal incidence of green leafhopper based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT ºC	MinT ºC	RF mm	RH1 %	RH2 %
1	Zone-I NW-Hills	CHT	804	34	36	34.0	23.5	221.4	90.9	65.4
2		MLN	3724	652	37	25.0	16.7	3.4	85.2	63.7
3	Zone-II North	PNT	1176	235	40	32.7	22.8	0	88.1	60.0
4		KUL	553	89	34	33.6	25.5	7.9	94.4	80.1
5										
6	Zone-III East	GGT	32574	2880	44	20.4	32.4	0.0	NR	NR
7		MSD	9973	627	40	NR	NR	NR	NR	NR
8		CHP	2378	497	42	34.4	22.9	0.1	90.2	63.6
9		CHN	1200	110	43	31.1	23.9	93.3	76.7	13.3
10	Zone-III N-East	TTB	18822	2355	37	33.5	24.3	1.4	90.0	70.4
11	Zone V-Central	JDP	93071	7309	48	27.6	13.8	0.0	89.4	50.0
12	Zone-VI Western	KJT	6983	552	28	28.3	23.9	76.4	93.4	90.1
13	Zone-VII: Sothern	PTB	48120	5232	5	34.0	19.6	0.0	88.9	44.0
14		MNC	983	64	40	32.0	25.3	13.8	82.5	84.2
15		ADT	2005	232	41	NR	NR	NR	NR	NR
16		KRK	1104	121	2	29.7	23.4	4.0	92.6	76.6
17		CBT	3508	133	22	33.8	24.6	0.2	89.6	59.9
18		GNV	2640	314	43	30.9	23.2	0.0	93.1	73.9
19		BRH	3156	230	33	31.5	23.0	2.1	92.4	81.7
20		RGL	484	35	43	31.9	24.7	0.0	88.6	72.9
21		NLR	2372	400	46	21.3	27.7	4.6	93.0	80.1
22		MTU	6794	1127	40	33.4	26.1	0.9	88.9	80.7
23		WGL	6343	741	16	39.3	25.9	0.0	81.3	52.3
24		JGL	2448	96	21	41.2	27.0	0.8	64.1	35.6
25		RNR	711	255	11	36.1	22.5	0.0	76.7	32.6

Case worm: Case worm was recorded in 13 locations spread across all the zones except Northern zone. It was highest in terms of annual cumulative catches at GGT (16426), MSD (9097), and PTB (1416) and was most active in 43rd, 35th and 38th SW at GGT, MSD and RPR (**Table 2.7.2.7** and **Fig. 2.7.2.7**). In the previous year 2023, annual cumulative catches were highest at GGT, MSD, and TTB and was most active in 43rd, 35th and 34th SW at GGT, TTB and MSD.

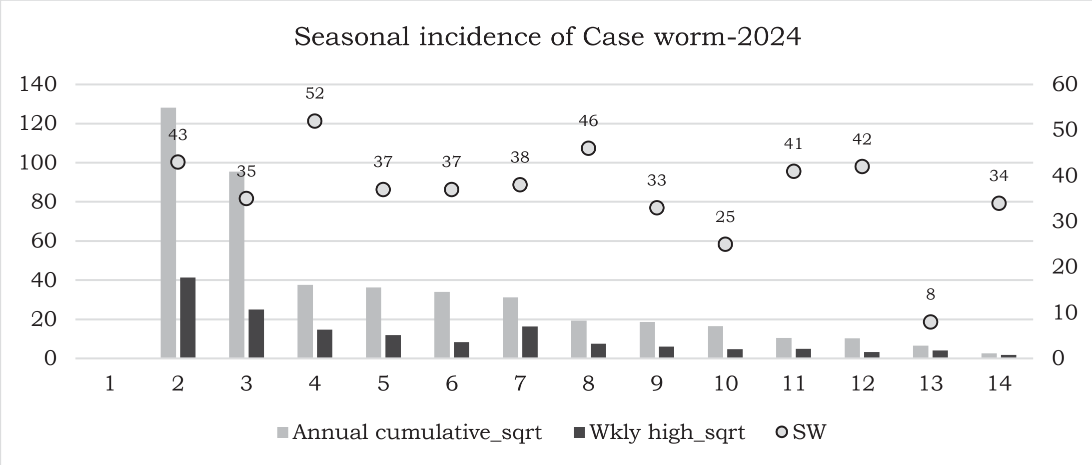


Fig. 2.7.2.7. Seasonal incidence of case worm based on light trap catches

Table 2.7.2.7. Seasonal incidence of case worm based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT °C	MinT °C	RF mm	RH1 %	RH2 %
1	Zone-I NW-Hills	MLN	7	3	34	37.8	24	100.4	84.6	80.6
2	Zone-III East	CHP	109	24	41	32.3	23.2	0.0	87.9	75.0
3		GGT	16426	1703	43	22.3	32.9	0.0	NR	NR
4		MSD	9097	627	35	NR	NR	NR	NR	NR
5	Zone-III N-East	TTB	1320	141	37	33.5	24.3	1.4	90.0	70.4
6	Zone V-Central	JDP	371	56	46	30.5	14.6	0.0	85.9	41.0
7		RPR	978	265	38	31.9	24.7	1.6	87.6	65.9
8	Zone-VII: Sothern	CBT	273	23	25	32.6	24.3	0.2	80.3	57.3
9		GNV	348	36	33	21.9	23.9	11.4	81.1	74.9
10		MND	1150	68	37	30.6	20.1	0.7	86.9	58.3
11		BRH	106	11	42	30.5	21.6	11.4	94.9	77.4
12		PTB	1416	214	52	32.8	19.4	0.2	88.9	50.4
13		RNR	43	16	8	34.3	17.7	0.0	81.3	27.9

Gundhi bug: Rice gundhi bug was recorded at 13 locations. It was most abundant at GGT (6212), MSD (2150), and TTB (1721) on annual cumulative basis and was most active during 41st SW at GGT and PNT, 40th SW at MSD and 39th SW at TTB, respectively (**Table 2.7.2.8 and Fig. 2.7.2.8**). In the previous year 2023, it was most abundant at PTB, TTB, and PNT on annual cumulative basis and was most active during 40th, 39th and 40th SW, respectively.

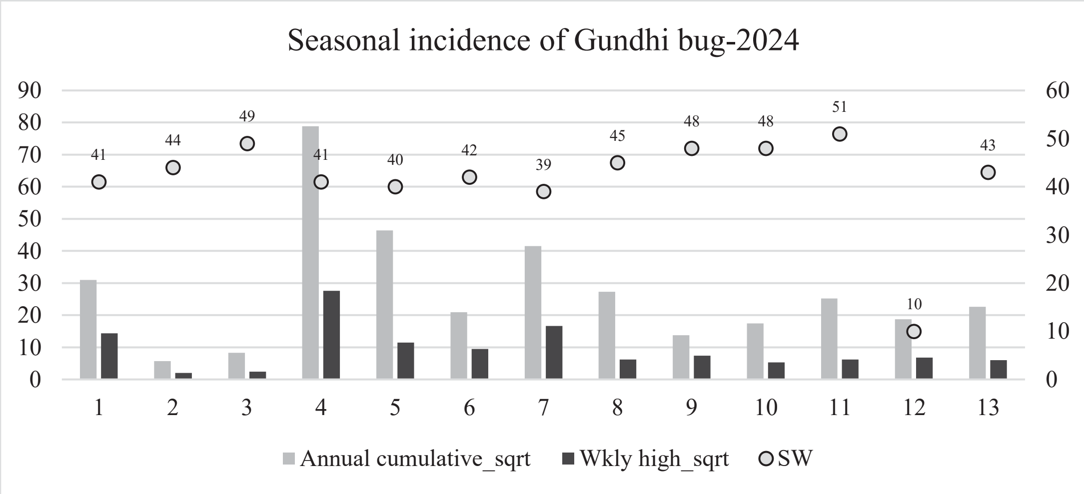


Fig. 2.7.2.8. Seasonal incidence of gundhi bug based on light trap catches

Table 2.7.2.8. Seasonal incidence of gundhi bug based on light trap catches

S. No	Zone	Location	Annual cumulative	Weekly high	SW	MaxT ºC	MinT ºC	RF mm	RH1 %	RH2 %
1	Zone-II North	PNT	959	205	41	32.5	20.5	0.0	88.1	53.4
2		KUL	33	4	44	27.9	14.5	0.0	93.6	54.9
3	Zone-III East	CHN	69	6	49	26.2	13.1	0.0	91.9	59.3
4		GGT	6212	761	41	22.3	33.1	0.0	NR	NR
5		MSD	2150	131	40	NR	NR	NR	NR	NR
6		REW	437	90	42	33.0	20.5	0.0	87.6	62.6
7	Zone-III East	TTB	1721	276	39	32.4	23.3	4.9	89.9	66.0
8	Zone V-Central	JDP	743	39	45	30.8	15.9	0.0	90.7	43.4
9		RPR	190	54	48	26.6	15.0	0.4	84.9	48.7
10	Zone-VII: Sothern	MNC	305	28	48	31.0	24.7	9.9	89.4	77.2
11		CBT	634	38	51	30.9	19.9	0.0	93.1	50.1
12		KRK	353	46	10	33.7	22.9	8.6	92.1	59.4
13		MND	510	36	43	30.0	20.3	1.6	83.4	59.0

White stem borer was reported from LDN, MLN, PTB, TTB and WGL; Pink stem borer was reported from LDN, RNR, and RPR. Black bug was reported from five locations: ADT, CBT, MNC, MTU, and TTB. Zigzag leafhopper was found in six locations: BRH, CHN, GNV, JDP, KRK, MTU, and RPR. White grub was a concern at KHD and CHT. Grasshoppers were regular pests at CHT and was also recorded at GGT, JDP, MSD and TTB. Regarding natural enemies green mirid bugs, coccinellids, rove beetles and ground beetles were reported.

***Summary**: Overall, the light trap data revealed that yellow stem borer, leaf folder, and hoppers continued to be the most important pests in terms of numbers as well as spread across the locations. Gall midge continues to be an endemic pest. However, case worm, and gundhi bug showed an increase in the spread and intensity of incidence posing concern for future. Patterns in seasonal incidence and population build up based on light trap catches indicates that the key pests are reaching their peak levels in the months of October and November in the kharif season and in the late January or early February during post rainy (rabi) season. Therefore, strategies are to be timed accordingly for the effective management of insect pests in rice.*

Rabi 2023-24

Summary

During Rabi 2023-24, four trials under host plant resistance and Integrated pest management special (IPMs) were conducted. The summary of the trials is given below.

Stemborer screening trial (SBST) was constituted with 45 entries and evaluated at 8 locations against dead heart and white ear damage. Grain yield in infested plants and larval survival was also recorded. Evaluation of 45 entries 11 valid tests from 6 locations identified 10 entries viz., BK 49-76 RP5977-Bio-SB-5-(SM74), RP-6112-SM-92-R-293-1-1-3-3, RP 6505-40, RP5977-Bio-SB-4 (SM72), RP4919-NSR40, RP4919-NSR52, NWGR-19007, RP 6505-50 and W1263 as promising in 2-3 tests for stem borer damage of the 11 valid tests.

Multiple resistance screening trial (MRST) was constituted with 32 entries and evaluated at 4 locations against 5 insect pests. Entries were evaluated for gall midge, stem borer, and whorl maggot and grass hoppers. None of the entries were promising for gall midge and grass hoppers and SBDH. NND4 was promising against whorl maggot and white ear damage (≤5%) at Chinsurah.

National Screening Nursery (NSN-Boro) was constituted with 51 entries and evaluated at 8 locations against 4 insect pests. The results of the evaluation suggest that only PTB33 was promising at Coimbatore against BPH. IET No 31319, 32241, 32245 and 32257 were promising in two tests of the 4 valid tests for stem borer white ear damage with ≤ 5 % WE. None of the entries were promising for dead heart and whorl maggot damage.

National Screening Nursery (ETP) was constituted with 32 entries along with one disease check and ten insect checks (total 43 entries) and evaluated at 13 locations against 7 insect pests. Evaluation of 43 entries in 18 valid field tests (7 green house and 11 field tests) identified IET No 32273 as promising in 5 tests; IET No 31368 in 4 tests; IET No 32272, 32274, 32281 and 32292 as promising in 3 tests of the 18 valid tests against one to two pests.

Integrated Pest Management special (IPMs) trial was conducted in four farmers' fields at three locations, Chinsurah, Maruteru and Pattambi, during Rabi 2023-24. At Chinsurah, the incidence of stem borer and whorl maggot were low in IPM plots (7.6 – 8.3% DH, 5.5% WE, 10.8-12.8% WMDL) as compared to FP plots (17.5 – 24.3% DH & 11.7% WE, 16.6-17.5% WMDL). At Maruteru, the incidence of BPH crossed ETL in IPM plots (52.8 – 54/ 5 hills) as compared to FP plots (23 – 32.4/ 5 hills) in both the farmers' fields. At Pattambi, the incidence of dead hearts (12.3 - 18.8% DH) and gall midge (12.7 – 17.8% SS) was high in the IPM plot, while the incidence of leaf folder (9.4% LFDL) and whorl maggot (9.5% WMDL) was low in the IPM plot. Across the locations, gross returns were high in IPM plots due to the high grain yield and low cost of cultivation, resulting in a high BC ratio (2.13 – 3.20).

2.1 STEM BORER SCREENING TRIAL (SBST)

This trial was constituted with 45 entries and evaluated at 8 locations against dead heart and white ear damage. At Chinsurah, Titabar, and Pattambi staggered sowing were taken up to catch up with the infestation. Grain yield in the infested plants and larval survival was also recorded. Of these 26 entries were under retesting. Data from Maruteru and Coimbatore not considered due to low pest pressure.

Dead heart damage: Field evaluation of entries identified RP 6505-40, RP4919-NSR40, RP4919-NSR52, NWGR-19197, RP5977-Bio-SB-10 (SM48), RP5977-Bio-SB-4 (SM72), RP5977-Bio-SB-5-(SM74) as promising in one test against stem borer of the 3 valid tests with ≤10% DH (DS1.0).

White ear damage: Field evaluation of entries identified BK 49-76 as promising in 3 tests, RP 6505-50, RP5977-Bio-SB-5-(SM74), RP-6112-SM-92-R-293-1-1-3-3* and W1263 as promising in 2 tests of the 8 valid tests with ≤5% WE. However, all the entries had very high damage at Bapatla where the average damage in the trial was as high as 83.6%. The larval survival varied from 0.3- 1.9 larvae/hill.

Grain yield: Under infested condition 31 test entries yield more than 15g/hill at both IIRR and Pattambi.

Overall reaction: *Evaluation of 45 entries 11 valid tests from 6 locations identified 10 entries viz., BK 49-76 RP5977-Bio-SB-5-(SM74), RP-6112-SM-92-R-293-1-1-3-3, RP 6505-40, RP5977-Bio-SB-4 (SM72), RP4919-NSR40, RP4919-NSR52, NWGR-19007, RP 6505-50 and W1263 as promising in 2-3 tests for stem borer damage of the 11 valid tests. Seven entries had higher grain yield (>15g/ hill) in two valid tests. Of these, 5 entries were in the second year of testing.*

Table 2.1.1 Reaction of entries to stem borer in SBST trial, rabi 2023-24

SBST No		PTB 30 DAT DH(%)	IIRR 57 DAT DH%	BPT 50 DAT DH(%)	SBDH NPT 3	CHN-1 73 DAT WE(%)	CHN-2 76 DAT WE(%)	PTB-1 85 DAT WE (%)	TTB-1 82 DAT WE(%)	TTB-2 52 DAT WE(%)	IIRR 80 DAT WE(%)	BPT pre har WE(%)	GER 56 DAT WE(%)	SBWE NPT 8	SBDH+SBWE 11	GY/Hill IIRR	GY/Hill PTB	GY NPT 2
5	BK 49-76*	56.7	11.34	NG	0	3.7	4.4	9.8	8.8	8.1	3.3	NG	6.4	3	3	32.2	36.0	2
39	RP5977-Bio-SB-5-(SM74)	50.7	9.92	24.8	1	6.5	4.3	8.1	8.1	8.1	3.5	90.0	NG	2	3	14.8	25.0	1
11	RP-6112-SM-92-R-293-1-1-3-3*	44.4	18.53	28.5	0	7.7	10.6	0.0	8.8	8.1	9.5	100.0	4.5	2	2	21.6	32.0	2
2	RP 6505-40*	40.0	6.67	26.2	1	7.7	7.0	16.9	6.8	8.1	9.3	45.7	3.8	1	2	29.0	56.0	2
38	RP5977-Bio-SB-4 (SM72)	32.3	9.02	27.3	1	9.4	12.6	22.0	8.8	8.8	0.0	86.0	7.8	1	2	18.3	32.0	2
6	RP4919-NSR40	NG	8.40	28.0	1	5.6	5.6	NG	9.0	7.8	0.0	76.3	NG	1	2	30.5	NG	1
7	RP4919-NSR52	NG	7.95	35.3	1	8.5	11.2	NG	8.8	8.8	0.0	100.0	NG	1	2	33.4	NG	1
31	NWGR-19007	32.1	11.70	23.5	0	6.7	2.0	21.4	9.0	9.0	3.3	89.0	9.4	2	2	24.1	27.0	2
3	RP 6505-50*	55.6	10.34	25.4	0	8.7	2.5	4.3	8.1	6.8	9.0	74.6	NG	2	2	23.2	33.0	2
44	W1263*	31.9	12.93	20.1	0	9.2	5.5	2.0	8.8	6.5	0.8	70.5	NG	2	2	21.9	29.0	2
	Total count	41	42.00	40		45	45	41	45	45	45	40	20	45		37	41	
	Max.	56.7	22.00	38.0		13.4	18.2	33.1	9.4	9.4	36.1	100.0	14.9	3.0		33.5	56.0	
	Min.	15.9	0.00	15.6		3.7	1.0	0.0	6.5	6.5	0.0	45.7	3.8	0.0		10.9	18.0	
	Average	38.3	12.89	26.5		8.1	8.2	14.7	8.7	8.2	8.2	83.6	8.5	1.0		21.0	30.1	
	Promising level	10	10	10		5	5	5	5	5	5	5	5	6		15	15	
	No. of Promising entries	0	7	0		3	10	4	0	0	15	0	5			34	41	
	TN1	43.1	11.30	21.5		6.1	6.8	5.0	9.4	6.9	6.9	71.5	NG	1.0		21.4	25.0	
	Pusabasmati	43.5	22.0	25.3		13.1	4.2	12.0	9.0	8.8	8.8	96.7	NG	1.0		40.4	45.0	
1	RP 6505-1*	35.7	10.72	16.2		10.5	7.3	15.4	8.1	8.8	14.1	60.8	4.0	1	1	25.9	25.0	

- Entry under retesting

2.2 MUTIPLE RESISTANCE SCREENING TRIAL (MRST)

The trial was constituted with 32 entries and evaluated at 4 locations against 5 insect pests. 14 entries were under retesting. None of the entries were promising for gall midge (the average damage in the trial was 17.6%SS) and dead heart damage (the average damage in the trial was 31.5%DH) at Bapatla. Entries were evaluated at Chinsurah and Bapatla for stem borer at white ear stage. At Chinsurah, four entries, CR Dhan 308, RPGP-3000-179-3-9-1, NWGR-19064 and NND4* recorded ≤5 % WE damage. Eight entries *viz.*, RP Bio 4918-230*, TN1, RP 6614-102-11-3-3-1-1-1(FBL 19101), RNR 37971, RNR 37964, IBT-BPHM23, PTB 33*, RP-6112-SM-92-MS-M-R-279-3-6-2-10-5-8, NND4* recorded ≤5% WMDL at Chinsurah. NND4 was promising for white ear and whorl maggot damage (≤5 %). All the entries had high damage to grass hoppers at Khudwani. Planthopper population was negligible in the trial at Bapatla.

2.1.3 NATIONAL SCREENING NURSERY

2.1.3.a NATIONAL SCREENING NURSERY (Boro)

The trial was constituted with 40 entries along with 11 checks and evaluated at 8 locations, IIRR, Coimbatore, Maruteru for planthoppers; Titabar, Arundhutinagar, Gerua, Pattambi, and Chinsurah against stemborer; Pattambi and Chinsurah for whorl maggot damage. The results of the evaluation suggest that only PTB33 was promising at Coimbatore against BPH. IET No 31319, 32241, 32245 and 32257 were promising in two tests of the 4 valid tests for stem borer white ear damage with ≤ 5 % WE (**Table 2.1.3.1**). None of the entries were promising for dead heart and whorl maggot damage.

2.1.3.1 Reaction of most promising entries to Stem borer in NSN Boro, rabi203-24.

				III	IV	IV	VII	
				CHN	AND	TTB	PTB	
				SBWE	SBWE	SBWE	SBWE	SBWE
				90DT	85DT	110DT	85DT	NPT
IET No.	Designation	Cross Combination		%WE	%WE	%WE	%WE	4
31319	CR 3969-24-1-2-2-1	IR-73930-31-3-2-2 / Pratiksya		4.3	NT	19.0	4.0	2
32241	CR3504-19-3-1-1-1-1	IR 36/Birupa		5.1	36.4	4.2	1.7	2
32245	CR 4557-IR16T1662 (IR117676-318-1-1-1)	BRRI DHAN 55/IR 58443-6B-10-3//BRRI DHAN 55		4.3	NT	11.8	0.0	2
32257	CR 4561-7-4-1-1-1-1	CR Dhan 316/ IR 71701-28-1-1-4-11-1-3/Sarbati		4.3	NT	11.1	3.2	2
	Suraksha			3.5	NT	13.3	5.0	2
	W1263			4.2	NT	33.3	1.1	2
	Total tested			48	14	51	46	
	Max. damage in the trial			29.1	36.4	40.0	43.2	
	Min. damage in the trial			1.8	5.6	4.2	0.0	
	Average damage in the trial			10.4	16.6	16.6	10.5	
	Damage in TN1			17.1	0.0	14.4	3.7	
	Promising level			5	5	5	5	
	No. promising			1	0	0	11	

2.1.3.b NATIONAL SCREENING NURSERY (ETP)

The NSN -ETP trial was constituted with 32 entries along with one disease check and ten insect checks (total 43 entries) and evaluated at 13 locations against 7 insect pests. The reaction of the entries from valid data in the trial is discussed pest wise.

Brown planthopper: MTU1407 (MTU2460-17-2-1-1-1,) CR 3543-4-3-2-1-1-3, RNR 41240, CR4415-3-1-3-1-1, RP 2068-18-3-5, Suraksha and W1263 was promising in one test of the 6 valid greenhouse tests.

White backed planthopper: RNR 41240, RP 2068-18-3-5 and MO 1 were promising in one greenhouse test at Coimbatore with a promising level of ≤ 5.0.

Planthoppers: Only PTB33 was promising against mixed population of planthoppers at Maruteru with a DS of 3.0.

Gall midge: RNR 41240, RP 5507-JBB-680-4-B-1-1-1, RP 6764-BGIR-7-26-3 and Aganni recorded nil damage at Chiplima.

Stemborer: WGL 1560 recorded <5% DH at Chiplima. CR 3561-3-1-2-2-1-1 and BPT 5204 (Parent) recorded <5% WE in 2 of the 5 valid tests.

Whorl maggot: Only, Suraksha recorded 3%DL at Pattambi.

Overall reaction: *Evaluation of 43 entries in 18 valid field tests (7 green house and 11 field tests) identified IET No 32273 as promising in 5 tests; IET No 31368 in 4 tests; IET No 32272, 32274, 32281 and 32292 as promising in 3 tests of the 18 valid tests against one to two pests. (**Table 2.1.3.2**)*

Valid data considered under NSN-ETP

Insects pests	Locations/tests					Tests
BPH	GH	IIRR	CBT	CTC	MND	4
BPH	Net house	RNR	ADT			2
WBPH	GH	CBT				1
PH	FR	MTU				1
GM	CHP					1
SBDH	CHP	PTB				2
SBWE	CHN	CHP	ADT	PTB	WGL	5
WM	CHN	PTB				2
			Total tests			18

Table 2.1.3.2 Performance of most promising entries to insect pests in NSN ETP- rabi 2023-24.

		VII	VII	VII	III	VII	VII		VII		VII		III		III	VII		III	III	VII	VII	VII		III	VII		
		Damage score																Per cent damage									
		IIRR	ADT	CBT	CTC	RNR	MND	BPH	MTU	PH	CBT	WBPH	CHP	GM	CHP	PTB	SBDH	CHN	CHP	ADT	PTB	WGL	SBWE	CHN	PTB	WM	Overall NPT
		BPH	BPH	BPH	BPH	BPH	BPH	NPT	PH	NPT	WBPH	NPT	GMB1	NPT	SBDH	SBDH	NPT	SBWE	SBWE	SBWE	SBWE	SBWE	NPT	WM	WM	NPT	
Entry No	IET No.	GH	Net house	GH	GH	poly house DS	DS	6	FR	1	GH	1	50DT	1	75DT	50DT	2	90DT	Pr.h	50DT	85DT	90DT	5	30DT	75DT	2	18
9	32273	8.1	6.3	3.0	9.0	NG	9	1	7.0	0	5.0	1	0.0	1	7.7	28.7	1	9.4	2.4	12.0	24.0	7.6	1	10.6	16.7	0	5
1	31368	8.1	3.7	5.6	9.0	4.1	7	0	5.0	1	6.0	0	50.0	0	11.9	16.0	0	7.8	0.0	3.8	26.7	0.0	3	10.4	18.1	0	4
8	32272	7.8	6.3	6.4	9.0	6.2	3	1	9.0	0	7.0	0	10.0	0	7.3	22.8	1	7.1	2.0	9.9	17.9	11.6	1	10.6	13.3	0	3
10	32274	NG	9.0	NG	9.0	9.0	9	0	9.0	0	NG	0	0.0	1	11.7	24.9	0	14.8	4.3	4.8	12.3	12.1	2	11.5	16.6	0	3
18	32281	8.5	9.0	9.0	9.0	9.0	5	0	9.0	0	8.0	0	30.0	0	11.0	25.8	0	3.7	2.7	8.8	3.1	12.3	3	7.9	9.9	0	3
30	32292	NG	5.7	3.2	9.0	NG	9	0	9.0	0	5.4	0	50.0	0	9.8	27.5	1	9.7	1.8	3.1	19.5	12.9	2	10.9	9.5	0	3
32	BPT 5204 (Parent)	9.0	7.7	9.0	9.0	8.0	5	0	9.0	0	9.0	0	50.0	0	13.2	19.5	0	3.5	11.1	2.0	3.2	10.6	3	15.8	11.0	0	3
	Checks																										
35	Aganni	NG	9.0	8.4	9.0	9.0	5	0	9.0	0	9.0	0	0.0	1	7.2	27.1	1	7.3	5.1	1.3	12.1	21.5	1	9.0	3.7	0	3
40	RP 2068-18-3-5	7.8	3.7	3.0	9.0	9.0	5	1	9.0	0	5.0	1	50.0	0	9.4	24.4	1	7.1	NT	2.7	22.5	32.5	1	7.9	9.0	0	4
41	Suraksha	NT	7.0	9.0	9.0	9.0	3	1	9.0	0	9.0	0	10.0	0	9.6	20.9	1	11.4	2.8	0.0	5.6	8.6	2	9.7	3.0	1	5
43	W1263	NT	7.0	7.8	9.0	6.1	3	1	9.0	0	8.0	0	40.0	0	8.8	22.5	1	7.7	1.6	3.4	35.8	21.2	2	10.8	6.3	0	4
Total Tested		22	43	39	45	40	45		40		39		42		42	41		43	40	41	41	42		43	41		
Maximum damage in the trial		9.0	9.0	9.0	9.0	9.0	9.0		9.0		9.0		100.0		21.6	43.5		19.0	20.0	22.0	35.8	40.0		16.0	18.1		
Minimum damage in the trial		7.8	3.7	3.0	1.0	3.7	3.0		3.0		5.0		0.0		2.8	16.0		3.5	0.0	0.0	3.1	0.0		5.1	3.0		
Average damage in the trial		8.4	6.3	6.9	8.7	7.5	6.8		8.7		7.3		44.5		11.7	29.5		9.6	5.5	5.2	15.1	14.7		10.8	10.8		
damage in TN1		9.0	8.0	7.8	9.0	9.0	9.0		9.0		8.0		90.0		12.9	19.5		13.9	3.5	4.0	6.5	30.2		9.1	3.9		
Promising level		3	3	3	3	4	5		3		5		0		10	5		5	0	0	5	5		5	3		
No. promising		0	0	2	1	0	3		1		2		4		11	0		3	3	3	3	3		0	1		

LF data from BRH, MNC, SBDH from CHN, ADT, MNC WGL; WM from ADT; CW from BRH not considered for analysis.

2.2 Integrated Pest Management Special Trial (IPMs)

During *Rabi* 2023-24, an IPM special trial was conducted at three locations, Chinsurah, Maruteru, and Pattambi. Location-wise details are discussed below:

Chinsurah: The IPM trial was conducted at Sri Narayan Chandra Mondal's field in Village Bele, Radhanagar Post, Pandua Mandal, Hooghly District, West Bengal. The practices followed in IPM and FP plots are given below:

Practices followed in IPMs trial at Chinsurah, ***Rabi (Boro)*** 2023-24

	IPM practices	Farmers practices (FP)
Area	0.5 acre	0.5 acre
Variety	IET 4786 (Satabdi)	IET 4786 (Satabdi)
Nursery	• Seed treatment with *Trichoderma viridae* @ 10g/kg seed	
Main field	• Field preparation with power tiller, cutting of bunds and leveling the field • Application of 31 kg 10:26:26 + Urea @ 28 kg • Application of Pretilachlor @ 400 ml/ acre + hand weeding • Installation of pheromone traps @ 3/acre for stem borer • Application of Azadirachtin 1500 ppm @ 600 ml/acre • Sprayed Cartap hydrochloride 50WP @ 400 g/ acre	• Field preparation with power tiller, cutting of bunds and leveling the field • Application of 53 kg 10:26:26 and Urea 27 kg • Application of Pretilachlor @ 400 ml/ acre + hand weeding • Application of Carbofuran 3CG @ 12 kg/ acre • Spraying of Chlorantraniliprole @ 60 ml/ acre – two times

The incidence of stem borer, leaf folder and whorl maggot was observed in both the treatments. Dead heart incidence was high in the FP plot (24.3 & 17.9% DH) as compared to the IPM plot (7.6 & 8.3% DH) at both 22 DAT and 29 DAT, respectively (**Table 2.2.1**). Similarly, white ear incidence was low in the IPM plot (5.5% WE) compared to the FP plot (11.7% WE). The leaf folder incidence was low in both the treatments (0.2-0.6% LFDL).

Table 2.2.1 Insect pest incidence, Returns and BC ratio in IPMs trial at Chinsurah, ***Rabi*** (Boro) 2023-24

Treatments	%DH		%WE	%LFDL		%WMDL		Yield	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net Returns (Rs.)	BC ratio
	22 DAT	29 DAT	Pre har	57 DAT	64 DAT	15 DAT	22 DAT	kg/ha				
IPM	7.6 ±2.0	8.3 ±2.3	5.5 ±0.8	0.3 ±0.2	0.2 ±0.1	10.8 ±1.1	12.8 ±1.0	5059± 59.6	126475	59430	67045	2.13
FP	24.3 ±3.7	17.5 ±2.6	11.7 ±1.1	0.5 ±0.2	0.6 ±0.2	17.5 ±1.5	16.6 ±1.1	4390 ± 76.0	109750	64165	45585	1.71

Price of Paddy = Rs 2500/q

Whorl maggot damage was high in the FP plot (17.5 & 16.6% WMDL) compared to the IPM plot (10.8 & 12.8% WMDL) at 15 DAT and 22 DAT, respectively. Grain yield was higher in the IPM plot (5059 kg/ ha), resulting in higher gross returns and a higher BC ratio (2.13) as compared to the FP plot (1.71).

Maruteru: At this location, the trial was conducted in two farmers' fields, i.e., in Sri G Satyanarayana's and Sri Ch V N Swamy's fields in Chinamallam village, Penugonda Mandal, Andhra Pradesh State. The package of practices followed were given below:

Practices followed in IPMs trial at Maruteru, ***Rabi*** 2023-24		
Sri G Satyanarayana, Chinamallam village, Penugonda Mandal, Andhra Pradesh Sri Ch V N Swamy, Chinamallam village, Penugonda Mandal, Andhra Pradesh		
Area	• 2000 sq.m	• 2000 sq.m
Variety	• MTU 1121	• MTU 1121
Nursery	• Seed treatment with Trichoderma @ 10 g/kg seed • Application of Fipronil 0.3G @ 500g/ 5 cents nursery, 5 days before pulling the seedlings	• Application of carbofuran 3 G @ 800 g/5 cents of nursery, 7 days before pulling of nursery
Main field	• Transplanted seedlings at a spacing of 20 x 15 cm • Clipping of leaf tips before transplantation • Formation of alleyways of 30 cm after every 2 m • NPK @ 180-90-90 kg/ ha • Application of metasulfuron ethyl+chlorimuronethyl (Almix) @ 20g/ha mixed with fine sand (50 kg/ha) • Installation of pheromone traps @ 3 per acre for stem borer monitoring • Installation of pheromone traps @ 8 per acre for mass trapping of stem borer • Spraying of neemazal @ 3ml/liter of water at 45 DAT • Spraying of chlorantraniliprole 18.5 SC @ 60 ml/acre against stem borer and leaf folder at 65 DAT • Spraying of triflumezopyrim 10 SC @ 94 ml/acre at 60 DAT • Spraying of hexaconazole 5 EC @ 2 ml/acre • Spraying of propiconazole @ 1ml/liter against false smut.	• Bengal method of transplantation (average spacing of 28x28 cm) • Formation of alleyways of 30 cm after every 2 m • NPK @ 225-80-90 kg/ha • Application of Londax power @10kg/ha within one week after transplantation + one manual weeding • Application of ferterra granules, Carbofuran 3CG granules and spraying of acephate @ 3 g/l against stem borer • Application of dinotefuran, pymetrozine and acephate against brown planthoppers • Spraying of tricyclazole twice against leaf blast • Spraying of Thifluzamide and azoxystrobin +difenconazole (amistar top) against sheath blight • Spraying of blitox against false smut.

The incidence of BPH was observed from 50 DAT onwards and it crossed ETL at 60 DAT. The population was high in IPM plots (52.8 – 54/ 5 hills) as compared to FP plots (23 – 32.4/ 5 hills) in both the farmers' fields. However, the incidence of stem borer (2.8-5.6% DH, 4.1-6.6% WE), gall midge (0.7-3.5% SS), and WBPH (1 – 2.2/ 5 hills) was low in both the treatments in both the farmers' fields (**Table 2.2.2**).

Table 2.2.2 Insect pest incidence in IPMs trial at Maruteru, ***Rabi*** 2023-24

Farmer	Treatments	%DH		%WE	%SS		BPH (No./5 hills)		WBPH (No./5 hills)	
		30 DAT	40 DAT	Pre har	30 DAT	50 DAT	50 DAT	60 DAT	50 DAT	60 DAT
F1 = Sri G Satyanarayana	IPM	2.8 ±1.0	4.1 ±0.7	3.8 ±0.4	0.7 ±0.1	1.0 ±0.3	33.4 ±4.8	52.8 ±5.9	1.0 ±0.3	2.0 ±0.5
	FP	2.9 ±1.2	4.7 ±0.8	5.7 ±1.3	1.0 ±0.2	1.1 ±0.3	39.6 ±1.1	23.0 ±5.6	1.6 ±0.2	1.4 ±0.4
F2 = Sri Ch V N Swamy	IPM	5.0 ±0.6	5.1 ±1.1	5.6 ±0.4	3.5 ±1.3	3.5 ±0.9	29.8 ±5.2	54.0 ±3.3	2.2 ±0.5	1.0 ±0.5
	FP	5.6 ±1.3	6.6 ±0.8	8.8 ±1.9	1.1 ±0.2	1.3 ±0.2	34.6 ±3.7	32.4 ±2.2	1.6 ±0.2	1.0 ±0.4

Grain yield was high in FP plots (86.25 & 84.38 q/ha) as compared to IPM plots (85.32 q/ ha) in both the farmers' fields, respectively. However, due to the high cost of cultivation in FP plots, the BC ratio was high in IPM plot (3.20) as against FP plot (2.96) in both the farmers' fields (**Table 2.2.3**).

Table 2.2.3. Returns and BC ratio in IPMs trial at Maruteru, ***Rabi*** 2023-24

Farmer	Treatments	Yield q/ha	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net Returns (Rs.)	BC ratio
F1 = Sri G Satyanarayana	IPM	82.50	180098	56875	123223	3.17
	FP	86.25	188284	64375	123909	2.92
F2 = Sri Ch V N Swamy	IPM	80.63	176015	54500	121515	3.23
	FP	84.38	184202	61500	122702	3.00
IPM		81.57	178056	55688	122369	3.20
FP		85.32	186243	62938	123305	2.96

Price of Paddy = Rs. 2183/q

Pattambi: IPMs trial was conducted in Sri Ummer's field in Kondurkara village, Palakkad district, Kerala. The package of practices followed in IPM and FP plots are given below:

Practices followed in IPMs trial at Pattambi, Rabi 2023- 24		
Area	4000 sq.m	4000 sq.m
Variety	Supriya	Supriya
Nursery	• Seed treatment with Pseudomonas flourescens @ 10 g/ kg seed • Seedling dip with Pseudomonas @ 20 g / litre of water	
Main field	• NPK @ 90:45:45 kg/ha • Three Sprays with Eco-neem 1 %at 20, 45 and 65 and cartaphydrochloride 4%G @ 1000g a.i/ha at 80 DAT • Release of *Trichogramma japonicum* for stem borer and *T.chilonis* for leaf folder, six releases each at weekly interval. • Pheromone mass trapping with 8 traps/ acre for YSB	• 120 Kg Factomphos,75 Kg Urea, 40 Kg potash • Spray with Chlorantranilipole, flubendiamide, lambdacyhalothrin and streptocycline at 30, 60, 75 and 85 DAT

The incidence of stem borer, gall midge, leaf folder, whorl maggot and caseworm was observed in both IPM and FP plots. Dead heart incidence was high in the IPM plot (18.8 & 12.3 % DH) as compared to the FP plot (9.7 & 9.9% DH) at 35 and 55 DAT, respectively (**Table 2.2.4**). However, the white ear incidence was low in the IPM plot (18.8% WE) as against the FP plot (20% WE). Similarly, gall midge incidence was high in the IPM plot (17.8 & 12.7% SS) as compared to the FP plot (16.2 & 10% SS) at 55 and 70 DAT, respectively. The leaf folder incidence was high in the IPM plot (20.1% LFDL) compared to the FP plot (9.4% LFDL). Likewise, whorl maggot damage was high in the FP plot (12.1% WMDL) as compared to the IPM plot (9.5% WMDL). The caseworm incidence was low in both the treatments.

Table 2.2.4. Insect pest incidence in IPMs trial at Pattambi, ***Rabi*** 2023-24

Treatments	%DH		% WE	%SS		%LFDL	%WMDL	%CWDL
	35 DAT	55 DAT	Pre har	55 DAT	70 DAT	70 DAT	25 DAT	35 DAT
IPM	18.8 ± 1.2	12.3 ± 2.6	18.8 ± 1.7	17.8 ± 2.5	12.7 ±0.9	9.4 ± 0.4	9.5 ± 0.3	0.7 ±0.2
FP	9.7 ± 1.7	9.9 ± 0.7	20.0 ± 1.7	16.2 ± 1.5	10.0 ± 1.6	20.1 ± 0.6	12.1 ± 0.5	1.0 ± 0.2

Grain yield was high in the IPM plot (5404 kg/ ha), resulting in higher gross returns (**Table 2.2.5**). Higher net returns accompanied by a low cost of cultivation resulted in a higher BC ratio in the IPM plot (2.18) as compared to the FP plot (1.27).

Table 2.2.5. Returns and BC ratio in IPMs trial at Pattambi, ***Rabi*** 2023-24

Treatments	Yield kg/ha	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net Returns (Rs.)	BC ratio
IPM	5404	151312	69400	81912	2.18
FP	4302	120456	95000	25456	1.27

Price of Paddy = Rs 2800/q

Integrated Pest Management special (IPMs) trial was conducted in four farmers' fields at three locations, Chinsurah, Maruteru and Pattambi, during Rabi 2023-24. At Chinsurah, the incidence of stem borer and whorl maggot were low in IPM plots (7.6 – 8.3% DH, 5.5% WE, 10.8-12.8% WMDL) as compared to FP plots (17.5 – 24.3% DH & 11.7% WE, 16.6-17.5% WMDL). At Maruteru, the incidence of BPH crossed ETL in IPM plots (52.8 – 54/ 5 hills) as compared to FP plots (23 – 32.4/ 5 hills) in both the farmers' fields. At Pattambi, the incidence of dead hearts (12.3 - 18.8% DH) and gall midge (12.7 – 17.8% SS) was high in the IPM plot, while the incidence of leaf folder (9.4% LFDL) and whorl maggot (9.5% WMDL) was low in the IPM plot. Across the locations, gross returns were high in IPM plots due to the high grain yield and low cost of cultivation, resulting in a high BC ratio (2.13 – 3.20).

Appendix-I

ICAR-IIRR headquarters, Hyderabad: Drs. A. P. Padmakumari, Chitra Shanker, Ch. Padmavathi, Y. Sridhar and Dr. Chinna Babu Naik.

Cooperating Centres

Sl. No.	Zone	State	Location	Code	Name of the cooperator, Designation
1	VII	Andhra Pradesh	Bapatla*	BPT	Dr. N. Kamakshi, Scientist (Entomology)
2	VII		Maruteru	MTU	Dr. P. Radhika, Pr. Scientist (Entomology)
3	VII		Nellore*	NLR	Dr. I. Paramasiva Reddy, Scientist (Entomology)
4	VII		Ragolu*	RGL	Dr.P. Udaya Babu, Scientist, Entomology
5	IV	Assam	Titabar	TTB	Dr. Mayuri Baruah, Junior Scientist
6	IV		Gerua*	GER	Dr. Kanchan Saikia, Pr. Scientist (Ento) – (under CRRI)
7	III	Bihar	Pusa	PSA	Dr. Abbas Ahmed, Scientist (Entomology)
8	V	Chattisgarh	Ambikapur *	ABP	Dr. Kanhaiyalal Painkra, Scientist (Entomology)
9	V		Jagdalpur	JDP	Dr. N. C. Mandawi, Scientist
10	V		Raipur	RPR	Dr. Sanjay Sharma, Pr. Scientist (Entomology)
13	VI	Gujarat	Nawagam	NWG	Dr. Sanju S.Thorat, Asst. Res. Scientist
14	VI		Navsari	NVS	Dr. Parth B. Patel, Asst. Res. Scientist (Entomology)
15	II	Haryana	Kaul	KUL	Dr. Sumit Saini, Asst. Scientist (Entomology)
16	I	Himachal Pradesh	Malan	MLN	Dr. Suman Sanjta, Asst. Prof. (Entomology)-Addl. charge.
17	II	Jammu & Kashmir	Chatha	CHT	Dr. Rajan Salalia, Prof cum chief Scientist (Entomology)
18	I		Khudwani	KHD	Dr. Basheer Ahmed, Scientist, AICRIP Rice (Ento)
12	III	Jharkhand	Ranchi	RCI	Dr. Binay Kumar, Jr. Scientist
19	VII	Karnataka	Brahmavar	BRM	Dr. Revanna Revannavar, Entomologist
20	VII		Gangavathi	GNV	Dr. Sujay Hurali, Scientist (Entomology)
21	VII		Mandya	MND	Dr. M. Shivanand Kitturmath, Entomologist
22	VII	Kerala	Moncompu	MNC	Dr. Jyoti Sara Jacob, Asst. Prof. (Entomology)
23	VII		Pattambi	PTB	Dr. K. Karthikeyan, Prof. of Entomology
24	V	Madhya Pradesh	Rewa	REW	Dr. Akhilesh Kumar, Head of Section (Entomology)
25	VI	Maharashtra	Karjat	KJT	Dr. Vaishali Sawant, Entomologist
26	V		Sakoli	SKL	Dr. Milind Meshram, Sr. Rice Breeder (Stn. Incharge)
11	II	New Delhi	New Delhi*	IAR	Dr. S. Rajna, Scientist (Entomology)
27	III	Odisha	Cuttack*	CTC	Dr. S.D. Mohapatra, Pr. Scientist & Head (Entomology) / Dr Guru Prasanna Pandi, Scientist (Entomology)
28	III		Chiplima	CHP	Dr. Atanu Seni, Jr Entomologist
29	II	Punjab	Ludhiana	LDN	Dr. P. S. Sarao, Principal Scientist
30	VII	Tamil Nadu	Aduthurai	ADT	Dr. P. Anandhi, Asst. Professor
31	VII		Coimbatore	CBT	Dr. S.Jeyarani, Professor (Entomology.)
32	IV	Tripura	Arundhutinagar*	AND	Smt. Mithu Rani Debnath, Asst. Director.
33	VII	Telangana	Jagtial*	JGT	Dr. Y. Swathi, Scientist (Entomology)
34	VII		Rajendranagar	RNR	Dr. N. Ramagopala Varma, Pr. Scientist (Entomology)
35	VII		Warangal	WGL	Dr. R. Shravan Kumar, Scientist (Entomology)
36	VII	Puducherry (UnionTerritory)	Karaikal*	KRK	Dr. K. Kumar, Prof. (Agril. Entomology)
37	VII		Kurumbapet	KBP	*No Entomologist-No Trials allotted*
38	II	Uttaranchal	Pantnagar	PNT	Dr. Ajay K. Pandey, Prof. (Dept. of Entomology)
39	III	Uttar Pradesh	Masodha	MSD	Dr. Sanjai Rajpoot looking after Masodha trials
40	III		Ghaghraghat	GGT	Dr. Sanjai Rajpoot, Entomologist
41	III	West Bengal	Chinsurah	CHN	Dr. Sitesh Chatterjee, Entomologist

* - Voluntary Centre

Appendix II

State	Location	***Rabi*** 2023-24		***Kharif*** 2024	
		Allotted	Received	Allotted	Received
Andhra Pradesh	Bapatla *	2	2	3	3
	Maruteru	5	5	14	14
	Nellore *	1	0	7	7
	Ragolu *			7	5
Assam	Titabar	2	2	10	10
	Gerua	2	2	0	0
Bihar	Pusa			7	7
Chattisgarh	Ambikapur *			6	6
	Jagdalpur			11	11
	Raipur			13	13
Gujarat	Navsari			11	11
	Nawagam			11	11
Haryana	Kaul			7	7
Himachal Pradesh	Malan			5	5
Jammu & Kashmir	Chatha			6	6
	Khudwani	1	1	4	4
Jharkhand	Ranchi			6	6
Karnataka	Brahmavar	1	1	8	8
	Gangavathi	2	0	17	17
	Mandya	1	1	12	12
Kerala	Moncompu	2	2	14	14
	Pattambi	5	5	12	12
Madhya Pradesh	Rewa			6	6
Maharashtra	Karjat			6	6
	Sakoli			4	4
New Delhi	New Delhi *			5	5
Odisha	Cuttack *			5	4
	Chiplima	1	1	11	11
Puducherry	Karaikal *			4	4
	Kurumbapet			0	0
Punjab	Ludhiana			18	18
Tamil Nadu	Aduthurai	1	1	14	14
	Coimbatore	3	3	15	15
Telangana	Jagtial *	1	0	7	7
	Rajendranagar	1	1	12	12
	Warangal	1	1	10	10
Tripura	Arundhutinagar *	1	1	2	2
Uttar Pradesh	Ghaghraghat			7	7
	Masodha			5	5
Uttaranchal	Pantnagar			14	14
West Bengal	Chinsurah	5	5	12	12
Total trials in funded and voluntary centres		38	34	348	345
% Receipt of data for ***kharif 2024*** & ***rabi 2023-24***		89.47		99.14	
Overall % Receipt of data		94.31			

* - Voluntary Centre

APPENDIX-III

List of Abbreviations

a.i.	:	Active ingredient		LF	:	Leaf folder
ADL	:	Average damaged leaves		MB	:	Mirid bug
AT		After treatment		MLB	:	Mealy bug
Av.No./AN	:	Average number		NG	:	No Germination
AW	:	Army worm		N.n	:	*Nephotettix nigropictus*
BB	:	Blue beetle		N.v	:	*Nephotettix virescens*
BCR	:	Benefit cost ratio		N.vi	:	*Nezara viridula*
BPH	:	Brown planthopper		No./10h	:	Number per 10 hills
BT		Before treatment		NP	:	Net profit
Cocc.	:	Coccinellids		NPT	:	Number of promising tests
CPP	:	Cost of plant protection		NT	:	Not tested
CW	:	Case worm		PH	:	Mixed population of Planthoppers
DAT/DT	:	Days after transplanting		PLD	:	Promising level of damage
DG	:	Damaged grain		PM	:	Panicle Mite
DH	:	Dead hearts		PSB	:	Pink stem borer
DHB	:	Dark Headed borer		RF	:	Rainfall
DL	:	Damaged leaves		RH	:	Relative humidity
DP	:	Damaged plants		RT	:	Rice thrips
DS	:	Damage score		SBDH	:	Stem borer dead heart
DAS		Days after spraying		SBWE	:	Stem borer white ear
FR	:	Field reaction		SW		Standard week
GB	:	Rice Gundhi bug		SMW		Standard meteorological Week
GF	:	Germination Failure		SS	:	Silver shoots
GH	:	Greenhouse reaction		SSB	:	Striped Stem borer
GHC	:	Green horned caterpillar		SSH	:	Sunshine hours
GLH	:	Green leafhopper		WB	:	Water bug
GMB	:	Gall midge biotype		WBPH	:	White-backed planthopper
Gr. H	:	Grass hopper		WE	:	White ears
GSB	:	Green stink bug		WLH	:	White leafhopper
HB	:	Hopper burn		WM	:	Whorl maggot
HBP	:	Hopper burned plants		WSB	:	White Stem borer
IOC	:	Increase over control		YSB	:	Yellow stem borer
IPD	:	Infested Plants Dead		ZZLH	:	Zigzag leafhopper

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PLANT PATHOLOGY

AICRPR Progress Report- Plant Pathology 2024

3.PATHOLOGY

SUMMARY

The All India Coordinated Research Project on Rice Program of the ICAR-Indian Rice Research Institute is an example of effective linkage and testing mechanism to assess the advanced breeding lines over a wide range of climatic and disease epidemic conditions and to identify broad spectrum of resistance to major rice diseases. This also helps in developing need-based management options for controlling major diseases of rice. During 2024, a total of 16 trials were conducted at 47 locations on host plant resistance, field monitoring of virulence of major pathogens and disease management methods. The details on screening nurseries and disease management trials proposed and conducted at various test locations are given in Table 1. The summary of observations is given below. Detailed data on extensive screening of diverse genotypes are furnished in a separate report entitled 'National Screening Nurseries, 2024'.

I. HOST PLANT RESISTANCE (NSN-1, NSN-2, NSN-H, NHSN and DSN)

❖ LEAF BLAST

The entries for leaf blast resistance was evaluated under NSN-1, NSN-2, NSN-Hills, NHSN and DSN at 27, 20, 11, 23 and 22 locations respectively. The entries were screened under natural and artificial methods in different centers. The disease pressure was high (LSI 6-7) at Cuttack, Almora and Gangavathi in different nurseries. The disease pressure was moderate in most of the locations; and in few centres such as Wangbal, Karaikal, and Imphal, disease pressure was low (LSI< 3.0). None of the entries in NSN-1, NSN-2 found resistant for leaf blast, however based on overall low disease score (SI) and high promising index, some of the promising entries included were IET# 31466, 31594, 31051, 32074, 31433, 31448, 30574, 30577, 31714, 30555, 30572, 31120, 31437, 31540, 31469, 30578, 31857, 30669, 29700 and 30657 under NSN-1; IET# 32866, 32610, 32917, 32736, 32397, 32942, 32472, 32816, 32625, 32854, 32656, 32789, 32600. 32376, 32451, 32918, 32569, 32929, 32646, 32584, 32527, 32492 and 32956 under NSN-2; IET# 32343, 32317, 32361, 32354, 31420, 32355, 31386, 32333, 32344, 31389, 32338, 32358, 31415, 29654, 31413 and 31424 under NSN-Hills. None of the entries found resistant against leaf blast in NHSN and DSN, however, IET# 33035, 33080, 32995, 33018, 33012, 33077, 33053, 33040, 33033,33006, 32998, 33084, 33078, 33082, 33086 and 33005 under NHSN and CBMASP 9014, JGL 47956, CBMASP 6016, JGL 47849, CBMASP 9015, GLB 94, WGL 1537, CBMASP 9013, JGL 47877, GLB 101, N 4823, CB 21515, NWGR-17008, GLB 119, N 733 and GSB 10 under DSN were considered promising.

❖ NECK BLAST

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN and DSN at 9, 6, 5, 9 and 8 centers respectively. In most of the centres the screening was carried out under natural infection condition except at Mandya, Rajendranagar and Nellore, where artificial method of inoculation was followed. In majority of the locations the disease pressure was moderate (LSI 3.0-6.0), which was good enough for selection of the best entries. A total of 6 entries *viz*., IET # 31120, 32065, 31733, 30617, 32061, 30603 under NSN-1 and 10 entries *viz*., IET# 32542, 32871, 32928, 32800, 32804, 32495, 32538, 32648, 32772 and 32956 under NSN-2 were found resistant (SI≤3.0). In NSN-hills nursery, 13 entries *viz*., 32325, 31415, 32362, 32329, 32331, 32372, 32360, 32357, 31420, 32358, 32330, 32342 and 32344 were found resistant with SI ≤ 3.0. In NHSN, IET# 33078, 33080, 33006, 33026, 33068, 33030, 33025, 33070, 33038, 33020, 33034, 33051, 33039, 33035 and 33060 were found resistant (SI ≤ 3.0).

Donors such as NWGR-17048, NWGR-17008, WGL 2033, N 4824, N 4925, N 4933, GLB 94, JGL 47870, CBMASP 9013, CBMASP 9015, CBMASP 9016, CBMASP 9017, BPT 3507, GSB 9, ISHB 9, ISHB 10, ISHB 11, ISHB 23, ISHB 29, ISHB 30 and ISHB 34 were reported resistant under DSN.

❖ BROWN SPOT

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN and DSN at 19, 14, 6, 15 and 14 centers respectively against brown spot disease across India. In most of the centres, the screening was carried out under natural infection condition except at Coimbatore, Gangavathi, Chinsurah, IIRR, Ludhiana and Pusa; where artificial screening was followed. In majority of the centres the brown spot pressure was moderate to high; it was very high at (LSI >7.0) at Gangavathi, IIRR, Pusa, Ludhiana, Almora in different nurseries. None of the entries found resistant to brown spot in any of the nurseries; however, some of the some of the promising entries with low disease score and high promising index included IET# 30819, 31630, 31998, 31733, 32963, 30641, 32964, 31509 and 30957 under NSN-1; IET # 32609, 32512, 32553, 32736, 32786, 32537, 32797, 32684, 32432, 32953, 32743, 32791 and 32652 under NSN-2; IET # 30513, 32371, 31415 and 32332, 31424, 32343, 32362 and 32358 under NSN-H; IET # 33053, 33015, 33006, 33073, 33048, 33066, 33070, 33084 and 33063 under NHSN. Promising donors for brown spot under DSN included N 4933, N 4925, RNR 51511, JGL 43094, CB 21515, RP 6469-107, RP Patho-1, GBB 67, GLB 94, RNR 51334, CB 21112, NWGR-17048, GBB 65, GSB 7, N 22 and JGL 47870.

❖ SHEATH BLIGHT

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN, and DSN at 20, 16, 3, 21 and 19 locations, respectively. In the majority of the locations, the disease pressure was moderate to high. None of the entries were found resistant (SI≤3) against sheath blight in all the nurseries during *Kharif*-2024. The promising entries to sheath blight were IET Nos., 32835, 32065, 31630, 31689, 31105, 29549, 31678, 31110, 31889, 31884, 31726, 31120, 32844, 31553, 32987, 32983, 31618, 31641, 32980, 31808, 31715, 31733 and 31639 in NSN-1-2024; IET Nos., 32487, 32575, 32375, 32542, 32428, 32569, 32580, 32744, 32537, 32382, 32857, 32492, 32683, 32676, 32746, 32680, 32794 in NSN-2-2024; IETs 32362, 32357, 32359, 32360, 32341, and 32350 in NSN-H-2024; IET Nos IET 33053, 33080, 33072, 33001, 33015, 33060, 33064, 33078, 33046, 33065, 33071, 33042 and 33000 in NHSN-2024; and designated entries viz., NWGR-17048, SM-SB-51-147-4, SM-SB-51-147-3, GLB 94, GLB 94, BPT 3278, CB 21112, ISHB 11, N 4999, GSB 10, N 4823, SM-SB-47-156-5-1, ISHB 29, NWGR-17008, NLRBL 23, CBMASP 9015, ISHB 30, CB 21103, NLRBL 25, WGL 2033, GLB 118, CBMASP 9014, RP 6469-89, RP Patho 3, ISHB 23, GLB 119, ISHB 22, CBMASP 9017, ISHB 28, RNR 44476, ISHB 19, ISHB 21, CBMASP 9013, ISHB 8 and CB 21515in DSN-2024.

❖ SHEATH ROT

The entries under NSN-1(432), NSN-2(571), NSN-Hills (2), NHSN (112) and DSN (229) were screened against sheath rot at 12, 5, 2, 12 and 8 locations, respectively. Screening for sheath rot was conducted under natural infection conditions at most of the locations except at Chinsurah, Navasari, Pusa, Raipur, Rajendranagar and Titabar, where pathogen was artificially inoculated to screen the entries. The disease pressure was moderate to high at most of the locations across the nurseries. Some of the highly promising entries scored less than 3 were IET # 28906, 31402, 31414, 31420, 31421, and 31422 in NSN-H and none of the entries recorded resistant reaction across the locations under NSN1, NSN-2, NHSN and DSN scoring below 3.

❖ GLUME DISCOLOURATION

Glume discolouration (GD) was observed at four locations viz., at Lonavala, Navasari Nawagam and Chatha during *Kharif* 2024. Some of the promising entries were: IET nos. IET nos. 30636, 31871, 31633, 30561 (H), 30165, 31998, 29558, 31975, 30605 (H) and 30957 in NSN 1; IET 32390, 32804, 32777, 32518, 32668, 32742, Swarnadhan, 32591 and 32579 in NSN2; IET Nos. 33074, 33055, 33016, 32996, 33000, 33001, 33003, 33008, 33012, 33014, 33018, in NHSN; and NWGR-17008, RNR 51511, ISHB 29, CBMASP 8022, SM-SB-51-147-3, ISHB 12, ISHB 32, JGL 47856, ISHB 6 and CB 21505 in DSN.

❖ RICE TUNGRO DISEASE

The entries in NSN-1, NSN-2, NHSN and DSN were evaluated at 2 locations for rice tungro virus disease. The promising entries identified in different nurseries were: IET 31462, IET 32036, IET 32036, IET 31481, IET 31693, IET 31804, IET 32845, IET 32846, IET 31004, IET 29560, IET 31982, IET 32983 and IET 31640 in NSN-1; IET Nos 32406, 32422, 32451, 32469, 32817, 32818, 32538, 32557, 32568, 32597, in NSN 2; IET 32318, RCPL 1-464, IET 32326 and 32371in NSNH; IET 33017, IET 32998, IET 33035, IET 33058, IET 33063 and IET 33083 in NHSN and JGL 38889, RNR 51334, RP 6469-89 and RP Patho 2 in DSN.

❖ BACTERIAL BLIGHT

The test entries and various checks in different bacterial blight screening nurseries viz., NSN-1, NSN-2, NSN-Hills, NHSN and DSN were evaluated at 25, 20, 4, 23 and 22 locations, respectively. The number of entries including checks in different nurseries was 481 in NSN1, 672 in NSN-2, 94 in NSN-Hills, 136 in NHSN and 196 in DSN. Some of the promising entries against bacterial blight in different nursery were IET # 32064, 32847, 32054, 32987, 30603 (H), 31553, 32058, 32835, 32036, 32986, 32983, 32827, 32062 and 32065 in NSN-1; IET # 32487, 32558, 32386, 32519, 32595, 32580, 32454, 32542, 32823, 32762, 32560, 32791, 32493, 32680, 32385, 32415 and 32582 in NSN-2; IET # 31386, 32371, 31413, 32363, 32364, 32348, 32317, 32359, 32358, 32362, 32333, 32335 and 31420 in NSN-Hills; IET # 33057, 33058, 33053, 33061, 33055, 33015, 33014, 33075, 33028, 33078, 33063, 33077 and 33064 in NHSN and NWGR-17048, CBMASP 9014, CBMASP 9015, ISHB 11, ISHB 23, CBMASP 9016, GSB 7, RP Bio Patho 5, ISHB 30, RP Bio Patho 3, RP Bio Patho 9, ISHB 31, RP Bio Patho 8, ISHB 2, CBMASP 8021 and ISHB 28 in DSN.

❖ MULTIPLE DISEASE RESISTANT LINES

Among the entries tested across the locations, total of 78 entries found moderately resistant or resistant to minimum of two and maximum of four diseases. A total of 11, 1, 13, 25 and 28 entries were identified with multiple disease resistance (for 2 or more diseases) in NSN-1, NSN-2, NSN-H, NHSN and DSN screening nurseries respectively. The entry IET# 32983 (MR to BB, ShR & RTD) which showed moderate resistant reaction to three diseases in NSN-1. In NSN-2, one entry showed resistance or moderate resistance reaction to diseases. The entry *viz*., IET # 31733 showed resistance reaction to NB, MR to BS. In NSN-H, a total of thirteen entries showed moderate or resistant reaction to two or more than two diseases. Entry *viz*., IET# 32358 (R to NB & MR to LB, BS, BB & RTD) showed resistant/moderate resistant reaction to five diseases. IET# 31413 (MR to LB, BS & BB), 31415 (R to NB & MR to LB, BS), 31420 (R to NB & MR to LB, BB), 32344 (MR to LB, NB & BS), and 32362 (R to NB & MR to BS, BB) showed resistant/moderate resistant reaction to three diseases. IET # 33048(MR to BS, ShR & RTD), 33053(MR to LB, BS & BB), 33058(MR to BB, ShR&RTD),

33063(MR to BS, BB & RTD) and 33078 (R to NB& MR to LB, BB) showed resistance to more than two diseases in NHSN. Seven donors exhibited resistant or moderate reaction to three and more diseases and that includes CBMASP 9016(MR to LB, NB, BB&ShR), GLB 94(MR to LB, NB & BS), ISHB 30(MR to NB, BB & ShR), JGL 47870 (MR to NB, BS &RTD), N 4933(R to BS & NB, MR to RTD) and NWGR-17048 (R to NB, BB & ShR and MR to BS) in DSN.

II. FIELD MONITORING OF VIRULENCE

1. *Pyricularia oryzae*

The experiment was conducted across 25 locations in India during *Kharif* 2024 to assess the virulence pattern of *Pyricularia oryzae* (rice blast), using 39 cultivars consisting of near isogenic lines, international differentials, donors and commercial cultivars possessing different gene(s) combinations for blast resistance. Disease severity varied, with high pressure (LSI>6.0) at Ghagarghat, Lonavala, Cuttack, Uppershillong and Almora, while several locations recorded moderate to low severity. Among differentials, Tetep, Raminad str-3, RP BioPath-3, PRS-58, RP Bio Path-1, Dular, RP BioPath-2 and RP BioPath-4 demonstrated stable resistance with SI of 4.0-4.1 across the locations. Tetep showed high resistance at 14 locations but was susceptible at Ghagarghat, Hazaribagh, Karjat, Almora, and Uppershillong. Raminad str-3 was highly resistant at Coimbatore, Gudalur, IIRR, Jagdalpur, Karjat, Mandya, New Delhi, while it was found highly susceptible at Cuttack, Gangavathi, and Ghagharghat. Differentials *viz*., RP Bio Patho-3, RP Bio Patho-1 and RP-Patho-2 possessing *Pi2* gene showed similar reaction pattern across all the locations, indicating effectiveness of *Pi2* gene. The *Pi2* gene conferred resistance to most isolates, except at Almora, Cuttack, Ghagarghat, and Lonavala, where it was not effective. Similarly, *Pi54* gene present in RP Biopatho-2, RP Biopath-4, PRS 50 and RP Patho-3 was moderately resistant across the locations with SI of 4.0-4.1 while *Pi9* gene (PRS-58) was resistant at 8 locations. Susceptible checks (HR-12, CO-39) were highly affected, while resistant checks like Rasi showed mixed reactions. Cluster analysis grouped isolates into eight major clusters and isolates from Ghagarghat and Almora were unique and formed separate cluster.

2. *Xanthomonas oryzae* pv. *oryzae*

Trial on monitoring virulence of bacterial blight (BB) pathogen, *Xanthomonas oryzae* pv. *oryzae* (*Xoo*) was conducted at 23 locations. At Ludhiana, the trial was conducted with 10 isolates. The rice differentials used in this trial consisted of eleven near isogenic lines (IRBB lines) possessing different single BB resistant genes in the genetic background of rice cultivar IR 24. Susceptible check varieties like IR 24, TN1 and resistant check variety Improved Samba Mahsuri was also included in the trial. Most of the differentials possessing single bacterial blight resistance genes like *Xa1*, *Xa3*, *Xa7*, *xa8*, *Xa10*, *Xa11* and *Xa14* were susceptible at most of the locations. BB resistance gene *xa13* was susceptible in 11 locations while *Xa21* was susceptible in 15 locations. Based on their virulence, the isolates were grouped into high, moderate and low virulence groups. Based on the reactions of the isolates on differentials possessing single BB resistance genes, the isolates from IIRR, Hyderabad, Chinsurah, Chiplima, Pantnagar and Raipur were categorized as highly virulent. Majority of the isolates were categorized as moderately virulent. The isolate from Raipur and strain 8 from Ludhiana were unique and formed separate cluster.

III. DISEASE OBSERVATION NURSERY

The trial was proposed at 11 locations i.e., Bankura, Chatha, Chinsurah, Kaul, Malan, Mandya, Maruteru, Moncompu, Nawagam, Pusa and Raipur. The data however was received from 8 centres for this trial. The trial of disease observation nursery (DON) was proposed to be conducted in 11 locations, but actually conducted at 8 locations with different sowing dates viz., early, normal and late with respect to the respective locations with an aim to estimate the effect of such varied sowing/planting dates on the occurrence and severity of the disease in the respective endemic regions. Disease development is generally known to depend on the availability of susceptible host, virulent pathogen and prevalence of favorable weather condition. The incidence of leaf blast was found to be relatively less in this year when compared to the previous year. Further the incidence was also more in the early sown crops than when compared to the normal and late sown crops. Sheath blight and bacterial blight severity was more in early sown compared to normal and late sown crops in the Maruteru, Mandya, Moncompu, Raipur, Chinsurah and Bankura centres. The severity of the BLB was more severe in late sown crops. In Nawagam, sheath rot incidence was more in late sown crops, the severity of the sheath rot was increased with decreasing rainfall in Nawagam center.

IV. DISEASE MANAGEMENT TRIALS

TRIAL 11. EVALUATION OF FUNGICIDES AGAINST LOCATION SPECIFIC DISEASES

A trial was conducted in second year with the objective to identify an effective combination fungicidal molecule against rice diseases. The trail constituted with fungicidal molecules viz., mancozeb 50% + thiophanate methyl 25% WG (3.0 g/l), kasugamycin 5% + copper oxychloride 45% WP (1.5 g/l), azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l), fenoxanil 5% + isoprothiolane 30% EC (2 ml/l), azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l), picoxystrobin 7.05% + propiconazole 11.7% SC (2 ml/l), and tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l). trail was proposed at 35 centers and conducted at 31 centres. The fungicides were evaluated against leaf blast (9 locations), neck blast (10 locations), sheath blight (14 locations), brown spot (7 locations), sheath rot (4 locations), grain discoloration (2 locations) and stem rot (one location).

Results from the multi-location testing of chemicals has revealed as follows. Leaf blast was effectively reduced by azoxystrobin 5.1% +tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) with low mean severity of 19.5% followed by Tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) with low mean severity and incidence 19.5% and 28% respectively. Minimum level of neck blast was recoded in Tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) treatment with 11.4% and 12.7% of incidence and severity followed by azoxystrobin 5.1% +tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) with 10% incidence. In sheath blight, azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l) was found effective in minimizing the disease severity (DS:25.4% and DI:45.5%) and azoxystrobin 5.1% +tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) minimizing the disease incidence (DS:27% and DI:45%). Fungicide, azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) also found effective in reducing the brown spot (DS: 27.6%). Sheath rot disease incidence and severity was effectively reduced by Tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) with low incidence and severity of 29.8% and 21.9% respectively followed by azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l). The new combi-product, azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) showed broad spectrum activity against leaf blast, neck blast, sheath blight, brown spot and sheath rot.

TRIAL 12. EVALUATION OF BIO-CONTROL FORMULATIONS AGAINST FUNGAL DISEASES

Among the different formulations tested viz., the liquid formulation was found to be better than the solid formulation. Similarly, the combination of bioagent formulation and fungicides were providing higher percent disease control and increased plant yield than when compared to the fungicide treatment alone. Among all the treatments and across all the locations, the treatment T6 = Seed treatment followed by seedling dip @ 10 g/l of liquid Formulation+ fungicide for the respective disease (31.29%) has shown best in controlling the disease as it produced very less disease as compared to the all the treatments tested followed by the treatment T5 (32.48%) against sheath blight. Among the different treatments overall for the management of the sheath blight disease, Navasari reported the highest percentage control over the disease (DC) viz., 62.48% followed by Varanasi (61.64) when applied with the liquid formulation of the bioagent as seed treatment followed by seedling dip @ 5g/l followed by foliar spray of Hexaconazole @ 2ml/l at tillering stage (T6). Karaikal centre reported the highest percent decrease in disease severity over control, when the plants were treated with treatment T6 viz., seed treatment plus seedling dip (10g/l liquid formulation) and foliar spray of fungicide followed by bioagent as seed treatment plus foliar spray @ 5g/l with liquid formulation (T4) followed by the bioagent as seed treatment plus foliar spray @ 5g/l with solid formulation (T3) for three diseases like False smut, Neck blast and Sheath rot of rice. In Rewa, the treatment T6 viz., seed treatment plus seedling dip (10g/l liquid formulation) and foliar spray of fungicide was the best in controlling the leaf blast disease which is reducing the 49.17% of the disease when compared to the untreated control (T8) followed by the treatment T5 (45.86% decrease over control) and T4 (40.88% decrease over control).

TRIAL 13. INTEGRATED PEST MANAGEMENT in DIRECT SEEDED RICE

The trial was conducted against rice diseases under direct seeded rice conditions at three different zones *viz*., Zone II (Northern zone - Kaul); Zone VI (Western zone – Navsari) and Zone VII (Southern zone – Aduthurai, Mandya, Gangavathi). Disease severity of various diseases, recorded at weekly intervals was converted in to AUDPC values and compared. Under Zone II, the IPM practices were effective against leaf blast, neck blast, sheath blight and bacterial blight. Similarly, IPM practices were effective against sheath blight and sheath rot compared to farmer’s practices at Navasari. In Zone VII, IPM practices reduced the disease severity of leaf and neck blast, bacterial blight at Aduthurai, Gangavathi and Mandya. Sheath blight disease severity was reduced due to adoption of IPM practices at Mandya.

TRIAL 14: SPECIAL TRIAL ON YIELD LOSS ASSESSMENT DUE TO BROWN SPOT DISEASE

A special trial was conducted during *Kharif* 2024 to assess the impact of brown spot disease on rice yield. The study involved three treatments (T1, T2, and T3) with varying number of *Bipolaris oryzae* inoculation to create different disease gradients and a control (T4). The trial was implemented in a randomized block design (RBD) at four hotspot locations *viz*., Gangavathi, Jagdalpur, Moncompu, and Pusa. Susceptible rice varieties were used in the experiment in each location. Results showed that, highest percent disease severity (PDI) of 70.37%, 34.17%, 57.40% caused the yield loss of 62%, 22% and 32% respectively at Jagdalpur, Moncompu and Pusa, when pathogen inoculum sprayed thrice at an interval of 2 days. Similarly, when inoculum sprayed twice at an interval of 2 days (T2) and when inoculum was sprayed once (T1), progressively lower PDIs and yield reductions were reported at Jagdalpur, Pusa and Moncompu. However, at Gangavathi, there was no variation in disease severity and yield loss among treatments (T1, T2 and T3). The mean values across all locations indicated a clear correlation between disease intensity and yield loss; a mean PDI of 53.98%, 38.55% and 27.10% in T1, T2 and T3 caused the yield reduction of 31.7%, 23.7% and 15.0% respectively. The control (T4) consistently showed the lowest disease severity and higher yields. These findings confirm that maximum disease severity of 54% can cause potential yield loss up to 32%, emphasizing the need for effective brown spot management strategies.

TRIAL 15: SPECIAL SCREENING TRIAL ON FALSE SMUT

Selected entries were screened artificially at IIRR and naturally screened at Gangavathi, Gudalur, Ludhiana, Masodha and Radhanagari (RDN). Among the 41 entries (coded as DL) screened across the five location either artificially (IIRR) or naturally (GNV, LDN, MSD, RDN) and the eleven entries *viz*., IET29536 R, IET29549, Rasi, RL-348, RL-479, PAU 1044, NPS-13, IET29939, RL-4, RL-1516 and RL-4609 recorded moderately tolerant disease reaction with the smut ball ranged from 3 to 4 per panicle with the disease score of 5. With respect to 44 GGV coded entries screened at IIRR, Gangavathi, Ludhiana and Masodha, 31 entries recorded 0 to 3 smut balls per panicle, which will be screened for one more season for confirmation.

TRIAL 16: EVALUATION OF DRONES FOR SPRAYING OF AGROCHEMICALS (HERBICIDES, INSECTICIDES, AND FUNGICIDES) IN RICE PEST MANAGEMENT (EDAPM)

The trial was conducted to evaluate the drone spray of agrochemicals for the management of leaf blast, sheath blight and grain discolouration. The trial was conducted at Gangavathi, Nawagam and Rajendranagar. With respect to leaf blast, the results revealed that, spraying of chemicals (tank mix of compatible fungicide and insecticide) at maximum tillering and booting stage using battery operated knapsack sprayer recorded 45.55% disease reduction and use of drone for spraying the chemicals recorded the percent disease reduction of 53.58% as compared to control. Similarly, for sheath blight disease, spraying of chemicals with drone recorded the PDI reduction of 48.65% as against 45.73% in the treatment when battery operated Knapsack sprayer was used for spraying the chemicals. In case of grain discolouration disease, the chemicals were sprayed only at booting stage the percentage of reduction of PDI was 43.91% when chemicals were sprayed with drone and 39.42% reduction of PDI was recorded when chemicals were sprayed with battery operated knapsack sprayer.

INTRODUCTION

The All-India Co-ordinated Rice Pathology Programme of Indian Institute of Rice Research (ICAR-IIRR) provides an effective linkage for collaboration among state agricultural universities, national institutes and Department of Agriculture, Agrochemical Industry and others. The objectives of the Programme are:

- To accelerate genetic improvement of rice for resistance against major diseases occurring in different ecosystems of the country.
- To provide a testing mechanism to assess the advanced breeding lines over a wide range of climatic, cultural, soil and disease epidemic conditions.
- To identify broad spectrum of resistance to major rice diseases.
- To monitor and evaluate the genetic variation of rice pathogens.
- To monitor the prevalence of diseases in the country.
- To develop need-based disease management practice.
- To identify production constraints in different ecosystems through Production Oriented Survey.

To achieve these objectives during 2024, a total of 16 trials were conducted at 47 locations on host plant resistance, field monitoring of virulence in major pathogens and disease management. Five national screening nurseries comprising of 1,579 entries of advanced breeding lines and new rice hybrids were evaluated for their reactions to major rice diseases at 48 locations.

The composition of the nurseries is as follows:

- ❖ National Screening Nursery 1 (NSN-1) - 481 entries drawn from Advanced Variety Trials.
- ❖ National Screening Nursery 2 (NSN-2) – 672 entries from Initial Variety Trials.
- ❖ National Screening Nursery-Hills (NSN-H) - 94 entries from Advanced and Initial Varietal Trials.
- ❖ National Hybrid Screening Nursery (NHSN) - 136 entries from Initial National Hybrid Rice Trials (HRT’S).
- ❖ Donor Screening Nursery (DSN) - 196 entries from different centres.

The virulence patterns of blast and bacterial blight pathogens in the field were monitored, using differentials for respective diseases at disease endemic areas. The prevalence of the diseases was monitored in three sequentially sown disease observation nurseries laid-out in the endemic locations.

The disease management trials were conducted at hot-spot locations to evaluate the efficacy of new fungicides and commercially available combination fungicide formulations against major rice diseases. Production Oriented Survey (POS) was undertaken in 18 centres (15 states) to identify the production constraints in different rice growing ecosystems.

The weather conditions and location details are given in Annexure II and III. Out of 605 experiments proposed, data were received from 560 experiments of 16 trials indicating the good response with 92.7 % data receipt from the centres.

Table 1: Scientists involved in Plant Pathology Coordinated Programme, *Kharif* 2024. ICAR-IIRR, Headquarters, Hyderabad- Dr. M. Srinivas Prasad, PI; Associates: Drs. G. S. Laha, D. Krishnaveni, C. Kannan, D. Ladhalakshmi, V. Prakasam, K. Basavaraj and G. S. Jasudasu

S.No	Location	Co-operators	Funded/ Voluntary	Experiments	
				Proposed	Conducted
1.	Aduthurai	Dr. K. Rajappan	Funded	16	14
2.	Almora	Dr. Gaurav Verma	Voluntary	7	8
3.	Arundhutinagar	Drs. Uttam Saha & Sentu Acharya	Funded	8	8
4.	Bankura	Dr. C. K. Bhunia	Funded	14	14
5.	Bikramgunj	Dr. Md. Reyaz Ahmad	Funded	15	23
6.	Chatha	Dr. Vijay Bahadur Singh	Funded	12	12
7.	Chinsurah	Dr. Dilip Kumar Patra	Funded	12	11
8.	Chiplima	Dr. Rini Pal	Funded	6	7
9.	Coimbatore	Dr. C. Gopalakrishnan	Funded	16	16
10.	Cuttack	Drs. Arup K. Mukherjee, Srikanta Lenka & Manas Kumar Bag	Voluntary	18	18
11.	Gangavati	Dr. Pramesh Devanna	Funded	24	23
12.	Ghaghraghat	Dr. Amrit Lal Upadhaya	Funded	11	11
13.	Gudalur	Dr. C. Gopalakrishnan	Voluntary	7	5
14.	Hazaribagh	Dr. Someshwar Bhagat & Amrita Banerjee	Voluntary	11	9
15.	IIRR	Dr. M. Srinivas Prasad, Dr. G. S. Laha, Dr D. Krishnaveni, Dr. C. Kannan, Dr D. Ladhalakshmi, Dr .V. Prakasam, Dr. K. Basavaraj and Dr. G. S. Jasudasu	HQ	29	29
16.	Imphal (Lamphalpet)	Dr. A.Ratankumar Singh	Voluntary	9	7
17.	Jagdalpur	Dr.R.S.Netam	Funded	15	15
18.	Karjat	Dr. Pushpa D. Patil	Funded	16	15
19.	Karaikal	Dr. C. Jeyalakshmi	Voluntary	5	5
20.	Kaul	Dr. Mahaveer Singh	Funded	10	5
21.	Khudwani	Dr. F. A. Mohiddin	Funded	11	10
22.	Lonavla	Dr. K. S. Raghuwanshi	Voluntary	16	26
23.	Ludhiana	Dr. Jagjeet Singh Lore	Funded	18	16
24.	Malan	Dr. Suman Kumar	Funded	11	2
25.	Mandya	Dr. V. B. Sanath Kumar	Funded	18	16
26.	Maruteru	Dr. V. Bhuvaneswari	Funded	22	16
27.	Masodha (Faizabad)	Dr. Vindeshwari Prasad	Funded	12	11
28.	Moncompu	Dr. M. Surendran	Funded	13	12
29.	Mugad	Dr. Gurupada Balol	Voluntary	14	6
30.	Navsari	Dr. Vijay A. Patil	Funded	17	19
31.	Nawagam	Dr. Rakesh Kumar Gangwar	Funded	20	22
32.	Nellore	Dr. P. Madhusudhan	Voluntary	7	9
33.	New Delhi	Drs. B. Bishnu Maya & G. Prakash	Voluntary	9	7
34.	Pantnagar	Dr. Bijendra Kumar	Funded	15	13
35.	Pattambi	Dr. P. Raji	Funded	16	15
36.	Ponnampet	Dr. Imran Khan H. S. & Dr.Mohan Kumar N. V	Funded	13	13
37.	Pusa	Dr. R. K. Ranjan	Funded	11	11
38.	Raipur	Dr. Pradeep Kumar Tiwari	Funded	17	15
39.	Rajendranagar	Dr. T. Kiran Babu	Funded	15	9
40.	Ranchi	Dr. Manoj Kumar Barnwal	Voluntary	11	6
41.	Rewa	Dr. S. K. Tripathi	Funded	12	10
42.	Sabour	Dr. Amarendra Kumar	Voluntary	7	8
43.	Titabar	Dr. Popy Bora	Funded	12	12
44.	Umiam (Barapani)	Dr. Pankaj Baiswar	Voluntary	2	1
45.	Upper Shillong	Shri.Derek Y.Pariat	Funded	8	5
46.	Varanasi	Dr. R. K. Singh	Funded	11	10
47.	Wangbal	Dr. Kh. Ngamreishang	Funded	6	6
Total Experiments (92.7%)				**605**	**561**

I. HOST PLANT RESISTANCE

TRIAL No.1: SCREENING FOR LEAF BLAST RESISTANCE

- **National Screening Nursery-1 (NSN-1)**

The National Screening Nursery (NSN-1) comprised of 481 entries that included AVT-1, AVT-2 entries, national, regional and pathology checks. The nursery was evaluated at 27 locations across India under different-agro ecological zones. The frequency distribution of disease scores and the representative location severity index (LSI) are presented in the Table 1.1A. The screening against leaf blast was carried out under both natural and artificial inoculation conditions at different locations. The highest disease pressure was recorded at Lonavala (LSI 6.7) and lowest at Wangbal (LSI 0.3). None of the locations recorded a very high (LSI ≥7.0) disease pressure; while high disease pressure (LSI 6-7) was recorded at Lonavala (6.7), Almora (6.6) and Cuttack (6.4). Most of the locations recorded moderate disease pressure (LSI 3-6) and that included Mandya (5.9), Gangavathi (5.8), Gagharghat (5.8). Hazaribagh (5.7), Nawagam (5.2), Ponnampet (5.2), Ranchi (5.0), Gudalur (5.0), Coimbatore (4.9), Navasari (4.8), Khudwani 94.8), IIRR (4.6), Nellore (4.6), New Delhi (4.2), Jagdalpur (4.2), Pattambi (4.0), Bikramgunj (3.5), Rewa (3.4), Karjat (3.4), Umiam (3.3), Maruteru (3.3) and Bankura (3.1). The disease pressure was low (LSI ≤3.0) at Karaikal and Wangbal and hence data from these centres was not considered for the selection of promising entries.

The promising entries with low susceptibility index (≤3.9) and high PI was presented in Table 1.1B. None of the entries found resistant (SI≤3.0) or performed better than resistant check Tetep (SI-2.5) across the locations; however, some of the moderately resistant entries included IET Nos. 31466, 31594, 31051, 32074, 31433, 31448, 30574, 30577, 31714, 30555, 30572, 31120, 31437, 31540, 31469, 30578, 31857, 30669, 29700 and 30657 (Table 1.1B).

- **National Screening Nursery-2 (NSN-2)**

The nursery consists of 672 lines drawn from initial variety trials (IVTs). These were evaluated at 20 centres under various ecological zones. The entries were evaluated under both artificial and natural screening methods at different locations. The disease pressure was highest at Cuttack (LSI 6.5) and the lowest at Wangbal (LSI 0.5). None of the locations showed a very high disease (LSI .7.0); however, the disease pressure was high (LSI 6.0-7.0) at Cuttack (6.5), Mandya (6.3) and Gangavathi (6.0). Location severity index was moderate (LSI 3.0-6.0) at most of the locations and that included Gagharghat (5.9), Hazaribagh (5.7), Nawagam (5.1), Ranchi (5.1), Jagdalpur (5.0), Coimbatore (4.9), IIRR (4.9), Ponnampet (4.6), Karjat (4.3), Khudwani (4.3), Pattambi (4.2), Nellore (3.9), Rewa (3.8), Mugad (3.3), Bikramgunj (3.2) and Maruteru (3.1). The Performance of entries at Wangbal (LSI 0.5) was not considered for the selection of best entries (Table 1.2A).

None of the entries found resistant (<3.0) or performed better than resistant check Tetep (SI 2.4), but a few promising entries with low susceptibility index and which showed moderate resistant reaction was presented in Table 1.2B and that included IET #32866, 32610, 32917, 32736, 32397, 32942, 32472, 32816, 32625, 32854, 32656, 32789, 32600. 32376, 32451, 32918, 32569, 32929, 32646, 32584, 32527, 32492 and 32956.

Table 1.1A: Location severity index (LSI) and frequency distribution of Leaf blast scores for NSN-1, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)																										
	ALM	BKG	BNK	CBT	CTK	GDL	GGT	GNV	HZB	IIRR	JDP	KHD	KJT	KRK	LNV	MND	MTU	NDL	NVS	NLR	NWG	PNP	PTB	RCI	REW	UMM	WBL
0	0	43	27	0	0	0	0	0	0	0	9	5	0	127	0	0	0	0	0	0	0	0	0	0	0	80	364
1	0	74	130	2	0	1	0	1	0	3	4	1	112	171	0	19	13	38	1	1	0	12	0	16	6	74	69
2	0	17	20	11	0	7	0	1	1	4	29	3	85	46	2	10	117	26	10	13	0	58	38	14	129	1	42
3	5	143	182	62	11	53	2	2	20	124	174	44	47	55	11	79	170	140	74	61	16	94	99	28	109	86	0
4	2	24	0	112	0	104	0	76	146	127	77	160	65	20	23	67	85	10	71	171	87	60	209	122	141	95	0
5	53	73	55	127	182	149	243	163	91	96	71	139	46	28	64	55	50	201	178	116	223	59	87	122	89	47	0
6	166	15	3	116	0	115	0	76	39	21	65	81	17	1	85	3	23	0	100	69	86	21	21	108	2	30	0
7	150	76	42	47	226	49	113	87	85	97	28	31	31	10	126	67	1	50	32	35	54	28	21	46	3	25	0
8	86	0	0	2	0	1	0	36	43	1	13	9	6	4	97	0	0	0	6	5	7	46	0	23	0	20	0
9	10	0	17	0	60	0	22	33	41	3	3	0	16	6	44	153	0	14	0	3	4	85	1	0	0	7	0
Total	**472**	**465**	**476**	**479**	**479**	**479**	**380**	**475**	**466**	**476**	**473**	**473**	**425**	**468**	**452**	**453**	**459**	**479**	**472**	**474**	**477**	**463**	**476**	**479**	**479**	**465**	**475**
LSI	**6.6**	**3.5**	**3.1**	**4.9**	**6.4**	**5.0**	**5.8**	**5.8**	**5.7**	**4.6**	**4.2**	**4.8**	**3.4**	**1.7**	**6.7**	**5.9**	**3.3**	**4.2**	**4.8**	**4.6**	**5.2**	**5.2**	**4.0**	**5.0**	**3.4**	**3.3**	**0.3**
SM	**N**	**N**	**N**	**A**	**A**	**N**	**N**	**A**	**A**	**A**	**N**	**N**	**A**	**N**	**N**	**A**	**A**	**A**	**N**	**A**	**A**	**N**	**N**	**N**	**A**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.1B: Promising entries with low susceptibility index (≤ 3.9) and high PI in NSN-1 to Leaf blast disease, *Kharif*-2024

P.No	Br. No.	IET No.	Location/Frequency of scores (0-9)																									SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ALM	BKG	BNK	CBT	CTK	GDL	GGT	GNV	HZB	IIRR	JDP	KHD	KJT	LNV	MND	MTU	NDL	NVS	NLR	NWG	PNP	PTB	RCI	REW	UMM						
112	3530	31466	6	1	3	3	5	3	5	5	3	3	3	6	1	4	3	2	5	4	4	5	2	3	6	2	1	**3.5**	**25**	**14**	**56**	**22**	**88**
119	3538	31594	5	3	1	3	5	3	5	4	4	3	0	6	-	-	-	-	5	5	3	6	-	3	5	2	1	**3.6**	**20**	**10**	**50**	**18**	**90**
139	4707	31051	6	4	1	3	7	4	5	4	4	4	5	3	1	5	3	3	5	2	4	5	2	2	6	2	3	**3.7**	**25**	**11**	**44**	**22**	**88**
427	5925	32074	6	1	1	5	9	4	-	6	4	3	3	4	4	8	7	2	3	3	1	5	1	3	1	3	3	**3.8**	**24**	**13**	**54**	**19**	**79**
14	3314	31433	6	1	3	6	5	3	7	4	4	4	3	5	2	5	1	2	3	3	4	7	3	4	6	3	0	**3.8**	**25**	**12**	**48**	**20**	**80**
102	3520	31448	6	1	3	3	7	4	7	5	2	4	2	6	1	6	3	4	3	4	3	5	3	4	4	3	1	**3.8**	**25**	**12**	**48**	**20**	**80**
84	3502	30574	6	0	3	4	7	6	7	4	5	3	2	4	1	7	3	3	1	3	6	5	3	4	4	3	0	**3.8**	**25**	**12**	**48**	**19**	**76**
87	3505	30577	6	3	3	3	5	3	5	5	4	3	2	4	1	7	3	3	3	5	6	4	4	2	4	4	3	**3.8**	**25**	**12**	**48**	**22**	**88**
216	3910	31714	6	1	1	4	5	4	9	4	4	3	3	4	2	6	3	1	3	8	5	4	3	4	5	3	0	**3.8**	**25**	**11**	**44**	**21**	**84**
1	3301	30555	3	5	3	5	7	3	3	5	3	5	3	6	1	6	1	3	5	3	4	4	2	4	5	4	3	**3.8**	**25**	**12**	**48**	**22**	**88**
46	3347	30572	5	1	1	6	7	4	5	5	4	4	0	4	-	-	-	2	4	3	4	5	9	4	5	3	0	**3.9**	**22**	**7**	**32**	**19**	**86**
323	5509	31120	5	4	3	6	5	6	5	6	5	3	5	4	-	7	1	2	3	3	4	4	3	4	3	2	1	**3.9**	**24**	**10**	**42**	**20**	**83**
19	3319	31437	6	0	7	4	7	4	5	4	6	3	3	4	-	7	1	2	3	3	5	5	5	4	1	4	1	**3.9**	**24**	**9**	**38**	**19**	**79**
31	3332	31540	6	3	3	4	5	3	5	5	4	4	3	5	1	5	3	2	1	5	5	5	8	5	5	2	1	**3.9**	**25**	**10**	**40**	**23**	**92**
113	3531	31469	7	3	3	6	5	6	5	7	4	4	2	4	1	4	3	2	5	2	4	3	5	3	4	5	1	**3.9**	**25**	**10**	**40**	**21**	**84**
88	3506	30578	6	1	0	5	5	6	5	4	4	4	3	6	2	8	2	3	5	3	5	3	3	4	6	4	1	**3.9**	**25**	**10**	**40**	**20**	**80**
152	4720	31857	6	1	1	5	5	5	5	5	4	5	3	0	2	5	3	4	3	6	6	7	3	5	6	3	0	**3.9**	**25**	**10**	**40**	**20**	**80**
10	3310	30669	5	3	3	6	5	5	5	5	5	4	1	5	1	3	3	4	1	4	5	7	4	5	6	3	0	**3.9**	**25**	**9**	**36**	**22**	**88**
13	3313	29700	5	3	3	3	5	4	7	7	4	4	3	6	1	4	2	2	5	5	4	5	5	4	4	2	1	**3.9**	**25**	**9**	**36**	**22**	**88**
9	3309	30657	5	3	1	4	5	4	7	7	5	4	3	6	1	4	4	3	3	7	4	6	4	4	1	3	0	**3.9**	**25**	**9**	**36**	**20**	**80**
225	HR-12		7	7	5	6	9	6	5	9	9	9	9	8	7	7	9	6	9	5	7	9	9	7	8	7	7	**7.4**	**25**	**0**	**0**	**3**	**12**
121	Tetep		5	0	1	1	7	2	5	4	3	1	0	0	-	3	4	3	3	1	4	4	2	3	1	4	0	**2.5**	**24**	**16**	**67**	**23**	**96**
LSI			**6.6**	**3.5**	**3.1**	**4.9**	**6.4**	**5.0**	**5.8**	**5.8**	**5.7**	**4.6**	**4.2**	**4.8**	**3.4**	**6.7**	**5.9**	**3.3**	**4.2**	**4.8**	**4.6**	**5.2**	**5.2**	**4.0**	**5.0**	**3.4**	**3.3**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 1.2A: Location severity index (LSI) and frequency distribution of Leaf blast scores of NSN-2, *Kharif* 2024

Score	Location/Frequency of scores (0-9)																			
	BKG	**CBT**	**CTK**	**GGT**	**GNV**	**HZB**	**IIRR**	**JDP**	**KJT**	**KHD**	**MND**	**MGD**	**MTU**	**NLR**	**NWG**	**PNP**	**PTB**	**RCI**	**REW**	**WBL**
0	42	0	0	0	0	0	0	3	4	4	0	0	0	0	0	0	0	0	2	421
1	152	0	0	0	0	0	4	4	11	5	17	103	24	25	0	48	0	10	38	164
2	37	4	0	0	1	0	0	12	22	46	14	0	179	26	0	138	55	25	117	85
3	202	74	12	2	13	73	72	138	136	113	82	371	226	97	1	141	112	49	154	0
4	42	173	0	0	115	201	219	110	185	243	100	0	127	389	214	60	273	133	134	0
5	118	200	251	405	150	77	195	144	114	153	68	163	54	86	263	44	129	189	138	0
6	8	168	0	1	164	48	34	125	47	70	0	0	21	28	93	29	75	167	53	0
7	67	53	299	229	82	121	121	83	47	26	122	26	4	7	79	29	27	60	33	0
8	0	0	0	0	74	67	0	29	1	8	0	0	0	2	6	60	1	34	3	0
9	0	0	106	35	60	72	5	13	10	0	243	0	0	0	3	102	0	5	0	0
Total	**668**	**672**	**668**	**672**	**659**	**659**	**650**	**661**	**577**	**668**	**646**	**663**	**635**	**660**	**659**	**651**	**672**	**672**	**672**	**670**
LSI	**3.2**	**4.9**	**6.5**	**5.9**	**6.0**	**5.7**	**4.9**	**5.0**	**4.3**	**4.3**	**6.3**	**3.3**	**3.1**	**3.9**	**5.1**	**4.6**	**4.2**	**5.1**	**3.8**	**0.5**
Screening	**N**	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**A**	**A**	**N**	**N**	**N**	**A**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.2B: Promising entries with low susceptibility index (≤ 3.8) and high PI in NSN-2 to leaf blast, *Kharif* 2024

P.No.	Br. No.	IET No.	Location/Frequency of scores (0-9)																			SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			BKG	CBT	CTK	GGT	GNV	HZB	IIRR	JDP	KJT	KHD	MND	MGD	MTU	NLR	NWG	PNP	PTB	RCI	REW						
651	5416	32866	1	4	7	7	6	3	3	3	4	4	3	3	2	3	4	1	2	6	3	**3.6**	**19**	**11**	**58**	**15**	**79**
323	4063	32610	5	5	7	7	5	3	4	3	4	4	2	1	2	1	5	2	3	5	1	**3.6**	**19**	**9**	**47**	**17**	**89**
474	6001	32917	3	5	5	5	4	4	3	5	3	4	3	3	1	1	4	2	4	6	4	**3.6**	**19**	**8**	**42**	**18**	**95**
536	4609	32736	1	4	5	5	4	4	4	8	3	4	4	3	2	4	5	1	2	4	2	**3.6**	**19**	**7**	**37**	**18**	**95**
26	3426	32397	1	5	5	7	6	3	3	3	3	4	3	3	3	4	4	2	3	5	3	**3.7**	**19**	**11**	**58**	**17**	**89**
504	6031	32942	1	4	5	7	4	4	3	5	3	4	3	3	3	3	5	2	3	3	5	**3.7**	**19**	**10**	**53**	**18**	**95**
105	3642	32472	2	7	5	9	5	7	3	3	1	4	1	1	2	4	4	1	4	5	2	**3.7**	**19**	**9**	**47**	**16**	**84**
153	5027	32816	1	5	5	5	5	3	4	4	-	4	3	3	3	4	5	3	3	5	2	**3.7**	**18**	**8**	**44**	**18**	**100**
350	4215	32625	3	6	9	5	4	4	4	2	-	5	3	5	1	2	4	1	2	4	3	**3.7**	**18**	**8**	**44**	**16**	**89**
639	5404	32854	1	3	7	5	5	4	4	3	3	3	5	3	2	4	4	2	4	4	5	**3.7**	**19**	**8**	**42**	**18**	**95**
385	4250	32656	1	4	5	5	7	4	3	5	6	4	3	3	2	3	5	1	4	6	0	**3.7**	**19**	**8**	**42**	**16**	**84**
182	4819	32789	1	5	5	5	6	-	-	-	-	3	-	3	-	4	4	-	2	4	3	**3.8**	**12**	**5**	**42**	**11**	**92**
313	4053	32600	0	5	9	7	5	3	4	2	3	4	3	3	3	4	5	2	3	4	3	**3.8**	**19**	**10**	**53**	**17**	**89**
4	3404	32376	1	6	5	5	6	3	5	6	5	3	1	3	3	4	4	3	6	1	2	**3.8**	**19**	**9**	**47**	**15**	**79**
81	3618	32451	1	4	7	5	6	5	4	4	2	4	4	3	2	4	4	3	3	5	2	**3.8**	**19**	**7**	**37**	**17**	**89**
475	6002	32918	1	3	5	5	4	4	3	5	4	5	4	3	2	4	4	4	6	4	2	**3.8**	**19**	**6**	**32**	**18**	**95**
280	4020	32569	0	4	7	5	5	4	4	3	5	4	3	1	2	4	7	1	4	5	4	**3.8**	**19**	**6**	**32**	**17**	**89**
488	6015	32929	3	5	7	7	5	4	4	5	3	5	1	3	2	3	-	1	6	2	3	**3.8**	**18**	**9**	**50**	**15**	**83**
374	4239	32646	0	3	7	5	3	4	4	5	-	3	7	3	2	3	4	1	4	6	5	**3.8**	**18**	**8**	**44**	**15**	**83**
295	4035	32584	3	3	7	7	5	3	5	5	4	4	3	3	1	3	4	1	3	6	3	**3.8**	**19**	**10**	**53**	**16**	**84**
237	3840	32527	1	3	5	5	5	7	4	5	7	3	4	3	2	2	4	2	5	3	3	**3.8**	**19**	**9**	**47**	**17**	**89**
198	3801	32492	5	6	7	5	5	4	4	2	4	3	1	3	3	3	5	3	4	4	2	**3.8**	**19**	**8**	**42**	**17**	**89**
521	6049	32956	1	5	7	7	5	7	4	3	3	4	1	1	3	5	6	1	4	2	4	**3.8**	**19**	**8**	**42**	**15**	**79**
463	HR-12		6	6	9	9	9	8	9	9	9	8	9	7	6	7	8	8	7	7	4	**7.6**	**19**	**0**	**0**	**1**	**5**
462	Tetep		0	2	5	7	3	3	1	1	-	0	1	1	2	3	4	3	3	1	3	**2.4**	**18**	**15**	**83**	**17**	**94**
LSI			**3.2**	**4.9**	**6.5**	**5.9**	**6.0**	**5.7**	**4.9**	**5.0**	**4.3**	**4.3**	**6.3**	**3.3**	**3.1**	**3.9**	**5.1**	**4.6**	**4.2**	**5.1**	**3.8**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

➢ **National Screening Nursery-Hills (NSN-Hills)**

The National Screening Nursery - Hills (NSN-H) comprised of 94 entries including checks, were evaluated at 11 hill locations across India for their resistance to leaf blast. These entries were screened through natural infection condition at most of the locations except at Coimbatore, Cuttack, and IIRR, where entries were screened under artificial method of screening. At Imphal and Khudwani, natural infection was supplemented by spread of diseased leaves. The frequency distribution of disease scores and location severity indices are presented in Table 1.3A. The disease pressure was high (LSI 6-7) at Cuttack (6.7). The disease pressure was moderate (LSI 3-6) at most of the locations such as Almora (5.9), Lonavala (5.6), Khudwani (5.0), Gudalur (4.9), IIRR (4.7), Karjat (4.7), Upper shilling (4.6), Coimbatore (4.4) and Ponnampet (4.2). The lowest disease pressure recorded at Imphal (2.4), hence data from this location was not considered for selection of best entries. The selection of best entries was done from the locations where LSI was more than 3 and presented in table 1.3B. None of the entries performed better over resistant check (Tetep SI 2.8); however, entries possessing moderate resistance with SI ≤4.4 with high PI were considered promising and that included IET# 32343, 32317, 32361, 32354, 31420, 32355, 31386, 32333, 32344, 31389, 32338, 32358, 31415, 29654, 31413 and 31424 (Table 1.3B).

Table 1.3A: Location severity index (LSI) and frequency distribution of leaf blast scores of NSN-H, *Kharif* 2024

Score	Location/Frequency of scores (0-9)										
	ALM	**CBT**	**GDL**	**CTK**	**IIRR**	**IMP**	**KJT**	**KHD**	**LNV**	**PNP**	**USG**
0	0	0	0	0	0	15	0	1	0	0	1
1	0	0	0	0	1	13	3	2	0	6	9
2	0	2	1	0	0	23	18	0	1	19	30
3	7	21	12	1	14	18	18	3	2	24	2
4	1	26	25	0	36	5	15	27	14	8	4
5	28	27	24	29	23	8	7	32	25	12	6
6	29	17	25	0	2	3	0	17	28	4	12
7	20	1	7	49	18	1	20	7	16	8	15
8	6	0	0	0	0	1	0	5	7	6	5
9	3	0	0	15	0	0	12	0	0	7	10
Total	**94**	**94**	**94**	**94**	**94**	**87**	**93**	**94**	**93**	**94**	**94**
LSI	**5.9**	**4.4**	**4.9**	**6.7**	**4.7**	**2.4**	**4.7**	**5.0**	**5.6**	**4.2**	**4.6**
Screening	**N**	**A**	**N**	**A**	**A**	**N/A**	**N**	**N/A**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.3B: Promising entries with low susceptibility index (<=4.4) and high PI in NSN-H to leaf blast, *Kharif* 2024

P. No	Ent No.	IET NO.	Location/Frequency of scores (0-9)										SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ALM	CBT	GDL	CTK	IIRR	KJT	KHD	LNV	PNP	USG						
66	2412	32343	3	3	3	7	4	2	4	5	1	2	**3.4**	**10**	**6**	**60**	**9**	**90**
23	2305	32317	3	3	3	5	4	1	5	8	2	1	**3.5**	**10**	**6**	**60**	**9**	**90**
8	2508	32361	5	3	4	5	3	2	4	6	4	1	**3.7**	**10**	**4**	**40**	**9**	**90**
77	2423	32354	5	2	5	5	3	2	4	6	2	5	**3.9**	**10**	**4**	**40**	**9**	**90**
2	2502	31420	5	3	4	7	4	5	4	4	2	1	**3.9**	**10**	**3**	**30**	**9**	**90**
78	2424	32355	3	3	3	7	3	2	4	6	1	8	**4.0**	**10**	**6**	**60**	**7**	**70**
21	2303	31386	5	4	4	7	4	2	1	8	3	2	**4.0**	**10**	**4**	**40**	**8**	**80**
41	2323	32333	3	3	3	7	4	2	4	4	6	4	**4.0**	**10**	**4**	**40**	**8**	**80**
67	2413	32344	4	5	5	7	4	3	4	5	2	2	**4.1**	**10**	**3**	**30**	**9**	**90**
22	2304	31389	3	5	6	5	5	2	5	7	3	1	**4.2**	**10**	**4**	**40**	**8**	**80**
60	2406	32338	5	4	4	7	3	2	4	6	5	2	**4.2**	**10**	**3**	**30**	**8**	**80**
4	2504	32358	6	4	4	5	4	7	4	4	2	2	**4.2**	**10**	**2**	**20**	**8**	**80**
57	2403	31415	5	5	6	9	4	1	3	6	2	2	**4.3**	**10**	**4**	**40**	**7**	**70**
56	2402	29654 (R)	6	5	5	7	4	2	4	6	2	2	**4.3**	**10**	**3**	**30**	**7**	**70**
58	2404	31413	5	6	6	5	4	2	5	6	2	2	**4.3**	**10**	**3**	**30**	**7**	**70**
1	2501	31424	3	4	5	7	4	9	5	4	1	2	**4.4**	**10**	**3**	**30**	**8**	**80**
81	HR-12		6	6	6	9	7	5	8	7	8	9	**7.1**	**10**	**0**	**0**	**1**	**10**
94	Tetep		5	2	2	5	1	5	1	2	3	2	**2.8**	**10**	**7**	**70**	**10**	**100**
LSI			**5.9**	**4.4**	**4.9**	**6.7**	**4.7**	**4.7**	**5.0**	**5.6**	**4.2**	**4.6**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **National Hybrid Screening Nursery (NHSN)**

One hundred and thirty-six hybrids that included checks were evaluated at 23 locations against leaf blast disease under national hybrid screening nursery. The frequency distribution of disease scores and the representative location severity index (LSI) are presented in the Table 1.4A. The disease pressure was high (LSI 6-7) at Gangavathi (6.7) and Cuttack (6.5). In most of the centres, location severity index was moderate and that included Gagharghat (5.7), Nawagam (5.4), Lonavala (5.3), Jagdalpur (5.1), Ranchi (4.9), Karjat (4.9), Madya (4.8), Coimbatore (4.8), Nellore (4.6), Khudwani (4.4), IIRR (4.3), Rewa (3.9), Hazaribagh (3.8), Ponnampet (3.6), Mugad (3.6), Uppershillong (3.5) and Imphal (3.0). The Performance of entries at Bikramgunj, Maruteru, Bankura and Wangbal was not considered for identifying promising entries; where the disease pressure was low (LSI<3.0).

None of the hybrid entries found resistant (SI<3.0) against leaf blast in NHSN; however, entries with SI≤4.1 with high PI across the locations considered promising and that included IET# 33035, 33080, 32995, 33018, 33012, 33077, 33053, 33040, 33033,33006, 32998, 33084, 33078, 33082, 33086 and 33005 (Table 1.4B).

- **Donor Screening Nursery (DSN)**

The donor screening nursery comprised of 196 entries including checks were evaluated at 22 locations. The location severity index was high (LSI 6-7) at Almora (6.4), Cuttack (6.3) and Gangavathi (6.1). Most of the centres showed moderate disease pressure (LSI 3-6) and that included Gagharghat (5.9), Mandya (5.3), Hazaribagh (5.3), Uppershillong (5.2), Nawagam (5.1), Ponnampet (4.9), Coimbatore (4.9), Jagdalpur (4.7), IIRR (4.6), Ranchi (4.4), Lonavala (4.3), Nellore (3.8), Karjat (3.7), Mugad (3.7), Bikramgunj (3.7), Rewa (3.5) and Maruteru (3.0). The data from locations *viz*., Imphal and Wangbal were not considered for the selection of promising entries where disease pressure was low (<3.0) (Table 1.5A).

None of the donors showed resistant reaction (SI<3.0), however the donors with severity index ≤3.9 were considered as promising and presented in table 1.5B and that included CBMASP 9014, JGL 47956, CBMASP 6016, JGL 47849, CBMASP 9015, GLB 94, WGL 1537, CBMASP 9013, JGL 47877, GLB 101, N 4823, CB 21515, NWGR-17008, GLB 119, N 733 and GSB 10 (Table 1.5B).

Table 1.4A: Location severity index (LSI) and frequency distribution of leaf blast scores of NHSN, *Kharif* 2024.

Score	Location/Frequency of scores (0-9)																						
	BKG	**BNK**	**CBT**	**CTK**	**GGT**	**GNV**	**HZB**	**IIRR**	**IMP**	**JDP**	**KHD**	**KJT**	**LNV**	**MND**	**MGD**	**MTU**	**NLR**	**NWG**	**PNP**	**RCI**	**REW**	**USG**	**WBL**
0	30	1	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	4	80
1	23	68	0	0	0	0	0	3	4	0	1	7	0	9	20	13	0	0	2	5	0	7	39
2	4	14	5	0	0	1	2	3	29	0	3	22	0	8	0	47	0	0	18	4	0	67	17
3	38	27	16	6	4	1	68	56	76	9	23	15	10	40	67	54	11	1	56	14	62	11	0
4	0	2	40	0	0	15	36	30	20	39	48	14	17	22	0	9	68	21	22	26	29	7	0
5	37	13	44	47	87	19	9	13	6	44	32	9	51	8	38	5	38	70	19	34	41	10	0
6	0	1	30	0	0	23	4	1	0	26	16	16	31	0	0	0	9	23	5	42	4	8	0
7	2	9	1	60	39	21	2	24	0	14	6	40	20	25	10	1	7	10	2	4	0	10	0
8	0	0	0	0	0	31	4	0	0	2	4	0	3	0	0	0	2	6	2	7	0	1	0
9	1	1	0	22	6	23	2	6	0	1	0	7	0	20	0	0	1	4	2	0	0	11	0
Total	**135**	**136**	**136**	**135**	**136**	**134**	**127**	**136**	**135**	**135**	**136**	**131**	**132**	**132**	**135**	**129**	**136**	**135**	**128**	**136**	**136**	**136**	**136**
LSI	**2.6**	**2.4**	**4.6**	**6.5**	**5.7**	**6.7**	**3.8**	**4.3**	**3.0**	**5.1**	**4.4**	**4.9**	**5.3**	**4.8**	**3.6**	**2.6**	**4.6**	**5.4**	**3.6**	**4.9**	**3.9**	**3.5**	**0.5**
SM	**N**	**N**	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**N**	**A**	**A**	**A**	**N**	**N**	**A**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.4B: Promising entries with low susceptibility index (≤ 4.1) and high PI in NHSN to leaf blast, *Kharif* 2024.

S. No	Br. No.	IET No	Location/Frequency of scores (0-9)																			SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			CBT	CTK	GGT	GNV	HZB	IIRR	IMP	JDP	KHD	KJT	LNV	MND	MGD	NLR	NWG	PNP	RCI	REW	USG						
52	2933	33035	4	7	5	5	3	3	3	4	4	1	6	4	3	4	4	3	4	3	2	**3.8**	**19**	**8**	**42**	**17**	**89**
105	3034	33080	4	5	5	6	3	3	3	5	5	2	3	2	3	6	5	3	4	3	3	**3.8**	**19**	**10**	**53**	**17**	**89**
1	2801	32995	6	5	3	6	2	4	3	5	4	6	5	1	3	4	5	3	5	3	1	**3.9**	**19**	**8**	**42**	**16**	**84**
31	2912	33018	5	5	5	4	3	3	3	4	5	2	6	3	1	4	5	2	4	5	5	**3.9**	**19**	**7**	**37**	**18**	**95**
23	2904	33012	4	7	5	9	3	3	1	5	3	3	-	3	3	5	5	5	1	4	2	**3.9**	**18**	**9**	**50**	**16**	**89**
102	3031	33077	4	3	3	7	3	3	4	5	5	7	4	3	1	4	5	3	6	3	2	**3.9**	**19**	**9**	**47**	**16**	**84**
74	3003	33053	4	5	5	6	3	3	2	5	4	7	5	4	1	6	6	2	2	3	2	**3.9**	**19**	**8**	**42**	**15**	**79**
57	2938	33040	6	5	7	9	4	3	2	4	5	1	5	1	3	4	5	3	3	4	2	**4.0**	**19**	**8**	**42**	**16**	**84**
49	2930	33033	5	5	5	9	3	3	2	5	4	3	5	3	5	3	5	1	4	5	2	**4.1**	**19**	**8**	**42**	**18**	**95**
15	2815	33006	6	7	5	5	-	4	3	-	4	-	-	-	1	3	4	-	6	5	0	**4.1**	**13**	**4**	**31**	**10**	**77**
4	2804	32998	6	5	5	9	3	3	3	6	4	2	4	1	5	4	6	3	2	5	2	**4.1**	**19**	**8**	**42**	**15**	**79**
115	3106	33084	5	5	5	6	3	4	3	5	5	2	4	5	3	5	5	2	6	3	2	**4.1**	**19**	**7**	**37**	**17**	**89**
103	3032	33078	4	7	5	6	3	4	5	5	5	2	3	3	1	4	5	3	6	5	2	**4.1**	**19**	**7**	**37**	**16**	**84**
111	3102	33082	4	9	5	6	4	3	3	4	2	1	4	2	3	5	5	2	5	5	6	**4.1**	**19**	**7**	**37**	**16**	**84**
119	3110	33086	4	5	5	6	3	3	3	5	5	1	4	5	5	4	6	3	1	3	7	**4.1**	**19**	**7**	**37**	**16**	**84**
13	2813	33005	4	7	5	8	3	4	1	4	5	4	4	1	3	4	6	3	6	4	2	**4.1**	**19**	**6**	**32**	**15**	**79**
120	HR-12		6	9	5	9	8	9	4	8	8	7	6	9	7	7	9	9	8	3	7	**7.3**	**19**	**1**	**5**	**3**	**16**
133	Tetep		2	5	7	4	3	1	3	3	1	6	3	2	1	5	4	3	1	3	6	**3.3**	**19**	**12**	**63**	**16**	**84**
LSI			**4.6**	**6.5**	**5.7**	**6.7**	**3.8**	**4.3**	**3.0**	**5.1**	**4.4**	**4.9**	**5.3**	**4.8**	**3.6**	**4.6**	**5.4**	**3.6**	**4.9**	**3.9**	**3.5**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 1.5A: Location severity index (LSI) and frequency distribution of leaf blast scores of DSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)																					
	ALM	**BKG**	**CBT**	**CTK**	**GGT**	**GNV**	**HZB**	**IIRR**	**IMP**	**JDP**	**KJT**	**LNV**	**MND**	**MGD**	**MTU**	**NLR**	**NWG**	**PNP**	**RCI**	**REW**	**USG**	**WBL**
0	0	15	0	0	0	0	0	0	16	0	1	0	0	0	0	0	0	0	0	0	10	97
1	0	8	0	0	0	0	0	2	31	1	36	0	21	16	13	7	0	12	6	17	4	73
2	0	5	0	0	0	0	3	0	23	1	38	11	13	0	32	13	1	27	5	92	43	26
3	2	80	20	7	1	0	34	29	13	64	19	71	44	102	91	47	3	38	54	0	15	0
4	3	3	37	0	0	49	44	70	3	36	25	41	12	0	38	73	29	13	38	27	12	0
5	34	64	88	78	62	26	21	54	2	28	16	23	14	61	10	39	106	23	35	20	17	0
6	67	2	40	0	0	45	27	13	1	32	13	17	0	0	3	13	37	14	45	20	15	0
7	54	15	11	89	41	22	39	23	1	13	26	13	22	10	0	0	13	12	9	9	20	0
8	30	0	0	0	0	19	13	0	0	16	0	6	0	0	0	0	0	19	4	11	22	0
9	1	0	0	21	6	26	6	2	0	0	7	4	60	0	0	0	0	28	0	0	38	0
Total	**191**	**192**	**196**	**195**	**110**	**187**	**187**	**193**	**90**	**191**	**181**	**186**	**186**	**189**	**187**	**192**	**189**	**186**	**196**	**196**	**196**	**196**
LSI	**6.4**	**3.7**	**4.9**	**6.3**	**5.9**	**6.1**	**5.3**	**4.6**	**1.7**	**4.7**	**3.7**	**4.3**	**5.3**	**3.7**	**3.0**	**3.8**	**5.1**	**4.9**	**4.4**	**3.5**	**5.2**	**0.6**
SM	**N**	**N**	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**N**	**A**	**N**	**A**	**A**	**A**	**N**	**N**	**A**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.5B: Promising entries with low susceptibility index (≤ 3.9) and high PI in DSN to leaf blast, *Kharif* 2024.

P.No.	Desgn.	Location/Frequency of scores (0-9)																				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		ALM	BKG	CBT	CTK	GGT	GNV	HZB	IIRR	JDP	KJT	LNV	MND	MGD	MTU	NLR	NWG	PNP	RCI	REW	USG						
37	CBMASP 9014	5	0	3	7	5	4	3	4	3	1	3	1	3	1	3	6	1	5	2	2	**3.1**	**20**	**13**	**65**	**18**	**90**
4	JGL 47856	5	3	4	3	5	4	3	5	3	2	2	5	5	1	4	-	2	2	1	0	**3.1**	**19**	**11**	**58**	**19**	**100**
39	CBMASP 9016	5	3	5	5	5	4	3	4	4	1	3	3	3	1	3	5	2	3	4	2	**3.4**	**20**	**11**	**55**	**20**	**100**
3	JGL 47849	5	5	6	5	3	5	3	7	3	2	2	3	3	3	2	6	1	2	2	1	**3.5**	**20**	**13**	**65**	**17**	**85**
38	CBMASP 9015	6	3	6	7	5	4	3	4	3	1	3	1	3	2	4	5	1	6	2	2	**3.6**	**20**	**11**	**55**	**16**	**80**
121	GLB 94	6	4	3	7	-	7	6	5	4	1	3	3	3	1	2	4	1	3	2	3	**3.6**	**19**	**11**	**58**	**15**	**79**
8	WGL 1537	5	3	5	7	5	6	3	5	3	3	3	1	5	2	3	5	2	3	2	1	**3.6**	**20**	**12**	**60**	**18**	**90**
36	CBMASP 9013	6	1	5	7	7	5	2	4	4	1	3	3	3	3	3	6	2	3	2	2	**3.6**	**20**	**12**	**60**	**16**	**80**
6	JGL 47877	5	3	4	5	5	4	4	5	4	2	3	3	-	3	-	6	4	4	1	2	**3.7**	**18**	**7**	**39**	**17**	**94**
122	GLB 101	7	3	5	7	-	6	5	4	5	1	2	3	3	2	2	6	2	3	4	3	**3.8**	**19**	**10**	**53**	**15**	**79**
85	N 4823	6	-	3	5	5	5	-	4	-	-	3	-	3	-	4	5	-	6	1	0	**3.8**	**13**	**5**	**38**	**11**	**85**
31	CB 21515	6	2	4	7	7	6	3	4	3	2	3	1	3	2	4	5	3	6	2	5	**3.9**	**20**	**10**	**50**	**15**	**75**
21	NWGR-17008	5	3	3	5	5	-	-	7	5	-	3	-	-	-	5	-	-	4	2	0	**3.9**	**12**	**5**	**42**	**11**	**92**
124	GLB 119	7	3	4	7	-	6	4	5		1	3	2	3	1	1	5	2	6	5	6	**3.9**	**18**	**8**	**44**	**13**	**72**
86	N 733	7	3	4	7	7	8	4	3	3	-	3	2	3	2	5	5	3	2	2	2	**3.9**	**19**	**11**	**58**	**15**	**79**
135	GSB 10	6	3	4	5	-	6	5	5	4	1	4	7	3	3	4	5	3	4	2	1	**3.9**	**19**	**7**	**37**	**16**	**84**
186	HR-12	8	5	6	9	-	5	8	9	8	9	7	9	5	3	5	5	4	4	5	6	**6.3**	**19**	**1**	**5**	**9**	**47**
119	Tetep	5	3	5	5	-	-	4	1	3	2	5	1	1	2	5	5	2	6	1	2	**3.2**	**18**	**10**	**56**	**17**	**94**
LSI		**6.4**	**3.7**	**4.9**	**6.3**	**5.9**	**6.1**	**5.3**	**4.6**	**4.7**	**3.7**	**4.3**	**5.3**	**3.7**	**3.0**	**3.8**	**5.1**	**4.9**	**4.4**	**3.5**	**5.2**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

❖ TRIAL No.2: SCREENING FOR NECK BLAST RESISTANCE

➢ NSN-1

During *Kharif* 2024, the National Screening Nursery-1 (NSN-1) comprised of 481 entries were evaluated for neck blast disease at nine locations across India. The entries were screened under natural infection conditions in all the centres except at Mandya, Nellore and Rajendranagar, where artificial method of screening was followed. The frequency distribution of disease scores and location severity indices are presented in Table 2.1A. None of the locations showed very high (LSI >7.0) location severity index. The highest location severity was observed in Jagdalpur (6.0) while the lowest at Bankura (1.9). The disease pressure was moderate (LSI 3-6) at all the locations that included Jagdalpur (6.0), Mandya (5.6), Nawagam (5.0), Ponnampet (4.9), Nellore (4.8), Rajendranagar (3.6), and Lonavala (3.1). The disease pressure at Karaikal and Bankura was low (LSI<3) and hence these locations data was not considered for selection of best entries.

The selection of promising entries was done based on the data of those locations where LSI was more than 3.0 and presented in Table 2.1B. Entries which scored SI ≤ 3.3, which was on par with Tetep was considered highly promising and that included IET # 31120, 32065, 31733, 30617, 32061, 30603, 32844, 30907, 30649, 30561, 31461, 32987, 32984, 30613 and 31839 (Table 2.1B).

➢ NSN-2

A total of 672 entries were evaluated under NSN-2 at six different locations during *Kharif* 2024. The screening was done under natural infection condition at all the locations except at Mandya. The location severity index and frequency distribution of scores presented in the Table 2.2A indicated that, none of the locations showed very high (LSI ≥7.0) and high (LSI 6-7) disease pressure. All the locations recorded moderate disease pressure (LSI 3-6) and that included Nellore (5.7), Mandya (5.5), Nawagam (4.9), Ponnampet (4.8), Jagdalpur (3.9), and Mugad (3.2). The selection of promising entries was done based on the data of all the locations.

The entries that had shown low disease scores (≤3.0) across the locations were listed in Table 2.2B and that included IET# 32542, 32871, 32928, 32800, 32804, 32495, 32538, 32648, 32772 and 32956.

➢ NSN-H

A total of 94 entries including checks was evaluated under NSN-hills nursery at five different locations across India under hill ecosystem. The entries were screened under natural infection condition at all the locations. The location severity index and frequency distribution of scores were presented in the Table 2.3A. The disease pressure was moderate (LSI 3-6) at three locations *viz*., Malan (4.9), Ponnampet (4.5) and Almora (3.9). The disease pressure was low at Lonavala (2.5) and Imphal (2.1) and hence data from these two locations not considered for selection of promising entries.

The entries found resistant with SI≤3.0 listed in Table 2.3B which included IET# 32325, 31415, 32362, 32329, 32331, 32372, 32360, 32357, 31420, 32358, 32330, 32342 and 32344.

Table 2.1A: Location severity index (LSI) and frequency distribution of Neck blast scores of NSN-1, *Kharif* 2024.

Score	Location/Frequency of scores (0-9)								
	BNK	**JDP**	**KRK**	**LNV**	**MND**	**NLR**	**NWG**	**PNP**	**RNR**
0	161	1	162	0	0	0	0	0	116
1	131	7	131	73	15	26	0	27	40
2	13	0	0	4	0	0	0	0	0
3	101	44	83	275	99	56	77	142	51
4	0	0	0	0	0	0	0	0	0
5	35	176	55	98	160	307	329	158	196
6	0	0	0	2	0	0	3	0	0
7	22	194	29	0	100	65	68	106	74
8	0	0	0	0	0	0	0	0	0
9	13	51	8	0	79	0	0	32	2
Total	**476**	**473**	**468**	**452**	**453**	**454**	**477**	**465**	**479**
LSI	**1.9**	**6.0**	**2.0**	**3.1**	**5.6**	**4.8**	**5.0**	**4.9**	**3.6**
Screening	**N**	**N**	**N**	**N**	**A**	**A**	**N**	**N**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 2.1B: Promising entries with low susceptibility index (≤3.3) and high PI in NSN-1 to Neck blast, *Kharif* 2024.

S.No.	Br. No.	IET No.	Location/Frequency of scores (0-9)							SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			JDP	LNV	MND	NLR	NWG	PNP	RNR						
323	**5509**	31120	1	1	1	1	3	5	1	**1.9**	**7**	**6**	**86**	**7**	**100**
435	**5933**	32065	5	1	1	5	5	1	0	**2.6**	**7**	**4**	**57**	**7**	**100**
223	**3917**	31733	5	3	3	1	5	1	1	**2.7**	**7**	**5**	**71**	**7**	**100**
172	**3705**	30617 (H)	7	3	1	1	3	5	0	**2.9**	**7**	**5**	**71**	**6**	**86**
421	**5919**	32061	5	3	5	1	5	1	0	**2.9**	**7**	**4**	**57**	**7**	**100**
168	**3701**	30603 (H)	7	1	1	3	5	1	3	**3.0**	**7**	**5**	**71**	**6**	**86**
289	**5127**	32844	5	3	5	1	5	3	0	**3.1**	**7**	**4**	**57**	**7**	**100**
379	**4109**	30907(R)	5	3	3	1	5	5	0	**3.1**	**7**	**4**	**57**	**7**	**100**
97	**3515**	30649	5	3	-	-	5	-	0	**3.3**	**4**	**2**	**50**	**4**	**100**
2	**3302**	30561 (H)	7	1	1	3	3	3	5	**3.3**	**7**	**5**	**71**	**6**	**86**
109	**3527**	31461 (H)	5	3	1	5	5	1	3	**3.3**	**7**	**4**	**57**	**7**	**100**
451	**5949**	32987	3	5	3	5	5	1	1	**3.3**	**7**	**4**	**57**	**7**	**100**
447	**5945**	32984	3	1	5	5	7	1	1	**3.3**	**7**	**4**	**57**	**6**	**86**
169	**3702**	30613(H)	7	-	1	3	5	3	1	**3.3**	**6**	**4**	**67**	**5**	**83**
255	**4320**	31839	-	3	-	-	7	-	0	**3.3**	**3**	**2**	**67**	**2**	**67**
225	HR-12		9	3	9	7	7	9	7	**7.3**	**7**	**1**	**14**	**1**	**14**
121	Tetep		1	1	9	3	3	3	3	**3.3**	**7**	**6**	**86**	**6**	**86**
LSI			**6.0**	**3.1**	**5.6**	**4.8**	**5.0**	**4.9**	**3.6**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 2.2A: Location severity index (LSI) and frequency distribution of Neck blast scores of NSN-2, *Kharif* 2024.

Score	Location/Frequency of scores (0-9)					
	JDP	MGD	MND	NLR	NWG	PNP
0	1	0	0	0	0	0
1	135	103	23	0	0	65
2	0	0	0	0	0	0
3	197	392	138	12	146	191
4	0	0	0	0	1	0
5	244	166	241	428	403	212
6	0	0	0	0	3	0
7	73	2	130	197	106	141
8	0	0	0	0	0	0
9	17	0	114	24	0	53
Total	**667**	**663**	**646**	**661**	**659**	**662**
LSI	**3.9**	**3.2**	**5.5**	**5.7**	**4.9**	**4.8**
Screening	**N**	**N**	**A**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 2.2B: Promising entries with low susceptibility index (≤3.0) and high PI in NSN-2 to Neck blast, *Kharif* 2024

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)						SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			JDP	MGD	MND	NLR	NWG	PNP						
252	3855	32542	3	1	-	-	3	3	**2.5**	**4**	**4**	**100**	**4**	**100**
656	5421	32871	3	3	1	5	3	1	**2.7**	**6**	**5**	**83**	**6**	**100**
487	6014	32928	-	3	-		3	-	**3.0**	**2**	**2**	**100**	**2**	**100**
134	5008	32800	1	1	3	5	3	5	**3.0**	**6**	**4**	**67**	**6**	**100**
139	5013	32804	1	1	3	5	5	3	**3.0**	**6**	**4**	**67**	**6**	**100**
201	3804	32495	1	3	3	5	5	1	**3.0**	**6**	**4**	**67**	**6**	**100**
248	3851	32538	5	1	1	5	3	3	**3.0**	**6**	**4**	**67**	**6**	**100**
376	4241	32648	1	5	3	5	3	1	**3.0**	**6**	**4**	**67**	**6**	**100**
577	4650	32772	1	5	3	5	3	1	**3.0**	**6**	**4**	**67**	**6**	**100**
521	6049	32956	1	1	1	5	5	5	**3.0**	**6**	**3**	**50**	**6**	**100**
662	HR-12		7	7	9	9	7	9	**8.0**	**6**	**0**	**0**	**0**	**0**
462	Tetep		1	1	3	5	3	3	**2.7**	**6**	**5**	**83**	**6**	**100**
LSI			**3.9**	**3.2**	**5.5**	**5.7**	**4.9**	**4.8**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 2.3A: Location severity index (LSI) and frequency distribution of Neck blast scores of NSN-H, *Kharif* 2024

Score	Location/Frequency of scores (0-9)				
	ALM	IMP	LNV	MLN	PNP
0	0	19	0	17	0
1	10	26	26	0	7
2	0	0	0	0	0
3	36	30	65	9	31
4	0	0	0	0	0
5	33	5	2	39	38
6	0	0	0	0	0
7	9	6	0	11	15
8	0	0	0	0	0
9	0	0	0	17	3
Total	**88**	**86**	**93**	**93**	**94**
LSI	**3.9**	**2.1**	**2.5**	**4.9**	**4.5**
Screening	**N**	**N**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 2.3B: Promising entries with low susceptibility index (<=3.0) and high PI in NSN-H to neck blast, *Kharif* 2024

P No	Ent No.	IET No.	Location/Frequency of scores (0-9)			SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ALM	MLN	PNP						
33	2315	32325	1	0	3	**1.3**	**3**	**3**	**100**	**3**	**100**
57	2403	31415	-	0	3	**1.5**	**2**	**2**	**100**	**2**	**100**
9	2509	32362	3	0	3	**2.0**	**3**	**3**	**100**	**3**	**100**
37	2319	32329	3	0	3	**2.0**	**3**	**3**	**100**	**3**	**100**
39	2321	32331	3	0	3	**2.0**	**3**	**3**	**100**	**3**	**100**
52	2606	32372	3	0	3	**2.0**	**3**	**3**	**100**	**3**	**100**
7	2507	32360	1	0	5	**2.0**	**3**	**2**	**67**	**3**	**100**
3	2503	32357	3	3	1	**2.3**	**3**	**3**	**100**	**3**	**100**
2	2502	31420	1	5	1	**2.3**	**3**	**2**	**67**	**3**	**100**
4	2504	32358	3	0	5	**2.7**	**3**	**2**	**67**	**3**	**100**
38	2320	32330	5	0	3	**2.7**	**3**	**2**	**67**	**3**	**100**
64	2410	32342	5	0	3	**2.7**	**3**	**2**	**67**	**3**	**100**
67	2413	32344	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
94	Tetep		3	9	5	**5.7**	**3**	**1**	**33**	**2**	**67**
81	HR-12		-	7	9	**8.0**	**2**	**0**	**0**	**0**	**0**
LSI			**3.9**	**4.9**	**4.5**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NHSN**

The National Hybrid Screening Nursery (NHSN) was evaluated for their resistance to neck blast at nine hot spot locations. The entries were screened by natural infection conditions at most of the locations except at Mandya and Rajendranagar where artificial method of screening was followed. The frequency distribution of disease score and location severity index (LSI) was presented in the Table 2.4A. The disease pressure was highest at Mandya (LSI 5.1) while it was lowest at Imphal (2.6). The disease pressure was moderate (LSI 3-6) at most of the locations and that included Mandya (5.1), Nawagam (5.0), Malan (4.4), Jagdalpur (4.4), Mugad (3.3), Rajendranagar (3.1) and Lonavala (3.0). The disease pressure was low (LSI≤3.0) at Bankura (2.8) and Imphal (2.6), hence performance of entries from these locations was not considered for selecting the promising entries.

Based on the performance of entries across the seven locations, the entries found resistant (SI ≤ 3.0) to neck blast were presented in table 2.4B. Entries IET# 33078, 33080, 33006, 33026, 33068, 33030, 33025, 33070, 33038, 33020, 33034, 33051, 33039, 33035 and 33060 were found resistant (SI ≤ 3.0) (Table 2.4B).

Table 2.4A: Location severity index (LSI) and frequency distribution of neck blast scores of NHSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)								
	BNK	**IMP**	**JDP**	**LNV**	**MLN**	**MND**	**MGD**	**NWG**	**RNR**
0	25	16	3	0	34	0	0	0	15
1	35	35	18	17	0	10	20	0	31
2	10	0	0	0	0	0	0	0	0
3	19	60	33	104	11	27	73	22	34
4	0	1	0	0	0	0	0	0	0
5	37	15	50	15	55	61	42	90	50
6	0	0	0	0	0	0	0	0	0
7	0	8	28	0	14	16	0	21	5
8	0	0	0	0	0	0	0	0	0
9	10	0	3	0	22	18	0	2	0
Total	**136**	**135**	**135**	**136**	**136**	**132**	**135**	**135**	**135**
LSI	**2.8**	**2.6**	**4.4**	**3.0**	**4.4**	**5.1**	**3.3**	**5.0**	**3.1**
Screening	**N**	**N**	**N**	**N**	**N**	**A**	**N**	**N**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 2.4B: Promising entries with low susceptibility index (≤3.0) and high PI in NHSN to Neck blast, *Kharif* 2024.

P. No.	Br No.	IET No.	Location/Frequency of scores (0-9)							SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			JDP	LNV	MLN	MND	MGD	NWG	RNR						
103	3032	33078	3	3	0	1	1	5	0	**1.9**	**7**	**6**	**86**	**7**	**100**
105	3034	33080	1	3	0	1	3	5	1	**2.0**	**7**	**6**	**86**	**7**	**100**
15	2815	33006	-	1	5	-	1	5	0	**2.4**	**5**	**3**	**60**	**5**	**100**
40	2921	33026	3	3	0	3	3	5	0	**2.4**	**7**	**6**	**86**	**7**	**100**
92	3021	33068	1	3	3	1	3	5	1	**2.4**	**7**	**6**	**86**	**7**	**100**
45	2926	33030	5	1	0	1	3	7	0	**2.4**	**7**	**5**	**71**	**6**	**86**
39	2920	33025	3	3	0	3	3	5	1	**2.6**	**7**	**6**	**86**	**7**	**100**
95	3024	33070	1	3	0	5	3	5	1	**2.6**	**7**	**5**	**71**	**7**	**100**
55	2936	33038	3	5	0	5	3	3	0	**2.7**	**7**	**5**	**71**	**7**	**100**
33	2914	33020	3	3	0	3	3	5	3	**2.9**	**7**	**6**	**86**	**7**	**100**
50	2931	33034	3	3	0	3	3	7	1	**2.9**	**7**	**6**	**86**	**6**	**86**
72	3001	33051	5	3	0	3	5	3	1	**2.9**	**7**	**5**	**71**	**7**	**100**
56	2937	33039	3	3	5	3	3	3	1	**3.0**	**7**	**6**	**86**	**7**	**100**
52	2933	33035	1	5	3	5	3	3	1	**3.0**	**7**	**5**	**71**	**7**	**100**
83	3012	33060	3	1	5	5	1	5	1	**3.0**	**7**	**4**	**57**	**7**	**100**
120	HR-12		9	3	7	9	5	7	5	**6.4**	**7**	**1**	**14**	**3**	**43**
106	Tetep		3	3	0	1	1	5	3	**2.3**	**7**	**6**	**86**	**7**	**100**
LSI			**4.4**	**3.0**	**4.4**	**5.1**	**3.3**	**5.0**	**3.1**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

➢ DSN

The Donor Screening Nursery (DSN) was evaluated for resistance to neck blast at eight locations across India. The entries were screened under natural infection condition at all the locations except at Mandya and Rajendranagar; where artificial method of screening was followed. The frequency distribution of disease scores and location severity index (LSI) were presented in Table 2.5A. The location severity index was moderate (LSI 3-6) at most of the locations *viz*., Mandya (5.1), Nawagam (5.0), Jagdalpur (3.7) and Mugad (3.6). The selection of promising donors in DSN was done based on the reaction at those locations where LSI was ≥3.0, accordingly data from Lonavala, Rajendranagar, Almora and Imphal was not considered.

Based on the performance of entries across the four locations, the list of promising donors presented in Table 2.5B and that included NWGR-17048, NWGR-17008, WGL 2033, N 4824, N 4925, N 4933, GLB 94, JGL 47870, CBMASP 9013, CBMASP 9015, CBMASP 9016, CBMASP 9017, BPT 3507, GSB 9, ISHB 9, ISHB 10, ISHB 11, ISHB 23, ISHB 29, ISHB 30 and ISHB 34 (Table 2.5B).

Table 2.5A: Location severity index (LSI) and frequency distribution of Neck blast scores of DSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)							
	ALM	**IMP**	**JDP**	**LNV**	**MGD**	**MND**	**NWG**	**RNR**
0	0	65	6	0	0	0	0	73
1	122	15	39	45	14	16	0	29
2	0	0	0	0	0	0	0	0
3	15	10	59	141	116	29	23	14
4	0	0	0	0	0	0	0	0
5	12	0	68	1	49	92	142	64
6	0	0	0	0	0	0	0	0
7	22	0	21	0	10	25	24	10
8	0	0	0	0	0	0	0	0
9	0	0	2	0	0	24	0	0
Total	**171**	**90**	**195**	**187**	**189**	**186**	**189**	**190**
LSI	**2.2**	**0.5**	**3.7**	**2.5**	**3.6**	**5.1**	**5.0**	**2.4**
Screening	**N**	**N**	**N**	**N**	**N**	**A**	**N**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 2.5B: Promising entries with low susceptibility index (≤3.0) and high PI in DSN to Neck blast, *Kharif* 2024.

S.No.	Design	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		JDP	MGD	MND	NWG						
22	NWGR-17048	0	-	-	-	**0.0**	**1**	**1**	**100**	**1**	**100**
21	NWGR-17008	1	-	-	-	**1.0**	**1**	**1**	**100**	**1**	**100**
17	WGL 2033	1	3	1	5	**2.5**	**4**	**3**	**75**	**4**	**100**
87	N 4824	0	5	-	-	**2.5**	**2**	**1**	**50**	**2**	**100**
88	N 4925	0	-	-	5	**2.5**	**2**	**1**	**50**	**2**	**100**
89	N 4933	0	5	-	-	**2.5**	**2**	**1**	**50**	**2**	**100**
121	GLB 94	3	3	3	3	**3.0**	**4**	**4**	**100**	**4**	**100**
5	JGL 47870	1	3	5	3	**3.0**	**4**	**3**	**75**	**4**	**100**
36	CBMASP 9013	3	3	1	5	**3.0**	**4**	**3**	**75**	**4**	**100**
38	CBMASP 9015	3	3	1	5	**3.0**	**4**	**3**	**75**	**4**	**100**
39	CBMASP 9016	3	3	1	5	**3.0**	**4**	**3**	**75**	**4**	**100**
40	CBMASP 9017	3	3	1	5	**3.0**	**4**	**3**	**75**	**4**	**100**
78	BPT 3507	5	3	1	3	**3.0**	**4**	**3**	**75**	**4**	**100**
134	GSB 9	3	3	1	5	**3.0**	**4**	**3**	**75**	**4**	**100**
160	ISHB 9	1	3	3	5	**3.0**	**4**	**3**	**75**	**4**	**100**
161	ISHB 10	1	3	1	7	**3.0**	**4**	**3**	**75**	**4**	**100**
162	ISHB 11	1	3	3	5	**3.0**	**4**	**3**	**75**	**4**	**100**
174	ISHB 23	1	3	3	5	**3.0**	**4**	**3**	**75**	**4**	**100**
176	ISHB 29	1	3	3	5	**3.0**	**4**	**3**	**75**	**4**	**100**
177	ISHB 30	3	3	1	5	**3.0**	**4**	**3**	**75**	**4**	**100**
181	ISHB 34	1	3	5	3	**3.0**	**4**	**3**	**75**	**4**	**100**
186	HR-12	7	3	9	5	**6.0**	**4**	**1**	**25**	**4**	**100**
119	Tetep	5	1	3	5	**3.5**	**4**	**2**	**50**	**4**	**100**
LSI		**3.7**	**3.6**	**5.1**	**5.0**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

TRIAL No.3: SCREENING FOR BROWN SPOT RESISTANCE

- **NSN-1**

The National Screening Nursery (NSN-1) comprised of 481 entries evaluated at 19 locations across India under different-agro ecological Zones. The entries were screened under natural infection conditions at most of the centres except at Coimbatore, Gangavathi, Chinsurah, IIRR, Ludhiana and Pusa; where screening was conducted under artificial inoculation with spore suspension. The frequency distribution of disease scores and the representative location severity index (LSI) were presented in Table 3.1A. The disease pressure was highest at Gangavathi (8.3), while it was lowest at Sabour (1.4). The disease pressure was very high (LSI≥7.0) at Gangavathi (8.3), Chinsurah (7.5), IIRR (7.4); high (LSI 6-7) at Pusa (6.9) and Ludhiana (6.6). In most of the locations, the disease pressure was moderate (LSI 3-6) and that included Gagharghat (5.8), Khudwani (5.5), Hazaribagh (5.4), Rewa (5.4), Chatha (5.0), Gudalur (4.9), Ponnampet (4.7), Coimbatore (4.5), Bankura (4.3), Jagdalpur (4.0), Bikramgunj (3.6), and Uppershillong (3.4). The disease pressure at Lonavala (2.5) and Sabour (1.4) was low, hence performance of entries from these locations was not considered in selection of best entries.

None of the entry was found resistant (SI≤3.0) against brown spot disease under NSN-1; however, a few promising entries with low SI (≤4.8) across the centres included IET# 30819, 31630, 31998, 31733, 32963, 30641, 32964, 31509 and 30957 (Table 3.1B).

- **NSN-2**

A total of 672 entries including different checks were screened under NSN- 2 at 14 locations across the India for brown spot disease. The entries were screened under artificial inoculation conditions at Coimbatore, Gangavathi, IIRR, Ludhiana and Pusa; while it was under natural infection condition at remaining locations. The frequency distribution of disease scores and the representative location severity index (LSI) are presented in the Table 3.2A. The disease pressure was highest and lowest at Gangavathi (8.5) and Sabour (1.5) respectively. The disease pressure was very high (LSI ≥ 7.0) at Ganagavathi (8.5), IIRR (7.8) and Pusa (7.1); high (LSI 6-7) at Hazaribagh (6.6), Ludhiana (6.0) and Gagharghat (6.0). Moderate (LSI 3-6) disease pressure was recorded at Coimbatore (5.3), Chatha (5.2), Khudwani (5.0), Rewa (4.8), Ponnampet (4.4) and Jagdalpur (3.1) (Table 3.2A). The disease pressure at Sabour was low, hence data from this centre, not considered for selection of promising entries.

The entries with low SI (≤4.7) and high PI across the locations were considered promising and presented in Table 3.2B. None of the entries were found resistant, however some of the promising entries included IET# 32609, 32512, 32553, 32736, 32786, 32537, 32797, 32684, 32432, 32953, 32743, 32791 and 32652 (Table 3.2B).

Table 3.1A: Location severity index (LSI) and frequency distribution of brown spot scores of NSN-1, *Kharif* 2024

Score	Location/Frequency of scores (0-9)																		
	BKG	**BNK**	**CBT**	**CHN**	**CHT**	**GDL**	**GGT**	**GNV**	**HZB**	**IIRR**	**JDP**	**KHD**	**LDN**	**LNV**	**PNP**	**PSA**	**REW**	**SBR**	**USG**
0	40	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	62
1	83	52	0	0	1	0	0	0	0	0	0	0	0	1	2	0	0	374	116
2	0	34	15	0	17	4	0	0	0	0	55	0	0	285	20	0	13	0	78
3	150	189	77	0	59	40	2	0	2	0	120	9	14	126	104	0	54	93	4
4	0	0	132	0	60	122	0	0	10	6	120	90	0	6	79	0	93	0	12
5	105	78	179	47	200	189	209	1	220	9	120	168	67	32	138	2	101	4	58
6	0	2	73	0	71	105	89	2	117	55	53	117	0	2	31	58	93	0	62
7	87	65	3	269	51	19	13	65	26	177	5	60	362	0	76	372	62	0	58
8	0	1	0	1	14	0	67	195	1	179	0	29	1	0	6	31	54	0	26
9	0	54	0	162	2	0	0	212	0	48	0	0	1	0	9	1	9	0	3
Total	**465**	**477**	**479**	**479**	**475**	**479**	**380**	**475**	**376**	**474**	**473**	**473**	**445**	**452**	**465**	**464**	**479**	**474**	**479**
LSI	**3.6**	**4.3**	**4.5**	**7.5**	**5.0**	**4.9**	**5.8**	**8.3**	**5.4**	**7.4**	**4.0**	**5.5**	**6.6**	**2.5**	**4.7**	**6.9**	**5.4**	**1.4**	**3.4**
Screening	**N**	**N**	**A**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**N**	**N**	**A**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 3.1B: Promising entries with low susceptibility index (<=4.8) and high PI in NSN-1 to brown spot, *Kharif* 2024

P.No.	Br. No.	IET No.	Location/Frequency of scores (0-9)																	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			BKG	BNK	CBT	CHN	CHT	GDL	GGT	GNV	HZB	IIRR	JDP	KHD	LDN	PNP	PSA	REW	USG						
176	3709	30819	0	1	4	7	5	4	5	9	5	7	5	-	3	5	7	4	0	**4.4**	**16**	**4**	**25**	**12**	**75**
202	3736	31630	0	1	2	7	6	4	5	8	5	7	5	7	7	3	7	3	0	**4.5**	**17**	**6**	**35**	**10**	**59**
316	5502	31998	1	3	4	7	2	4	5	8	5	6	3	4	7	5	6	6	1	**4.5**	**17**	**5**	**29**	**11**	**65**
223	3917	31733	1	1	3	5	4	4	5	8	7	8	2	5	7	7	7	5	1	**4.7**	**17**	**5**	**29**	**11**	**65**
403	5901	32963	0	3	4	7	5	4	-	8	6	8	5	4	7	3	7	3	2	**4.8**	**16**	**5**	**31**	**10**	**63**
5	3305	30641	1	3	3	9	5	4	6	6	6	6	6	6	3	5	7	5	1	**4.8**	**17**	**5**	**29**	**9**	**53**
404	5902	32964	7	5	2	5	3	4	-	7	6	7	3	5	7	2	7	6	1	**4.8**	**16**	**5**	**31**	**9**	**56**
25	3325	31509	1	1	5	9	4	5	6	8	5	7	3	6	5	5	7	3	2	**4.8**	**17**	**5**	**29**	**11**	**65**
237	4302	30957	3	3	4	9	3	4	5	7	5	8	2	6	7	5	7	4	0	**4.8**	**17**	**5**	**29**	**11**	**65**
475	CO-39		7	7	7	7	5	7	-	9	5	9	4	8	7	5	7	5	2	**6.3**	**16**	**1**	**6**	**6**	**38**
233	CH-45		3	2	3	9	5	3	6	7	7	4	3	6	7	5	7	3	0	**4.7**	**17**	**7**	**41**	**10**	**59**
224	Tetep		0	1	4	9	5	4	5	7	5	5	2	5	5	4	7	4	0	**4.2**	**17**	**4**	**24**	**14**	**82**
LSI			**3.6**	**4.3**	**4.5**	**7.5**	**5.0**	**4.9**	**5.8**	**8.3**	**5.4**	**7.4**	**4.0**	**5.5**	**6.6**	**4.7**	**6.9**	**5.4**	**3.4**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 3.2A: Location severity index (LSI) and frequency distribution of brown spot scores of NSN-2, *Kharif* 2024

Score	Location/Frequency of scores (0-9)													
	BKG	CBT	CHT	GGT	GNV	HZB	IIRR	JDP	KHD	LDN	PNP	PSA	REW	SBR
0	45	0	0	0	0	0	0	63	0	0	0	0	0	0
1	189	0	1	0	0	0	0	72	0	1	14	0	3	505
2	0	5	22	0	0	0	0	120	0	0	47	0	37	0
3	253	57	67	2	0	6	0	116	38	61	184	0	117	154
4	0	153	74	1	0	8	12	101	193	0	79	0	154	0
5	72	179	259	339	1	15	8	79	238	195	198	3	134	9
6	0	140	104	170	0	201	26	71	132	0	44	77	138	0
7	109	95	99	1	101	215	152	26	37	410	72	446	53	0
8	0	43	30	158	148	49	305	18	26	0	15	145	33	0
9	0	0	9	1	409	7	163	1	4	0	9	0	3	0
Total	**668**	**672**	**665**	**672**	**659**	**501**	**666**	**667**	**668**	**667**	**662**	**671**	**672**	**668**
LSI	**3.1**	**5.3**	**5.2**	**6.0**	**8.5**	**6.6**	**7.8**	**3.3**	**5.0**	**6.0**	**4.4**	**7.1**	**4.8**	**1.5**
Screening	**N**	**A**	**N**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**N**	**A**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

➢ **NSN-H**

The National Screening Nursery - Hills (NSN-H) was evaluated for their resistance to brown spot at six locations *viz*., Almora, Coimbatore, IIRR, Khudwani, Lonavala and Ponnampet. These entries were screened through natural method in all the locations except at IIRR and Coimbatore, where disease was created artificially by inoculating pathogen. The frequency distribution of disease scores and location severity indices are presented in Table 3.3A. The disease pressure was very high (LSI >7) at Almora (7.7) and IIRR (7.2); while it was moderate (LSI 3-6) at Khudwani (5.5), Coimbatore (4.7), and Ponnampet (4.3). The disease pressure was low (LSI <3.0) at Lonavala (2.4). None of the entries found resistant against brown spot (SI≤3.0); however, few entries having moderate resistance reaction included IET# 30513, 32371, 31415 and 32332 (Table 3.3B). Other entries with low SI (≤5.2) and high PI included IET# 31424, 32343, 32362 and 32358.

Table 3.2B: Promising entries with low susceptibility index (<=4.7) and high PI in NSN-2 to brown spot, *Kharif* 2024

P.No.	Br. No.	IET No.	Location/Frequency of scores (0-9)													SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			BKG	CBT	CHT	GGT	GNV	HZB	IIRR	JDP	KHD	LDN	PNP	PSA	REW						
322	4062	32609	3	5	3	5	7	6	6	0	3	3	3	7	3	**4.2**	**13**	**7**	**54**	**9**	**69**
220	3823	32512	3	4	3	5	9	7	8	0	3	3	3	8	2	**4.4**	**13**	**7**	**54**	**9**	**69**
263	4003	32553	1	4	5	5	9	7	8	0	5	3	1	7	3	**4.4**	**13**	**5**	**38**	**9**	**69**
559	4632	IR 64	0	4	5	5	9	6	4	2	4	5	2	8	4	**4.5**	**13**	**3**	**23**	**10**	**77**
536	4609	32736	1	3	3	6	7	6	7	2	3	7	4	7	3	**4.5**	**13**	**6**	**46**	**7**	**54**
178	4815	32786	3	4	2	5	7	6	7	1	4	7	2	6	5	**4.5**	**13**	**4**	**31**	**8**	**62**
247	3850	32537	1	5	2	6	7	7	7	0	4	5	4	7	4	**4.5**	**13**	**3**	**23**	**8**	**62**
131	5005	32797	3	5	5	5	7	6	7	0	4	3	5	6	4	**4.6**	**13**	**3**	**23**	**9**	**69**
414	4416	32684	3	4	4	5	7	6	7	2	3	5	2	7	5	**4.6**	**13**	**4**	**31**	**9**	**69**
62	3462	32432	3	6	5	8	-	3	5	5	4	3	3	6	5	**4.7**	**12**	**4**	**33**	**9**	**75**
517	6044	32953	1	6	-	6	-	-	-	-	5	-	-	7	3	**4.7**	**6**	**2**	**33**	**3**	**50**
543	4616	32743	1	3	2	5	8	6	8	0	3	7	8	8	2	**4.7**	**13**	**6**	**46**	**7**	**54**
184	4821	32791	1	4	5	5	-	7	-	3	5	-	-	7	6	**4.7**	**9**	**2**	**22**	**6**	**67**
381	4246	32652	1	6	5	5	9	7	7	3	3	5	2	7	2	**4.7**	**13**	**5**	**38**	**8**	**62**
329	CO-39		5	7	5	8	8	6	9	4	8	7	5	7	6	**6.5**	**13**	**0**	**0**	**4**	**31**
462	Tetep		0	4	5	5	7	7	5	0	5	5	3	7	4	**4.4**	**13**	**3**	**23**	**10**	**77**
471	CH-45		3	3	5	5	8	4	4	0	5	5	5	7	6	**4.6**	**13**	**3**	**23**	**10**	**77**
LSI			**3.1**	**5.3**	**5.2**	**6.0**	**8.5**	**6.6**	**7.8**	**3.3**	**5.0**	**6.0**	**4.4**	**7.1**	**4.8**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 3.3A: Location severity index (LSI) and frequency distribution of brown spot scores of NSN-H, *Kharif* 2024

Score	Location/Frequency of scores (0-9)					
	ALM	CBT	IIRR	KHD	LNV	PNP
0	0	0	0	0	0	0
1	0	0	0	0	0	3
2	0	0	0	0	65	12
3	0	18	0	0	17	20
4	0	26	2	16	9	13
5	1	28	2	36	2	22
6	8	14	12	28	0	15
7	27	8	41	9	0	9
8	42	0	30	5	0	0
9	16	0	7	0	0	0
Total	**94**	**94**	**94**	**94**	**93**	**94**
LSI	**7.7**	**4.7**	**7.2**	**5.5**	**2.4**	**4.3**
Screening	**N**	**A**	**A**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 3.3B: Promising entries with low susceptibility index (<=5.4) and high PI in NSN-H to brown spot, *Kharif* 2024

P. No	Entry No.	IET NO.	Location/Frequency of scores (0-9)					SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ALM	CBT	IIRR	KHD	PNP						
55	2401	30513	7	3	6	5	2	**4.6**	**5**	**2**	**40**	**3**	**60**
50	2604	32371	6	5	6	5	1	**4.6**	**5**	**1**	**20**	**3**	**60**
57	2403	31415	8	4	6	4	3	**5.0**	**5**	**1**	**20**	**3**	**60**
40	2322	32332	6	4	6	5	4	**5.0**	**5**	**0**	**0**	**3**	**60**
1	2501	31424	7	3	**7**	6	3	**5.2**	**5**	**2**	**40**	**2**	**40**
66	2412	32343	8	5	6	4	3	**5.2**	**5**	**1**	**20**	**3**	**60**
9	2509	32362	7	4	7	6	2	**5.2**	**5**	**1**	**20**	**2**	**40**
4	2504	32358	6	4	7	4	5	**5.2**	**5**	**0**	**0**	**3**	**60**
67	2413	32344	7	5	8	4	3	**5.4**	**5**	**1**	**20**	**3**	**60**
70	2416	32347	8	5	8	5	1	**5.4**	**5**	**1**	**20**	**3**	**60**
76	2422	32353	8	4	7	5	3	**5.4**	**5**	**1**	**20**	**3**	**60**
37	2319	32329	6	3	7	5	6	**5.4**	**5**	**1**	**20**	**2**	**40**
52	2606	32372	6	5	7	7	2	**5.4**	**5**	**1**	**20**	**2**	**40**
58	2404	31413	8	5	7	6	1	**5.4**	**5**	**1**	**20**	**2**	**40**
63	2409	32341	7	4	8	4	4	**5.4**	**5**	**0**	**0**	**3**	**60**
93	CO-39		8	7	8	6	5	**6.8**	**5**	**0**	**0**	**1**	**20**
87	CH-45		7	3	4	5	5	**4.8**	**5**	**1**	**20**	**4**	**80**
94	Tetep		8	3	4	5	4	**4.8**	**5**	**1**	**20**	**4**	**80**
LSI			**7.7**	**4.7**	**7.2**	**5.5**	**4.3**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NHSN**

One hundred and thirty-six hybrid entries including checks were evaluated at 15 locations against brown spot disease under NHSN. The highest and lowest disease pressure was recorded at Gangavathi (8.6) and Bikramgunj (2.4) respectively. The disease pressure was very high (LSI ≥7) at Gangavathi (8.6), IIRR (7.3), and Ludhiana (7.1); high (LSI 6-7) at Pusa (6.7). Most of the centres recorded moderate disease pressure *viz.,* Hazaribagh (5.9), Gagharghat (5.9), Khudwani (5.3), Chatha (5.1), Rewa (4.9), Chinsurah (4.5), Coimbatore (4.5), Bankura (4.3) and Jagdalpur (3.1). The Performance of entries at Lonavala and Bikramgunj was not considered for identifying promising entries, as the disease pressure was low (< 3.0) (Table 3.4A).

The entries with low SI (≤5.1) and high PI across the locations were presented in Table 3.4B. None of the entries recorded resistance reaction across the locations however a few promising entries that included IET # 33053, 33015, 33006, 33073, 33048, 33066, 33070, 33084 and 33063 (Table 3.4B).

Table 3.4A: Location severity index (LSI) and frequency distribution of brown spot scores of NHSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)														
	BKG	**BNK**	**CBT**	**CHN**	**CHT**	**GGT**	**GNV**	**HZB**	**IIRR**	**JDP**	**KHD**	**LDN**	**LNV**	**PSA**	**REW**
0	27	0	0	0	0	0	0	0	0	5	0	0	0	0	0
1	41	46	0	0	0	0	0	0	0	17	0	0	0	0	0
2	0	10	0	0	1	0	0	0	0	37	0	0	57	0	0
3	26	15	30	55	17	4	0	2	0	28	1	0	69	4	0
4	0	1	42	0	10	0	0	3	2	23	32	0	0	4	62
5	38	17	41	57	78	72	2	29	7	11	54	10	10	4	29
6	0	0	15	0	5	25	1	59	20	8	35	0	0	30	41
7	3	20	8	24	20	0	2	17	47	3	9	107	0	60	4
8	0	0	0	0	0	35	35	6	34	3	4	0	0	29	0
9	0	27	0	0	3	0	94	1	25	0	1	17	0	0	0
Total	**135**	**136**	**136**	**136**	**134**	**136**	**134**	**117**	**135**	**135**	**136**	**134**	**136**	**131**	**136**
LSI	**2.4**	**4.3**	**4.5**	**4.5**	**5.1**	**5.9**	**8.6**	**5.9**	**7.3**	**3.1**	**5.3**	**7.1**	**2.7**	**6.7**	**4.9**
Screening	**N**	**N**	**A**	**A**	**N**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**N**	**A**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 3.4B: Promising entries with low susceptibility index (<=5.1) and high PI in NHSN to brown spot, *Kharif* 2024

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)													SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			BNK	CBT	CHN	CHT	GGT	GNV	HZB	IIRR	JDP	KHD	LDN	PSA	REW						
74	3003	33053	1	3	3	5	8	8	5	4	2	5	7	3	4	**4.5**	**13**	**5**	**38**	**10**	**77**
27	2908	33015	3	4	3	3	5	9	8	8	1	4	7	3	6	**4.9**	**13**	**5**	**38**	**8**	**62**
15	2815	33006	5	4	3	-	8	6	3	5	-	5	7	3	6	**5.0**	**11**	**3**	**27**	**7**	**64**
98	3027	33073	1	4	3	5	5	8	5	7	3	5	7	7	5	**5.0**	**13**	**3**	**23**	**9**	**69**
65	2946	33048	7	4	3	2	5	9	6	7	1	4	7	6	4	**5.0**	**13**	**3**	**23**	**7**	**54**
90	3019	33066	1	4	3	5	5	8	5	7	1	6	7	6	7	**5.0**	**13**	**3**	**23**	**7**	**54**
95	3024	33070	1	4	3	5	5	9	5	7	2	6	7	8	4	**5.1**	**13**	**3**	**23**	**8**	**62**
115	3106	33084	3	4	3	5	6	8	5	8	2	6	7	5	4	**5.1**	**13**	**3**	**23**	**8**	**62**
86	3015	33063	1	4	3	5	5	9	6	7	4	4	7	7	4	**5.1**	**13**	**2**	**15**	**8**	**62**
132	CO-39		1	7	5	5	8	8	8	9	3	6	7	8	4	**6.1**	**13**	**2**	**15**	**5**	**38**
126	CH-45		1	3	5	5	5	8	3	5	1	6	-	-	4	**4.2**	**11**	**4**	**36**	**9**	**82**
106	Tetep		2	3	3	7	5	8	6	5	2	5	7	6	4	**4.8**	**13**	**4**	**31**	**8**	**62**
LSI			**4.3**	**4.5**	**4.5**	**5.1**	**5.9**	**8.6**	**6.0**	**7.3**	**3.1**	**5.3**	**7.1**	**6.7**	**4.9**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

➢ DSN

The entries under donor screening nursery (DSN) were evaluated for their resistance to brown spot at 14 locations with 196 entries across the country. The brown spot resistance screening was done under natural infection conditions in most of the centres except at Coimbatore, Gangavathi, Ludhiana, IIRR and Pusa; where artificial method of screening was followed. The frequency distribution of disease scores and location severity index (LSI) are presented in Table 3.5A. The highest and lowest disease pressure was recorded at Gangavathi (8.5) and Sabour (2.0) respectively. The disease pressure was very high (LSI≥7.0) at Gangavathi (8.5), IIRR (7.4), Almora (7.2) and Pusa (7.0); it was high (LSI 6-7) at Ludhiana (6.6) and Gagharghat (6.0). Disease pressure was moderate (LSI 3-6) at Chatha (5.9), Hazaribagh (5.4), Rewa (4.5), Coimbatore (4.5), Lonavala (3.5), Bikramgunj (3.4) and Jagdalpur (3.4). The disease pressure was low at Sabour. The promising donor lines with low SI (≤4.9) and high PI across the locations were presented in Table 3.5B and that included N 4933, N 4925, RNR 51511, JGL 43094, CB 21515, RP 6469-107, RP Patho 1, GBB 67, GLB 94, RNR 51334, CB 21112, NWGR-17048, GBB 65, GSB 7, N 22 and JGL 47870.

Table 3.5A: Location severity index (LSI) and frequency distribution of brown spot scores of DSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)													
	ALM	**BKG**	**CBT**	**CHT**	**GGT**	**GNV**	**HZB**	**IIRR**	**JDP**	**LDN**	**LNV**	**PSA**	**REW**	**SBR**
0	0	12	0	0	0	0	0	0	8	0	0	0	0	2
1	0	40	0	0	0	0	0	0	26	0	0	0	0	92
2	0	0	6	0	0	0	0	0	41	0	21	0	14	0
3	0	65	32	11	1	0	1	0	43	3	83	0	91	97
4	2	0	62	22	0	0	14	4	23	0	59	0	1	0
5	9	50	59	51	52	0	105	3	15	61	18	3	31	2
6	39	0	35	37	32	1	40	26	18	0	6	12	20	0
7	66	25	2	41	0	24	12	66	17	100	0	172	21	0
8	51	0	0	17	25	49	4	71	3	0	0	9	10	0
9	26	0	0	12	0	113	0	23	0	31	0	0	8	0
Total	**193**	**192**	**196**	**191**	**110**	**187**	**176**	**193**	**194**	**195**	**187**	**196**	**196**	**193**
LSI	**7.2**	**3.4**	**4.5**	**5.9**	**6.0**	**8.5**	**5.4**	**7.4**	**3.4**	**6.6**	**3.5**	**7.0**	**4.5**	**2.0**
Screening	**N**	**N**	**A**	**N**	**N**	**A**	**N**	**A**	**N**	**A**	**N**	**A**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 3.5B: Promising entries with low susceptibility index (<=4.9) and high PI in DSN to brown spot, *Kharif* 2024

S. No.	Designation	Location/Frequency of scores (0-9)													SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		ALM	BKG	CBT	CHT	GGT	GNV	HZB	IIRR	JDP	LDN	LNV	PSA	REW						
89	N 4933	-	3	4	-	5	-	-	-	0	-	3	7	3	**3.6**	**7**	**4**	**57**	**6**	**86**
88	N 4925	6	3	4	5	8	-	5	6	0	5	3	7	3	**4.6**	**12**	**4**	**33**	**8**	**67**
50	RNR 51511	7	0	5	3	8	7	5	6	1	5	4	7	2	**4.6**	**13**	**4**	**31**	**8**	**62**
7	JGL 43094	5	5	2	-	6	-	4	-	4	7	-	7	2	**4.7**	**9**	**2**	**22**	**6**	**67**
31	CB 21515	7	1	2	4	5	9	5	9	1	5	4	7	2	**4.7**	**13**	**4**	**31**	**9**	**69**
64	RP 6469-107	6	1	4	5	5	8	5	8	1	5	3	7	3	**4.7**	**13**	**4**	**31**	**9**	**69**
91	RP Patho 1	8	7	3	3	5	9	4	4	3	3	3	7	2	**4.7**	**13**	**6**	**46**	**9**	**69**
129	GBB 67	6	3	2	6	-	9	5	8	0	5	2	6	5	**4.8**	**12**	**4**	**33**	**7**	**58**
121	GLB 94	7	1	4	4	-	7	5	7	2	5	5	7	3	**4.8**	**12**	**3**	**25**	**8**	**67**
49	RNR 51334	8	1	5	4	5	9	5	6	1	5	3	7	3	**4.8**	**13**	**4**	**31**	**9**	**69**
33	CB 21112	7	0	4	6	5	9	5	7	0	5	5	7	3	**4.8**	**13**	**3**	**23**	**8**	**62**
22	NWGR-17048	-	0	4	-	5	-	5	7	3	7	-	6	7	**4.9**	**9**	**2**	**22**	**5**	**56**
128	GBB 65	6	3	3	4	-	9	5	7	2	7	3	7	3	**4.9**	**12**	**5**	**42**	**7**	**58**
133	GSB 7	6	3	4	3	-	7	6	6	7	5	2	7	3	**4.9**	**12**	**4**	**33**	**6**	**50**
90	N 22	7	3	4	5	6	9	5	6	2	5	3	6	3	**4.9**	**13**	**4**	**31**	**8**	**62**
5	JGL 47870	7	1	5	5	5	7	5	6	2	7	4	7	3	**4.9**	**13**	**3**	**23**	**8**	**62**
190	CO-39	6	7	6	5	-	9	5	9	3	7	3	7	5	**6.0**	**12**	**2**	**17**	**5**	**42**
185	Tetep	5	3	5	5	-	9	4	5	2	7	3	7	6	**5.1**	**12**	**3**	**25**	**8**	**67**
194	CH-45	4	3	4	5	-	8	4	4	2	9	3	7	5	**4.8**	**12**	**3**	**25**	**9**	**75**
LSI		**7.2**	**3.4**	**4.5**	**5.9**	**6.0**	**8.5**	**5.4**	**7.4**	**3.4**	**6.6**	**3.5**	**7.0**	**4.5**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

❖ TRIAL No.4: SCREENING FOR SHEATH BLIGHT RESISTANCE

➢ NSN-1

The National Screening Nursery-1 (NSN-1) was evaluated for resistance to sheath blight at 20 locations across India. The entries were screened by artificial inoculation at most of the centres except Bikramgunj, where the entries were evaluated under natural condition. The highest disease pressure was recorded at Aduthurai (8.4) and lowest at Bankura (4.2). The frequency distribution of disease scores and location severity indices (LSI) were presented in Table 4.1A. The disease pressure was very high (LSI >7) at Aduthurai (8.4), Maruteru (8.1), Gangavati (8.0), New Delhi (7.6), Chinsurah (7.5), Titabar (7.4), Pant Nagar (7.2), Ludhiana (7.2), Mandya (7.0); high (LSI: 6 - 7), Chiplima (6.7), Kaul (6.6), IIRR (6.2), Moncompu (6.0), moderate (LSI 3-6) at Navasari (5.9), Masodha (5.6), Pattambi (5.4), Raipur (5.0), Varanasi (4.9), Bikramgunj (4.3) and Bankura (4.2). The selection of best entries in NSN-1 was done based on the reaction at those locations where LSI was ≥3. None of the entries were found resistant (SI≤3.0) against sheath blight disease. Some of the promising entries with SI ≤ 5.5 are presented in the Table 4.1B. Promising entries (SI ≤5.5) are IET Nos. 32835, 32065, 31630, 31689, 31105, 29549, 31678, 31110, 31889, 31884, 31726, 31120, 32844, 31553, 32987, 32983, 31618, 31641, 32980, 31808, 31715, 31733, and 31639 were identified as better that tolerant check Swarnadhan.

➢ NSN-2

The National Screening Nursery-2 (NSN-2) was evaluated for its resistance to sheath blight at 16 locations. The entries were screened by artificial inoculation at most of the centres except Bikramgunj where the entries were evaluated under natural conditions and observed moderate level of (LSI <3.9) disease severity. The frequency distribution of disease scores and location severity index (LSI) are presented in Table 4.2A. The disease pressure was very high (LSI >7) at Aduthurai (8.5), Gangavati (8.2), Pant Nagar (7.4), Titabar (7.1); high (LSI 6 - 7) at Maruteru (7.0), Ludhiana (6.7), Pattambi (6.6), IIRR (6.5), Mandya (6.5), Kaul (6.5), Navasari (6.1), and moderate (LSI 3-6) Moncompu (5.9), Masodha (5.7), Raipur (5.3), Varanasi (4.8), Bikramgunj (3.9). The selection of promising entries in NSN-2 was done based on the reaction at those locations where LSI was ≥3.0. None of the entries were resistant (SI≤3.0) against sheath blight based on similarity index. Some of the promising entries with SI ≤ 5.5 are IETs 32487, 32575, 32375, 32542, 32428, 32569, 32580, 32744, 32537, were found better than tolerant check Tetep and other few entries viz., IETs 32382, 32857, 32492, 32683, 32676, 32746, 32680, 32794 were on par with the check Tetep and better than tolerant check Swarnadhan (Table 4.2B).

➢ NSN-H

The National Screening Nursery - Hills (NSN-H) was evaluated for their resistance to sheath blight at Cuttack, IIRR and Pantnagar. These entries were screened through artificial inoculation at all the locations. The frequency distribution of disease scores and location severity indices are presented in Table 4.3A. The disease pressure was very high (LSI >7) at Pantnagar (7.9), IIRR (7.6), and Cuttack (7.3). The selection of best entries was done based on the reaction at these three locations. None of the entries were resistant (SI≤3.0) against sheath blight. Some of the highly promising entries are IETs *viz.*, 32362, 32357 were found better than tolerant check (Swarnadhan) and other few entries viz., IETs IR-64, 32359, 32360, 32341, and 32350 were on par with the check Swarnadhan (Table 4.3B).

Table 4.1A: Location severity index and frequency distribution of sheath blight disease score for NSN-1 entries, *Kharif*-2024

Score	Location/Frequency of scores (0-9)																			
	ADT	**BKG**	**BNK**	**CHN**	**CHP**	**GNV**	**IIRR**	**KUL**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NDL**	**NVS**	**PNT**	**PTB**	**RPR**	**TTB**	**VRN**
0	2	31	5	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0
1	2	13	43	0	2	0	0	0	0	28	0	0	0	0	0	0	0	11	1	0
2	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	10	167	197	11	30	3	3	6	0	26	23	28	1	0	18	3	44	149	12	138
4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	24	155	83	67	138	30	221	135	17	106	122	273	21	24	225	68	298	209	101	220
6	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	35	99	71	198	164	175	211	269	359	261	129	152	146	217	224	279	94	52	135	86
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	386	0	43	203	125	264	40	53	53	44	179	4	276	144	9	109	23	54	211	10
Total	**459**	**465**	**476**	**479**	**459**	**472**	**475**	**463**	**429**	**478**	**453**	**457**	**444**	**385**	**476**	**459**	**459**	**475**	**460**	**454**
LSI	**8.4**	**4.3**	**4.2**	**7.5**	**6.7**	**8.0**	**6.2**	**6.6**	**7.2**	**6.0**	**7.0**	**5.6**	**8.1**	**7.6**	**5.9**	**7.2**	**5.4**	**5.0**	**7.4**	**4.9**
Screening	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.1B: Location severity index(LSI) and frequency distribution of sheath blight scores (<=5.5) of NSN-1, *Kharif* 2024

P.No.	IET No.	Location/Frequency of scores (0-9)																									
		ADT	BKG	BNK	CHN	CHP	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NDL	NVS	PNT	PTB	RPR	TTB	VRN	**SI**	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
276	32835	3	7	3	7	3	5	5	5	-	1	5	5	7	9	7	-	5	5	5	3	**5.0**	18	5	27.8	13	72.2
470	Tetep	0	0	1	5	3	7	5	7	7	5	9	5	7	7	5	5	5	3	9	5	**5.0**	20	5	25.0	13	65.0
435	32065	9	5	1	7	3	7	5	7	5	0	3	5	5	9	7	7	3	3	5	5	**5.1**	20	6	30.0	13	65.0
202	31630	7	0	7	3	5	5	3	7	5	5	5	7	9	7	5	5	3	5	5	5	**5.2**	20	4	20.0	14	70.0
314	31004(R)	5	3	3	3	5	7	5	5	7	7	5	7	7	7	5	5	3	5	5	5	**5.2**	20	4	20.0	14	70.0
212	31689	5	7	5	7	5	7	3	7	7	1	5	5	7	5	7	5	5	3	5	3	**5.2**	20	4	20.0	13	65.0
466	31105	9	3	3	7	-	9	5	-	7	0	-	7	-	7	5	5	3	3	-	-	**5.2**	14	5	35.7	8	57.1
369	29549	7	0	3	7	7	7	5	3	7	1	5	5	9	9	5	7	3	5	5	5	**5.3**	20	5	25.0	12	60.0
208	31678	9	3	3	9	5	7	5	5	5	0	5	5	7	5	3	9	5	5	5	5	**5.3**	20	4	20.0	15	75.0
467	31110	5	5	5	7	5	7	5	7	7	0	7	5	7	7	5	5	3	3	5	5	**5.3**	20	3	15.0	13	65.0
60	31889	5	3	2	7	5	3	5	7	7	1	5	5	9	9	5	5	-	7	5	5	**5.3**	19	4	21.1	13	68.4
70	31884	3	3	3	5	5	5	7	7	7	3	5	5	9	7	5	7	3	5	9	3	**5.3**	20	6	30.0	13	65.0
221	30882 (h)	9	3	1	7	5	5	5	3	7	5	7	5	9	7	5	7	5	3	5	3	**5.3**	20	5	25.0	13	65.0
219	31726	9	5	1	5	5	5	5	5	7	5	5	5	9	7	7	7	5	3	3	3	**5.3**	20	4	20.0	14	70.0
323	31120	7	5	3	3	5	9	5	5	7	7	3	3	9	-	5	7	3	3	7	5	**5.3**	19	6	31.6	12	63.2
289	32844	5	3	2	5	9	5	7	7	-	3	3	5	9	9	7	5	3	3	7	5	**5.4**	19	6	31.6	12	63.2
35	31553	9	3	2	3	7	9	7	5	7	1	5	3	9	-	7	5	5	5	1	9	**5.4**	19	6	31.6	11	57.9
168	30603 (H)	7	3	9	5	9	7	5	5	-	0	5	5	7	7	5	7	5	3	5	3	**5.4**	19	4	21.1	12	63.2
451	32987	5	5	5	7	3	9	5	-	7	0	5	5	-	9	7	7	5	3	5	5	**5.4**	18	3	16.7	12	66.7
445	32983	0	5	3	7	1	9	5	7	7	0	7	3	9	7	9	7	5	5	5	7	**5.4**	20	5	25.0	10	50.0
179	31618	7	0	3	7	5	9	5	3	7	5	5	3	7	7	7	9	5	3	5	7	**5.5**	20	5	25.0	11	55.0
194	31641	7	0	9	5	7	9	5	5	7	5	5	3	7	7	7	7	5	1	3	5	**5.5**	20	4	20.0	11	55.0
169	30613(H)	9	5	5	5	7	7	5	5	5	1	7	5	9	7	7	7	3	3	5	3	**5.5**	20	4	20.0	12	60.0
441	32980	7	3	3	7	5	7	5	5	7	5	5	5	7	7	7	7	5	5	3	5	**5.5**	20	3	15.0	12	60.0
249	31808	5	3	5	5	9	7	5	5	5	5	5	5	5	9	3	9	5	5	5	5	**5.5**	20	2	10.0	16	80.0
218	31715	9	7	1	7	3	7	5	5	7	1	9	7	7	-	5	9	5	3	5	3	**5.5**	19	5	26.3	10	52.6
223	31733	9	3	1	7	5	9	5	5	7	7	5	-	9	5	5	7	5	3	5	3	**5.5**	19	4	21.1	12	63.2
192	31639	3	3	7	5	7	7	5	5	7	7	5	5	9	-	5	7	5	3	7	3	**5.5**	19	4	21.1	11	57.9
129	Swarnadhan	9	7	5	7	5	9	5	7	7	7	5	5	7	7	7	5	5	5	7	3	6.2	20	1	5	9	45
124	TN1	9	7	9	7	5	7	9	7	7	7	9	7	9	9	7	9	9	9	7	7	7.8	20	0	0	1	5
125	IR-50	9	5	7	9	7	7	9	9	7	9	9	7	7	9	7	7	9	9	9	7	7.9	20	0	0	1	5
	LSI	**8.4**	**4.3**	**4.2**	**7.5**	**6.7**	**8.0**	**6.2**	**6.6**	**7.2**	**6.0**	**7.0**	**5.6**	**8.1**	**7.6**	**5.9**	**7.2**	**5.4**	**5.0**	**7.4**	**4.9**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 4.2A: Location severity index and frequency distribution of sheath blight disease score for NSN-2 entries, *Kharif*-2024

Score	Location/Frequency of scores (0-9)															
	ADT	**BKG**	**GNV**	**IIRR**	**KUL**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NVS**	**PNT**	**PTB**	**RPR**	**TTB**	**VRN**
0	1	38	0	0	0	0	7	0	0	0	0	0	0	0	0	0
1	3	52	0	0	0	0	12	0	0	0	0	1	0	26	2	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	15	262	1	0	8	0	66	77	40	4	12	4	15	138	29	230
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	33	218	44	215	202	128	218	199	391	126	271	72	222	297	162	263
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	28	98	176	405	396	508	314	167	188	369	351	360	284	141	209	118
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	577	0	438	44	48	31	55	203	49	125	11	220	129	67	257	22
Total	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**	**672**
LSI	**8.5**	**3.9**	**8.2**	**6.5**	**6.5**	**6.7**	**5.9**	**6.5**	**5.7**	**7.0**	**6.1**	**7.4**	**6.6**	**5.3**	**7.1**	**4.8**
Screening	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.2B: Location severity index(LSI) and frequency distribution of sheath blight scores (<=5.3) of NSN-2, *Kharif* 2024

P.No.	B.No.	IET No.	Location/Frequency of scores (0-9)																					
			ADT	BKG	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NVS	PNT	PTB	RPR	TTB	VRN	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
121	3658	32487	3	5	5	5	5	5	7	7	5	5	5	3	3	3	7	3	4.8	16	5	31	13	81
286	4026	32575	-	3	-	5	-	5	3	-	3	-	-	-	-	7	9	3	4.8	8	4	50	6	75
3	3403	32375	5	3	9	5	7	5	3	3	3	7	5	5	7	3	7	3	5.0	16	6	38	11	69
252	3855	32542	-	1	9	-	-	5	1	-	5	7	7	-	-	5	5	-	5.0	9	2	22	6	67
58	3458	32428	-	3	-	7	-	5	7	-	5	-	-	-	-	3	-	-	5.0	6	2	33	4	67
280	4020	32569	3	0	5	5	7	5	3	9	5	7	5	9	5	3	5	5	5.1	16	4	25	12	75
291	4031	32580	9	5	9	7	5	5	0	5	3	5	5	5	5	5	3	5	5.1	16	3	19	13	81
588	6108	PR 116	7	0	7	5	5	5	1	7	5	-	5	7	5	7	5	5	5.1	15	2	13	10	67
544	4617	32744	3	3	9	5	5	7	5	3	5	5	7	7	5	5	5	3	5.1	16	4	25	12	75
247	3850	32537	5	3	5	9	7	7	1	5	7	7	5	5	5	3	5	3	5.1	16	4	25	11	69
193	Ajaya	Ajaya	-	5	-	5	9	5	3	-	5	5	7	7	-	1	-	5	5.2	11	2	18	8	73
10	3410	32382	9	3	9	5	5	5	5	5	3	5	5	7	5	3	5	5	5.3	16	3	19	13	81
642	5407	32857	5	5	9	5	5	5	3	7	5	5	5	9	5	3	5	3	5.3	16	3	19	13	81
198	3801	32492	5	5	7	7	7	5	3	3	5	7	7	5	5	3	5	5	5.3	16	3	19	11	69
413	4415	32683	1	5	9	5	5	7	3	7	7	-	5	7	5	5	-	3	5.3	14	3	21	9	64
406	4408	32676	9	1	9	5	7	7	0	9	3	7	3	7	3	5	7	3	5.3	16	6	38	8	50
546	4619	32746	9	0	9	7	7	7	1	3	5	7	7	7	5	3	5	3	5.3	16	5	31	8	50
410	4412	32680	9	0	5	5	5	7	5	3	5	7	7	7	7	5	5	3	5.3	16	3	19	10	63
128	5002	32794	3	3	7	-	5	7	3	3	9	-	-	9	3	5	-	7	5.3	12	5	42	7	58
462	Tetep		9	0	7	5	7	7	5	5	5	5	7	3	3	5	7	5	5.3	16	3	19	10	63
465	TN1		9	5	9	9	5	7	9	9	7	7	7	9	7	9	9	5	7.6	16	0	0	3	19
190	IR-50		9	7	9	7	9	7	9	9	5	7	7	7	9	5	9	5	7.5	16	0	0	3	19
332	Swarnadhan		9	5	9	5	7	7	7	7	5	-	5	9	5	5	5	3	6.2	15	1	7	8	53
LSI			**12.5**	**7.9**	**12.1**	**10.4**	**10.5**	**10.6**	**9.9**	**10.6**	**9.7**	**11.2**	**10.2**	**11.4**	**10.7**	**9.3**	**11.1**	**9.0**	**-**	**-**	**-**	**-**	**-**	**-**

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 4.3A: Location severity index(LSI) and frequency distribution of sheath blight scores of NSN-H, *Kharif* 2024

Score	Location/Frequency of scores (0-9)		
	CTK	IIRR	PNT
0	0	0	0
1	2	0	0
2	0	0	0
3	7	0	0
4	0	0	0
5	8	32	11
6	0	0	0
7	33	3	32
8	0	0	0
9	42	59	51
Total	**92**	**94**	**94**
LSI	**7.3**	**7.6**	**7.9**
Screening	**A**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 4.3B: Promising entries with low susceptibility index (<=6.0) and high PI in NSN-H to sheath blight, *Kharif* 2024

P. No	Ent. No.	IET NO.	Location/Frequency of scores (0-9)								
			CTK	IIRR	PNT	SI	Total	<=3*	PI (<=3)**	<=5*	PI (<=5)**
94	Tetep	Tetep	3	5	5	4.3	**3**	**1**	**33.3**	**3**	**100.0**
9	2509	32362	3	5	7	5.0	**3**	**1**	**33.3**	**2**	**66.7**
27	2309	RCPL 1-464	3	5	7	5.0	**3**	**1**	**33.3**	**2**	**66.7**
81	HR-12	HR-12	3	5	7	5.0	**3**	**1**	**33.3**	**2**	**66.7**
3	2503	32357	5	5	5	5.0	**3**	**0**	**0.0**	**3**	**100.0**
82	IR-64	IR-64	1	9	7	5.7	**3**	**1**	**33.3**	**1**	**33.3**
5	2505	32359	7	5	5	5.7	**3**	**0**	**0.0**	**2**	**66.7**
7	2507	32360	7	5	5	5.7	**3**	**0**	**0.0**	**2**	**66.7**
63	2409	32341	5	5	7	5.7	**3**	**0**	**0.0**	**2**	**66.7**
73	2419	32350	7	5	5	5.7	**3**	**0**	**0.0**	**2**	**66.7**
90	Swarnadhan	Swarnadhan	5	5	7	5.7	**3**	**0**	**0.0**	**2**	**66.7**
89	IR-50	IR-50	5	9	9	7.7	**3**	**0**	**0.0**	**1**	**33.3**
54	2608	TN1 (LC)	7	9	9	8.3	**3**	**0**	**0.0**	**0**	**0.0**
LSI			**7.3**	**7.6**	**7.9**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

➢ NHSN

The National Hybrid Screening Nursery (NHSN) was evaluated for their resistance to sheath blight at 21 varied locations. The entries were screened by artificial inoculation at most of the centres except Bikramgunj, where the entries were evaluated under natural incidence. The frequency distribution of disease score and location severity index (LSI) are presented in the Table 4.4A. The disease pressure was very high (LSI >7) at Aduthurai (8.6), Chinsurah (8.0), Gangavati (7.9), New Delhi (7.6), Titabar (7.5), Pantnagar (7.4), Cuttack (7.2), Ludhiana (7.2), High (LSI 6-7) at Maruteru (6.5), Kaul (6.4), IIRR (6.3), Navasari (6.2), Masodha (6.1), Varanasi (6.1), Moncompu (6.0), Pattambi (6.0), Mandya (6.0); moderate (LSI 3-6) at Bankura (4.3), Raipur (3.8), Bikramgunj (3.5), and low (LSI >3) Arundhatinagar (2.2).

The selection of promising entries in NHSN was done based on the reaction at those locations where LSI was ≥3.0. None of the entries were showed resistance against sheath blight based on the 0-9 disease screening scale. Some of the selected promising entries are namely, IET 33053, 33080, and 33072 were found better than tolerant check (Tetep) and other entry 33001 was on par with the check Tetep. Some of the other entries viz., 33015, 33060, 33064, 33078, 33046, 33065, 33071, 33042 and 33000 found better than or on par with tolerant check Swarnadhan (Table 4.4B).

➢ DSN

The Donor Screening Nursery (DSN) was evaluated for resistance to sheath blight at 19 disease hot spot locations in India. The entries were screened by artificial inoculation at all the centers except Bikramgunj, where the entries were evaluated under natural conditions. The frequency distribution of disease scores and location severity index (LSI) were presented in Table 4.5A. The disease pressure was very high (LSI >7) at Aduthurai (8.1), Gangavati (8.1), Pant Nagar (7.5), Pattambi (7.3), Cuttack (7.2), Maruteru (7.2), Mandya (7.2), Titabar (7.0); high (LSI 6-7) at Ludhiana (6.9), Kaul (6.8), IIRR (6.3); moderate (LSI 3-6) at Navasari (6.0), Masodha (5.8), Chiplima (5.7), Varanasi (5.4), Moncompu (4.7), Raipur (4.4), Bikramgunj (4.2), and low (LSI >3) Arundhatinagar (1.5).

The selection of promising entries in DSN was done based on the reaction at those locations where LSI was ≥3.0. Some of the entries were found better than tolerant check Tetep and promising entries (≤5.5) are namely, NWGR-17048, SM-SB-51-147-4, SM-SB-51-147-3, GLB 94, GLB 94, BPT 3278, CB 21112, ISHB 11, N 4999, GSB 10, N 4823, SM-SB-47-156-5-1, ISHB 29, NWGR-17008, NLRBL 23, CBMASP 9015, ISHB 30, CB 21103, NLRBL 25, WGL 2033, GLB 118, CBMASP 9014, RP 6469-89, RP Patho 3, ISHB 23, GLB 119, ISHB 22, CBMASP 9017, ISHB 28, RNR 44476, ISHB 19, ISHB 21, CBMASP 9013, ISHB 8 and CB 21515 (Table 4.5B).

Table 4.4A: Location severity index and frequency distribution of sheath blight disease score for NHSN entries, *Kharif*-2024

Score	Location/Frequency of scores (0-9)																				
	ADT	**ARD**	**BKG**	**BNK**	**CHN**	**CTK**	**GNV**	**IIRR**	**KUL**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NDL**	**NVS**	**PNT**	**PTB**	**RPR**	**TTB**	**VRN**
0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	47	12	15	0	2	0	0	0	0	9	0	0	0	0	0	0	0	7	0	0
2	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2	44	40	49	4	6	0	0	3	0	6	14	10	3	0	0	0	6	89	5	11
4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	7	9	61	26	14	16	6	54	33	5	38	62	56	44	6	57	11	66	26	14	51
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	6	0	3	22	26	61	59	74	73	109	71	30	55	63	86	67	80	50	10	56	58
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	111	0	1	13	92	49	67	8	6	20	12	26	14	18	44	6	38	12	4	56	13
Total	**126**	**100**	**135**	**136**	**136**	**134**	**132**	**136**	**115**	**134**	**136**	**132**	**135**	**128**	**136**	**130**	**129**	**134**	**136**	**131**	**133**
LSI	**8.6**	**2.2**	**3.5**	**4.3**	**8.0**	**7.2**	**7.9**	**6.3**	**6.4**	**7.2**	**6.0**	**6.0**	**6.1**	**6.5**	**7.6**	**6.2**	**7.4**	**6.0**	**3.8**	**7.5**	**6.1**
Screening	**A**	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.4B: Promising entries with low susceptibility index (<6.0) and high PI in NHSN to sheath blight, *Kharif* 2024

P.No.	Br. No.	IET No.	Location/Frequency of scores (0-9)																									
			ADT	BKG	BNK	CHN	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NDL	NVS	PNT	PTB	RPR	TTB	VRN	**SI**	**Total**	**<=3***	**PI (<-3)****	**<=5***	**PI (<-5)****
74	3003	33053	5	3	2	5	9	7	5	5	7	1	5	3	5	9	5	7	5	1	7	5	**5.1**	**20**	**5**	**25**	**14**	**70**
105	3034	33080	9	3	9	5	9	7	5	-	7	1	3	5	-	7	5	7	5	3	3	5	**5.4**	**18**	**5**	**28**	**11**	**61**
97	3026	33072	5	5	3	9	7	7	5	5	7	5	5	3	5	7	-	9	5	3	5	7	**5.6**	**19**	**3**	**16**	**12**	**63**
8	2808	33001	7	3	2	5	7	7	5	5	7	5	5	5	5	7	5	7	7	3	7	9	**5.7**	**20**	**3**	**15**	**11**	**55**
106	Tetep		9	0	1	7	5	9	5	7	7	7	5	5	5	7	5	5	5	3	9	7	**5.7**	**20**	**3**	**15**	**11**	**55**
116	3107	RCV	3	1	5	7	7	5	7	9	7	7	7	5	5	9	7	7	5	3	3	5	**5.7**	**20**	**4**	**20**	**10**	**50**
126	CH-45	CH-45	-	5	5	7	3	7	7	7	-	7	-	7	-	7	5	-	-	1	-	7	**5.8**	**13**	**2**	**15**	**5**	**38**
51	2932	OBCH-1	3	3	5	9	9	7	7	5	7	5	3	5	5	7	7	7	5	3	9	5	**5.8**	**20**	**4**	**20**	**11**	**55**
27	2908	33015	9	3	1	5	9	9	5	5	7	1	7	7	7	7	5	7	7	3	5	7	**5.8**	**20**	**4**	**20**	**9**	**45**
83	3012	33060	7	5	3	5	9	7	5	7	7	1	5	3	7	9	7	7	5	3	7	7	**5.8**	**20**	**4**	**20**	**9**	**45**
87	3016	33064	-	3	3	9	9	9	5	7	7	5	5	3	5	7	7	7	5	3	9	3	**5.8**	**19**	**5**	**26**	**10**	**53**
103	3032	33078	9	3	9	5	7	9	5	5	7	3	3	7	-	7	5	7	7	3	5	5	**5.8**	**19**	**4**	**21**	**10**	**53**
63	2944	33046	9	0	3	9	7	7	5	7	7	7	5	5	5	7	5	7	5	3	9	5	**5.9**	**20**	**3**	**15**	**10**	**50**
89	3018	33065	5	5	3	9	9	9	5	7	5	3	3	7	5	9	5	7	5	3	7	7	**5.9**	**20**	**4**	**20**	**11**	**55**
96	3025	33071	9	3	3	3	5	7	7	5	7	7	5	5	7	9	7	7	5	3	7	7	**5.9**	**20**	**4**	**20**	**9**	**45**
59	2940	33042	9	3	5	3	7	7	7	5	7	7	3	7	5	7	5	7	7	3	7	7	**5.9**	**20**	**4**	**20**	**8**	**40**
7	2807	33000	9	5	1	7	9	5	7	7	7	5	3	7	7	7	5	7	5	3	7	5	**5.9**	**20**	**3**	**15**	**9**	**45**
129	Swarnadhan		9	7	3	7	5	7	5	7	7	5	5	5	5	7	7	9	5	3	3	7	**5.9**	**20**	**3**	**15**	**10**	**50**
135	DRR Dhan 53		9	3	3	7	5	7	7	-	9	1	9	5	7	7	5	7	9	3	5	5	**5.9**	**19**	**4**	**21**	**9**	**47**
128	IR-50		9	5	5	9	3	7	5	9	7	1	5	5	9	7	7	9	5	5	9	7	**6.4**	**20**	**2**	**10**	**9**	**45**
123	TN1		-	9	9	7	5	9	7	7	7	7	7	7	9	9	7	9	7	3	-	7	**7.3**	**18**	**1**	**6**	**2**	**11**
LSI			**8.6**	**3.5**	**4.3**	**8.0**	**7.2**	**7.9**	**6.3**	**6.4**	**7.2**	**6.0**	**6.0**	**6.1**	**6.5**	**7.6**	**6.2**	**7.4**	**6.0**	**3.8**	**7.5**	**6.1**	-	-	-	-	-	-

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

Table 4.5A: Location severity index and frequency distribution of sheath blight disease score for DSN entries, *Kharif*-2024

Score	Location/Frequency of scores (0-9)																		
	ADT	**ARD**	**BKG**	**CHP**	**CTK**	**GNV**	**IIRR**	**KUL**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NVS**	**PNT**	**PTB**	**RPR**	**TTB**	**VRN**
0	0	29	12	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0
1	0	48	6	3	3	0	0	0	0	23	0	0	0	0	0	0	9	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	11	21	72	26	13	1	0	3	0	21	10	10	3	3	0	1	90	9	45
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	12	11	62	80	17	16	88	25	20	45	39	100	25	84	20	36	57	46	75
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	24	0	40	55	88	50	86	98	163	77	61	69	108	93	100	87	28	61	67
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	141	0	0	23	73	120	20	15	12	7	76	7	49	0	70	68	11	68	9
Total	**188**	**109**	**192**	**187**	**194**	**187**	**194**	**141**	**195**	**196**	**186**	**186**	**185**	**180**	**190**	**192**	**195**	**184**	**196**
LSI	**8.1**	**1.5**	**4.2**	**5.7**	**7.2**	**8.1**	**6.3**	**6.8**	**6.9**	**4.7**	**7.2**	**5.8**	**7.2**	**6.0**	**7.5**	**7.3**	**4.4**	**7.0**	**5.4**
Screening	**A**	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.5B: Promising entries with low susceptibility index (<6.0) and high PI in DSN to sheath blight, *Kharif* 2024

S.No.	Designation	ADT	BKG	CHP	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NVS	PNT	PTB	RPR	TTB	VRN	SI	Total	<=3*	PI (<=3)**	<=5*	PI (<=5)**
22	NWGR-17048	3	3	-	9	-	5	-	7	0	-	7	-	-	-	-	3	-	7	**4.9**	9	4	44	5	56
145	SM-SB-51-147-4	5	3	3	9	5	5	5	7	3	5	7	5	5	5	7	3	3	5	**5.0**	18	5	28	14	78
144	SM-SB-51-147-3	7	5	1	5	7	5	7	5	5	7	5	3	5	5	9	1	5	3	**5.0**	18	4	22	13	72
193	Swarnadhan	3	3	5	7	5	5	7	5	0	7	5	7	5	7	7	3	5	5	**5.1**	18	4	22	12	67
133	GSB 7	3	3	3	7	7	5	-	7	3	5	5	7	7	7	3	3	5	7	**5.1**	17	6	35	10	59
121	GLB 94	7	7	5	5	5	5	7	7	1	5	5	7	5	7	5	3	5	3	**5.2**	18	3	17	12	67
73	BPT 3278	3	3	3	5	9	5	7	7	5	5	5	5	5	7	7	3	5	7	**5.3**	18	4	22	12	67
33	CB 21112	7	0	3	7	9	5	7	5	0	7	3	5	5	9	5	7	5	7	**5.3**	18	4	22	10	56
162	ISHB 11	9	5	3	7	3	5	5	5	0	7	5	3	7	7	7	7	7	5	**5.4**	18	4	22	10	56
81	N 4999	5	3	5	9	-	5	7	5	5	7	5	7	-	5	5	3	-	5	**5.4**	15	2	13	11	73
135	GSB 10	9	5	1	7	7	7	5	7	7	7	5	3	3	5	7	3	7	3	**5.4**	18	5	28	9	50
85	N 4823	-	-	-	3	7	7	-	9	3	-	3	-	-	-	7	3	-	7	**5.4**	9	4	44	4	44
138	SM-SB-47-156-5-1	9	5	3	7	7	5	7	5	5	5	7	5	5	7	5	3	5	3	**5.4**	18	3	17	12	67
78	BPT 3507	3	3	5	7	7	5	-	7	1	5	5	7	7	7	7	3	7	7	**5.5**	17	4	24	8	47
143	SM-SR-51-147-11	9	-	5	7	7	5	3	7	7	5	5	5	5	7	5	3	5	3	**5.5**	17	3	18	11	65
176	ISHB 29	9	3	5	7	7	5	-	7	0	7	5	7	5	9	5	3	5	5	**5.5**	17	3	18	10	59
137	SM-SB-47-118-1	3	7	5	3	7	5	5	7	5	7	7	7	3	7	7	3	7	5	**5.6**	18	4	22	9	50
75	BPT 3585	9	3	7	9	5	5	-	7	5	5	7	7	5	5	5	3	3	5	**5.6**	17	3	18	11	65
134	GSB 9	3	5	3	5	9	7	-	7	5	3	7	7	-	9	5	3	5	7	**5.6**	16	4	25	9	56
83	N 4858	5	7	5	7	7	5	7	7	3	7	5	7	-	5	5	1	-	7	**5.6**	16	2	13	8	50
21	NWGR-17008	-	0	-	7	-	5	7	7	5	-	5	-	-	7	9	3	-	7	**5.6**	11	2	18	5	45
24	NLRBL 23	3	3	5	9	9	5	7	7	1	5	5	7	5	9	5	3	5	9	**5.7**	18	4	22	11	61
38	CBMASP 9015	9	3	5	3	9	5	7	5	5	5	5	7	7	7	7	5	3	5	**5.7**	18	3	17	11	61
177	ISHB 30	7	5	3	1	9	5	7	7	5	3	7	9	7	7	5	5	5	5	**5.7**	18	3	17	10	56
32	CB 21103	9	5	5	7	9	5	7	5	5	5	7	5	5	5	7	1	5	5	**5.7**	18	1	6	12	67
26	NLRBL 25	3	3	5	9	9	7	7	7	0	7	5	7	7	9	7	3	5	3	**5.7**	18	5	28	8	44

S.No.	Designation	ADT	BKG	CHP	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NVS	PNT	PTB	RPR	TTB	VRN	SI	Total	<=3*	PI (<=3)**	<=5*	PI (<=5)**
17	WGL 2033	5	1	7	9	9	5	-	7	0	3	5	7	7	7	7	3	9	7	**5.8**	17	4	24	7	41
123	GLB 118	7	7	3	7	9	5	-	7	0	7	5	7	5	7	7	3	5	7	**5.8**	17	3	18	7	41
37	CBMASP 9014	9	3	3	7	9	7	7	7	1	3	7	5	7	7	9	3	7	3	**5.8**	18	6	33	7	39
63	RP 6469-89	7	3	7	9	9	5	7	7	5	7	5	5	5	5	5	3	5	5	**5.8**	18	2	11	11	61
93	RP Patho 3	9	5	5	5	7	7	7	7	5	7	7	7	5	5	5	3	3	5	**5.8**	18	2	11	10	56
139	SM-SB-49-147-2-1	5	7	1	9	7	5	5	7	5	5	7	7	5	7	7	5	5	5	**5.8**	18	1	6	10	56
174	ISHB 23	9	5	3	7	5	7	-	7	1	7	5	7	5	9	7	5	7	3	**5.8**	17	3	18	8	47
124	GLB 119	7	7	5	7	7	5	-	7	1	9	5	7	7	5	7	5	3	5	**5.8**	17	2	12	8	47
173	ISHB 22	7	5	5	7	5	5	-	7	1	7	5	7	7	9	7	5	7	3	**5.8**	17	2	12	8	47
40	CBMASP 9017	9	5	5	7	9	5	7	7	0	3	5	7	5	7	9	3	9	3	**5.8**	18	4	22	9	50
25	NLRBL 24	5	0	3	7	9	7	7	7	7	5	5	9	5	9	7	3	5	5	**5.8**	18	3	17	9	50
175	ISHB 28	9	3	3	9	9	5	-	7	0	5	5	9	7	9	7	3	5	5	**5.9**	17	4	24	9	53
79	BPT 3363	9	7	5	3	7	5	7	7	3	7	5	9	5	5	7	3	7	5	**5.9**	18	3	17	9	50
82	N 4857	7	3	7	5	7	5	5	7	5	9	7	7	7	7	5	3	7	3	**5.9**	18	3	17	8	44
36	CBMASP 9013	9	3	5	7	9	7	7	7	5	5	5	5	5	7	7	3	5	5	**5.9**	18	2	11	10	56
47	RNR 44476	9	3	7	7	9	5	-	5	3	7	5	7	5	7	9	3	5	5	**5.9**	17	3	18	9	53
170	ISHB 19	9	7	5	5	5	7	-	7	3	9	5	7	5	7	7	3	7	3	**5.9**	17	3	18	8	47
172	ISHB 21	5	3	5	9	7	5	-	7	5	7	5	9	5	9	5	3	7	5	**5.9**	17	2	12	10	59
159	ISHB 8	9	3	5	1	9	7	9	7	0	7	7	7	7	9	9	3	5	3	**5.9**	18	5	28	7	39
31	CB 21515	9	0	5	9	9	5	7	5	7	5	3	7	5	9	7	3	5	7	**5.9**	18	3	17	9	50
119	Tetep	9	7	7	9	-	5	7	5	3	7	-	9	5	5	7	3	9	3	**6.3**	16	3	19	7	44
189	IR-50	9	7	7	9	9	9	9	7	7	9	5	-	5	9	9	7	9	7	**7.8**	17	0	0	2	12
188	TN1	9	7	5	9	9	7	7	7	1	9	7	7	7	7	9	7	9	5	**7.1**	18	1	6	3	17
	LSI	**8.2**	**4.2**	**5.7**	**7.2**	**8.1**	**6.3**	**6.8**	**6.9**	**4.7**	**7.2**	**5.8**	**7.2**	**6.0**	**7.5**	**7.3**	**4.4**	**7.0**	**5.4**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

TRIAL No.5: SCREENING FOR SHEATH ROT RESISTANCE

➢ NSN 1

The National Screening Nursery-1 consisting of 481 entries were evaluated against sheath rot disease at 10 locations across the country. Screening was done artificially in some centers viz., Bankura, Chinsurah, Navasari, Pusa, Raipur and Titabar. In Chinsurah, Navasari and Raipur, inoculation done by grain culture plugging at booting stage. It was done under natural conditions at Aduthurai, Karjat, Lonavala and Nawagam.

High disease pressure was recorded at Chinsurah (7.1) Aduthurai (6.6) Raipur (6.3); and moderate disease pressure at Navasari (5.9), Nawagam (5.2), Lonavala (4.0), Pusa (3.2), Titabar (3.0). The disease pressure was very low (LSI≤ 3) at Bankura and Karjat, hence the data from these centres were not considered for selecting the resistant entries for sheath rot disease. The frequency distribution of sheath rot scores are presented in the (Table 5.1A) along with location severity indices.

Table 5.1A: Location severity index (LSI) and frequency distribution of sheath rot scores of NSN-1, *Kharif*-2024

Score	Location/Frequency of scores (0-9)									
	ADT	BNK	CHN	KJT	LNV	NVS	NWG	PSA	RPR	TTB
0	59	52	0	56	0	0	0	6	0	0
1	7	156	2	265	0	0	0	60	0	34
2	0	21	0	0	13	0	0	0	0	4
3	49	142	12	94	217	17	43	286	0	397
4	0	0	0	1	13	0	0	0	0	2
5	33	51	85	40	201	247	333	112	237	22
6	0	1	0	0	6	0	0	0	0	0
7	48	37	247	16	0	189	100	0	158	1
8	0	0	0	0	2	0	0	0	0	0
9	263	16	133	4	0	23	1	0	80	0
Total	459	476	479	476	452	476	477	464	475	460
LSI	**6.6**	**2.7**	**7.1**	**1.9**	**4.0**	**5.9**	**5.2**	**3.2**	**6.3**	**3.0**
Screening method	**N**	**A**	**A**	**N**	**N**	**A**	**N**	**A**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

The selection of promising entries was done based on the disease data of those locations where the disease pressure was moderate to high. A few promising entries with high promising index are presented in the Table 5.1B they include IET#31693, 31633, 31855, 28070, 31618, 31726, 32844, 30604, 31678, 32983, 31709, 31638, 31461, 31582, 31715, 31120, 31619, 31509, 31889 and 30505.

Table 5.1B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NSN-1 to Sheath rot, *Kharif*-2024

P.No.	Entry No.	IET No.	Location/Frequency of scores (0-9)								SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ADT	CHN	LNV	NVS	NWG	PSA	RPR	TTB						
214	**3907**	31693	0	5	5	5	3	1	5	1	**3.1**	8	4	50	8	100
187	**3720**	31633	0	7	3	5	3	1	5	3	**3.4**	8	5	63	7	88
150	**4718**	31855	0	3	5	5	5	3	5	1	**3.4**	8	4	50	8	100
351	**5210**	28070	0	5	5	3	5	1	5	3	**3.4**	8	4	50	8	100
179	**3712**	31618	0	5	3	5	3	1	9	3	**3.6**	8	5	63	7	88
219	**3913**	31726	0	7	3	5	3	3	5	3	**3.6**	8	5	63	7	88
289	**5127**	32844	0	7	3	5	3	3	5	3	**3.6**	8	5	63	7	88
175	**3708**	30604 (H)	0	7	3	5	3	5	5	1	**3.6**	8	4	50	7	88
208	**3901**	31678	0	3	5	5	7	1	5	3	**3.6**	8	4	50	7	88
445	**5943**	32983	0	3	5	7	5	3	5	1	**3.6**	8	4	50	7	88
215	**3908**	31709 (H)	0	5	5	5	5	1	5	3	**3.6**	8	3	38	8	100
205	**3739**	31638	0	7	5	5	5	1	5	1	**3.6**	8	3	38	7	88
109	**3527**	31461 (H)	0	9	3	5	5	1	5	3	**3.9**	8	4	50	7	88
116	**3534**	31582	0	9	3	5	5	1	5	3	**3.9**	8	4	50	7	88
218	**3912**	31715	0	7	3	5	5	3	5	3	**3.9**	8	4	50	7	88
323	**5509**	31120	0	5	3	5	5	3	7	3	**3.9**	8	4	50	7	88
199	**3732**	31619	1	7	3	5	7	0	5	3	**3.9**	8	4	50	6	75
25	**3325**	31509	3	5	5	5	5	1	5	2	**3.9**	8	3	38	8	100
60	**4902**	31889	0	5	5	5	5	3	5	3	**3.9**	8	3	38	8	100
24	**3324**	30505	0	1	5	7	5	3	5	5	**3.9**	8	3	38	7	88
129	**Swarnadhan**		0	5	5	5	5	1	7	3	**3.9**	8	3	38	7	88
227	**TN1**		9	7	5	7	7	5	5	3	**6.0**	8	1	13	4	50
	LSI		**6.6**	**7.1**	**4.0**	**5.9**	**5.2**	**3.2**	**6.3**	**3.0**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NSN-2**

The NSN -2 nursery consisting of 672 entries was evaluated only at 5 locations and screening was done under natural conditions at Aduthurai and Nawagam. Artificial screening was done at Navasari, Pusa and Raipur. High disease pressure was recorded at Aduthurai (7.9), Raipur (6.1) and Navasari (6.0) and moderate disease pressure at Nawagam (5.2) and Pusa (3.1) (Table 5.2A).

The selection of promising entries was done based on the disease data of those locations where the disease pressure was moderate to high. A few promising entries with high promising index are presented in the Table 5.2B. These entries are IET# 32805, 32575, 32478, 32555, 32607, 32651, 32392, 32442, 32669, 32462, 32799, 32431, 32817, 32502, 32633, 32752, 32418, 32719, 32938 and 32858.

Table 5.2.A: Location severity index (LSI) and frequency distribution of sheath rot scores of NSN-2, *Kharif*-2024

Score	Location/Frequency of scores (0-9)				
	ADT	NVS	NWG	PSA	RPR
0	22	0	0	1	0
1	10	0	0	110	0
2	0	0	0	0	0
3	32	31	90	423	0
4	0	0	0	0	0
5	37	302	414	137	406
6	0	0	0	0	0
7	53	280	154	0	168
8	0	0	0	0	0
9	503	32	1	0	95
Total	657	645	659	671	669
LSI	**7.9**	**6.0**	**5.2**	**3.1**	**6.1**
Screening method	**N**	**A**	**N**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 5.2.B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NSN-2 to Sheath rot, *Kharif*-2024

P.No.	Entry No.	IET No.	Location/Frequency of scores (0-9)					SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ADT	NVS	NWG	PSA	RPR						
140	5014	32805	0	3	5	1	5	**2.8**	5	3	60	5	100
286	4026	32575	-	-	-	1	5	**3.0**	2	1	50	2	100
111	3648	32478	0	5	5	1	5	**3.2**	5	2	40	5	100
265	4005	32555	0	5	5	1	5	**3.2**	5	2	40	5	100
320	4060	32607	0	5	5	1	5	**3.2**	5	2	40	5	100
380	4245	32651	1	5	3	3	5	**3.4**	5	3	60	5	100
21	3421	32392	1	5	5	1	5	**3.4**	5	2	40	5	100
72	3609	32442	0	7	3	3	5	**3.6**	5	3	60	4	80
399	4401	32669	0	3	5	3	7	**3.6**	5	3	60	4	80
94	3631	32462	0	5	5	3	5	**3.6**	5	2	40	5	100
133	5007	32799	0	5	5	3	5	**3.6**	5	2	40	5	100
61	3461	32431	5	3	3	3	5	**3.8**	5	3	60	5	100
154	5028	32817	3	5	3	3	5	**3.8**	5	3	60	5	100
209	3812	32502	3	3	5	3	5	**3.8**	5	3	60	5	100
359	4224	32633	3	5	3	3	5	**3.8**	5	3	60	5	100
552	4625	32752	3	3	7	1	5	**3.8**	5	3	60	4	80
48	3448	32418	5	5	3	1	5	**3.8**	5	2	40	5	100
451	4453	32719	5	5	3	1	5	**3.8**	5	2	40	5	100
499	6026	32938	3	5	5	1	5	**3.8**	5	2	40	5	100
643	5408	32858	1	5	5	3	5	**3.8**	5	2	40	5	100
189	TN1	TN1	9	9	9	3	5	**7.0**	5	1	20	2	40
		LSI	**7.9**	**6.0**	**5.2**	**3.1**	**6.1**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NSN -H**

Screening for sheath rot under NSN- hills was conducted at only at Karjat and Lonavala under natural infection condition. The location severity index at Lonavala was 3.4 and at in Karjat 1.2. The frequency distribution of scores at Karjat centre indicated that, 28 entries showed 0 score, 56 entries showed score of 1 and 2 entries scored 5 and 2 entries scored 9 and in Lonavala, 72 entries scored 3 and 20 entries scored 5 and remaining all entries showed very less score of below 5 (Table 5.3A). Karjat centre was not considered for analysis as its LSI was below 3. The data from single centre was not considered for selection of promising entries.

Table 5.3.A: Location severity index (LSI) and frequency distribution of sheath rot scores of NSN-H, *Kharif*-2024

Score	Location/Frequency of scores (0-9)	
	KJT	LNV
0	28	1
1	56	0
2	0	0
3	0	72
4	0	0
5	2	20
6	0	0
7	4	0
8	0	0
9	2	0
Total	92	93
LSI	**1.2**	**3.4**
Screening method	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

- **NHSN**

The NHSN trial consisted of 136 entries including checks. The entries were evaluated at 11 locations representing different geographical regions. The frequency distribution of disease scores and the LSI are presented in Table 5.4A. The disease pressure was very high at Aduthurai (8.3) Chinsurah (7.4), Cuttack (6.2) and Navasari (6.2); high at Nawagam (5.2), Lonavala (4.1), Titabar (3.4), Bankura (3.1). and The disease pressure was very low (LSI$\leq$ 3) at Karjat and Pusa, data from these centres were not considered for selecting the resistant entries.

The promising entries were selected based on the disease data of those locations where the disease pressure was moderate and high. The promising entries that had an SI less than 5.0 are IET Nos. 33000, 33025, 33015, 33085, 33056, 33048, 33008, 33057, 33017, 33050, 33065, 33058 and 33029 (Table 5.4B).

Table 5.4A: Location severity index (LSI) and frequency distribution of sheath rot scores of NHSN, *Kharif*-2024

Score	Location/Frequency of scores (0-9)										
	ADT	BNK	CHN	CTK	KJT	LNV	NVS	NWG	PSA	RPR	TTB
0	2	7	1	25	46	0	0	0	6	0	0
1	2	37	3	0	76	0	0	0	42	0	10
2	0	13	0	0	0	0	0	0	0	0	0
3	3	49	2	0	0	63	0	17	65	0	94
4	0	0	0	0	0	0	0	0	0	0	0
5	5	8	14	13	6	73	60	86	17	82	22
6	0	0	0	0	0	0	0	0	0	0	0
7	6	13	61	54	4	0	61	31	1	34	4
8	0	0	0	0	0	0	0	0	0	0	0
9	108	9	55	44	1	0	9	1	0	20	1
Total	126	136	136	136	133	136	130	135	131	136	131
LSI	**8.3**	**3.1**	**7.4**	**6.2**	**1.1**	**4.1**	**6.2**	**5.2**	**2.5**	**6.1**	**3.4**
Screening method	**N**	**A**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 5.4B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NHSN to Sheath rot, *Kharif*-2024

P. No	Ent No.	IET NO.	Location/Frequency of scores (0-9)									SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ADT	BNK	CHN	CTK	LNV	NVS	NWG	RPR	TTB						
129	Swarnadhan		1	3	7	0	5	5	5	5	1	**3.6**	**9**	**4**	**44**	**8**	**89**
7	2807	33000	7	0	7	0	3	5	3	5	3	**3.7**	**9**	**5**	**56**	**7**	**78**
39	2920	33025	5	3	1	7	3	7	3	5	3	**4.1**	**9**	**5**	**56**	**7**	**78**
27	2908	33015	9	1	5	0	5	5	5	5	3	**4.2**	**9**	**3**	**33**	**8**	**89**
117	3108	33085	9	5	3	0	3	7	5	5	3	**4.4**	**9**	**4**	**44**	**7**	**78**
78	3007	33056	9	1	7	0	5	5	5	5	3	**4.4**	**9**	**3**	**33**	**7**	**78**
65	2946	33048	9	1	9	0	5	5	5	5	3	**4.7**	**9**	**3**	**33**	**7**	**78**
19	2819	33008	-	2	7	7	3	-	5	5	-	**4.8**	**6**	**2**	**33**	**4**	**67**
79	3008	33057	9	1	7	0	3	9	5	7	3	**4.9**	**9**	**4**	**44**	**5**	**56**
30	2911	33017	3	2	9	7	5	5	5	5	3	**4.9**	**9**	**3**	**33**	**7**	**78**
67	2948	33050	9	3	9	0	5	5	5	5	3	**4.9**	**9**	**3**	**33**	**7**	**78**
89	3018	33065	9	3	9	0	5	5	5	5	3	**4.9**	**9**	**3**	**33**	**7**	**78**
80	3009	33058	9	1	9	0	5	7	5	5	3	**4.9**	**9**	**3**	**33**	**6**	**67**
44	2925	33029	7	0	7	7	5	5	5	5	3	**4.9**	**9**	**2**	**22**	**6**	**67**
123	TN1		-	7	7	7	5	7	7	7	-	**6.7**	**7**	**0**	**0**	**1**	**14**
	LSI		**8.3**	**3.1**	**7.4**	**6.2**	**4.1**	**6.2**	**5.2**	**6.1**	**3.4**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **DSN**

The DSN trial consisted of 196 entries including checks were screened at 8 locations across the country. The frequency distribution of disease scores and the LSI are presented in Table 5.5A. The nursery was screened under natural conditions at Aduthurai, Cuttak, Karjat, Lonavala, Nawagam and artificially done in remaining locations viz., Navasari, Pusa, and Raipur. Very high disease pressure was at Aduthurai (7.6); high disease pressure was recorded at Cuttack (6.1), Navasari (6.1), Raipur (5.7), Nawagam (5.1). Moderate disease pressure was recorded at Pusa (3.6) and Lonavala (3.1) and very low disease pressure was observed at Karjat (1.5) during the season, so the data from this location not considered for the selection of resistant lines for sheath rot disease.

The selection of promising entries were done based on the data of those locations where the disease pressure was moderate to high. The promising entries with SI≤4 are presented in the Table 5.5B. Some of the promising lines were NWGR-17048, NLRBL 23, Ajaya, BPT 3485, NLRBL 25, BPT 3507, SM-SB-51-147-3, RP Bio Patho 3, NLRBL 24, NLRBL 22, CBMASP 9016, ISHB 30, GSB 10, CB 22136 and ISHB 12.

Table 5.5A: Location severity index (LSI) and frequency distribution of sheath rot scores of DSN, *Kharif*-2024

Score	Location/Frequency of scores (0-9)							
	ADT	**CTK**	**KJT**	**LNV**	**NVS**	**NWG**	**PSA**	**RPR**
0	13	39	23	7	0	0	0	0
1	4	0	136	0	0	0	10	0
2	0	0	0	0	0	0	0	0
3	8	0	7	161	7	27	116	0
4	0	0	0	2	0	0	0	0
5	11	31	11	17	81	126	70	139
6	0	0	0	0	0	0	0	0
7	13	40	6	0	78	34	0	44
8	0	0	0	0	0	0	0	0
9	139	80	2	0	14	1	0	12
Total	**188**	**190**	**185**	**187**	**180**	**188**	**196**	**195**
LSI	**7.6**	**6.1**	**1.5**	**3.1**	**6.1**	**5.1**	**3.6**	**5.7**
Screening method	**N**	**N**	**N**	**N**	**A**	**N**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 5.5B: Promising entries with low susceptibility index (≤ 4.0) and high PI in DSN to Sheath rot, *Kharif*-2024

S.No.	Designation	Location/Frequency of scores (0-9)							SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		ADT	CTK	LNV	NVS	NWG	PSA	RPR						
22	NWGR-17048	0	0	-	-	-	3	5	**2.0**	**4**	**3**	**75**	**4**	**100**
24	NLRBL 23	0	0	-	3	5	3	5	**2.7**	**6**	**4**	**67**	**6**	**100**
192	Ajaya	0	0	3	-	5	3	5	**2.7**	**6**	**4**	**67**	**6**	**100**
77	BPT 3485	0	0	3	7	3	3	5	**3.0**	**7**	**5**	**71**	**6**	**86**
26	NLRBL 25	0	0	-	5	5	3	5	**3.0**	**6**	**3**	**50**	**6**	**100**
78	BPT 3507	0	0	3	5	5	3	7	**3.3**	**7**	**4**	**57**	**6**	**86**
144	SM-SB-51-147-3	0	0	3	7	5	3	5	**3.3**	**7**	**4**	**57**	**6**	**86**
105	RP Bio Patho 3	5	0	0	5	5	3	5	**3.3**	**7**	**3**	**43**	**7**	**100**
25	NLRBL 24	0	0	-	7	5	3	5	**3.3**	**6**	**3**	**50**	**5**	**83**
23	NLRBL 22	0	0	-	7	5	5	-	**3.4**	**5**	**2**	**40**	**4**	**80**
39	CBMASP 9016	0	5	3	5	3	3	5	**3.4**	**7**	**4**	**57**	**7**	**100**
177	ISHB 30	3	0	3	5	5	3	5	**3.4**	**7**	**4**	**57**	**7**	**100**
135	GSB 10	1	7	3	3	3	3	5	**3.6**	**7**	**5**	**71**	**6**	**86**
35	CB 22136	5	5	3	3	3	3	5	**3.9**	**7**	**4**	**57**	**7**	**100**
163	ISHB 12	1	5	3	5	5	3	5	**3.9**	**7**	**3**	**43**	**7**	**100**
119	Tetep	1	0	0	9	5	5	7	**3.9**	**7**	**3**	**43**	**5**	**71**
188	TN1	9	7	3	7	7	3	5	**5.9**	**7**	**2**	**29**	**3**	**43**
		7.6	**6.1**	**3.1**	**6.1**	**5.1**	**3.6**	**5.7**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

TRIAL No.6: SCREENING FOR BACTERIAL BLIGHT RESISTANCE

➢ NSN-1

The National Screening Nursery-1 (NSN-1) consisted of 481 entries including different checks. The entries were evaluated at 25 Bacterial Blight (BB) hot spot locations across the country. The entries were evaluated through artificial inoculation at all the locations. The frequency distribution of the disease scores and location severity indices are presented in Table 6.1A**.** The disease pressure was very high (LSI >8) at Chinsurah (8.6) and Maruteru (8.3); high (LSI: 6-8) at Pantnagar (7.9), Chiplima (7.2), Raipur (6.3), Rajendranagar (6.3), IIRR (6.3), Aduthurai (6.2), Navsari (6.1), Pattambi (6.1), Ludhiana (6.0) and Karjat (6.0); moderate (LSI: 3-6) at Titabar (5.9), Gangavathi (5.9), Nawagam (5.7), Masodha (5.3), Chatha (5.3), Moncompu (4.8), Varanasi (4.8), Bankura (4.5), New Delhi (3.9), Nellore (3.8) and Bikramganj (3.4) and very low (LSI: <3) at Karaikal (2.3) and Sabour (1.6).

For selection of the promising entries, data of Karaikal and Sabour were not considered as the disease pressure was very low (LSI below 3). At Chinsurah and Maruteru, the reported disease pressure was exceptionally high (LSI: 8.3-8.6) where more than 97% of the entries showed highly susceptible BB reaction with a disease score of 7-9. These need to be reconfirmed. However, the data of these two centres were included for selection of best entries. The promising entries which exhibited an SI of 4.8 or less, and which showed a disease score of 5 at or more than 65% locations are presented in Table 6.1B**.** Some of the promising entries which performed better than the resistant check Improved Samba Mahsuri, showed an SI of 4.8 or less and showed a disease score of 5 or less at 65% or more locations were IET # 32064, 32847, 32054, 32987, 30603 (H), 31553, 32058, 32835, 32036, 32986, 32983, 32827, 32062 and 32065.

➢ NSN-2

The National Screening Nursery-2 (NSN-2) consisted of 672 entries including different check entries. The entries were evaluated at 20 BB hot spot locations across the country. The entries were evaluated using artificial inoculation at all the centres. The frequency distribution of the disease scores and location severity indices are presented in Table 6.2A**.** The disease pressure was very high (LSI> 8) at Pantnagar (8.4); high (LSI: 6-8) at Raipur (7.8), IIRR (7.2), Maruteru (7.1), Chiplima (6.8), Gangavathi (6.5), Pattambi (6.5), Aduthurai (6.3) and Titabar (6.2); moderate (LSI: 3-6) at Ludhiana (5.9), Cuttack (5.8), Navsari (5.7), Nawagam (5.6), Varanasi (5.6), Chatha (5.3), Masodha (5.0), Moncompu (4.7), Nellore (4.2) and Bikramganj (3.3) and very low (LSI < 3) at Sabour (1.8)

For selection of the promising entries, data of Sabour were not considered as the disease pressure was very low (LSI below 3). At Pantnagar, the disease pressure was exceptionally high (LSI-8.4) where more than 90% of the entries showed highly susceptible BB reaction with a disease score of 7-9. This needs to be reconfirmed. However, the data of this centre were included for selection of best entries. The promising entries with SI of 4.7 or less and the entries which exhibited a score of 5 at or more than 65% of the locations are presented in Table 6.2B**.** Some of the highly promising entries which performed better than resistant check Improved Samba Mahsuri and which exhibited an SI of 4.7 or less and showed a disease score of 5 at more than 65% test locations are IET # 32487, 32558, 32386, 32519, 32595, 32580, 32454, 32542, 32823, 32762, 32560, 32791, 32493, 32680, 32385, 32415 and 32582.

Table 6.1A: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-1, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)											
	ADT	BKG	BNK	CHN	CHP	CHT	GNV	IIRR	KJT	KRK	LDN	MNC
0	10	53	2	0	0	0	0	0	0	71	0	48
1	23	70	61	0	7	0	7	57	0	160	4	37
2	0	1	19	0	0	0	0	0	0	0	0	0
3	80	173	180	0	21	69	64	16	17	146	50	65
4	0	0	0	0	0	0	0	0	0	0	0	0
5	89	97	82	14	88	284	159	3	208	74	103	140
6	0	0	0	0	0	0	0	0	0	0	0	0
7	94	71	57	71	149	112	202	363	171	15	264	159
8	0	0	1	0	0	0	0	0	0	0	0	0
9	163	0	74	394	194	10	40	35	23	2	0	29
Total	**459**	**465**	**476**	**479**	**459**	**475**	**472**	**474**	**419**	**468**	**421**	**478**
LSI	**6.2**	**3.4**	**4.5**	**8.6**	**7.2**	**5.3**	**5.9**	**6.3**	**6.0**	**2.3**	**6.0**	**4.8**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(Contd.,) Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-1, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)												
	MSD	MTU	NDL	NLR	NVS	NWG	PNT	PTB	RPR	RNR	SBR	TTB	VRN
0	0	0	0	0	0	0	0	0	0	0	149	0	0
1	0	0	16	63	0	0	5	0	1	1	152	0	0
2	0	0	74	0	0	0	0	0	0	0	0	0	0
3	66	0	148	172	17	15	18	5	27	23	138	22	145
4	0	0	81	0	0	0	0	0	0	0	0	0	0
5	268	10	114	191	187	273	57	207	146	112	25	253	227
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	116	148	32	28	265	186	65	245	253	331	10	144	70
8	0	0	0	0	0	0	0	0	0	0	0	0	0
9	6	304	14	2	7	3	314	3	47	4	0	41	12
Total	**456**	**462**	**479**	**456**	**476**	**477**	**459**	**460**	**474**	**471**	**474**	**460**	**454**
LSI	**5.3**	**8.3**	**3.9**	**3.8**	**6.1**	**5.7**	**7.9**	**6.1**	**6.3**	**6.3**	**1.6**	**5.9**	**4.8**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 6.1B: NSN 1 entries with low susceptibility index (SI <4.8) with score <5 to BB at or more than 65% of the locations

Br. No.	IET No.	Location/Frequency of scores (0-9)																							SI	PI (<-3)**	PI (<-5)**
		ADT	BKG	BNK	CHN	CHP	CHT	GNV	IIRR	KJT	LDN	MNC	MSD	MTU	NDL	NLR	NVS	NWG	PNT	PTB	RPR	RNR	TTB	VRN			
5932	32064	1	0	3	9	5	3	5	1	5	7	3	5	7	2	5	5	5	3	7	7	5	5	5	**4.5**	**35**	**78**
5131	32847	1	1	3	9	9	3	7	7	5	3	1	5	7	2	3	3	5	3	5	5	7	5	5	**4.5**	**43**	**74**
5918	32054	1	5	3	9	7	3	3	1	3	3	5	5	9	3	3	7	7	1	5	7	7	5	3	**4.6**	**48**	**70**
5949	32987	0	3	5	9	1	5	7	7	7	5	0	3	5	2	3	5	7	9	5	5	5	3	5	**4.6**	**35**	**74**
3701	30603 (H)	3	3	3	9	9	3	5	1	5	-	0	7	7	2	1	7	5	7	5	7	5	5	3	**4.6**	**41**	**68**
3336	31553	5	3	2	5	5	5	7	7	5	7	1	5	7	2	1	7	5	9	3	3	5	3	5	**4.7**	**35**	**74**
5920	32058	1	7	3	9	5	5	1	1	5	3	1	5	7	2	3	7	7	7	7	5	7	5	5	**4.7**	**35**	**65**
5114	32835	3	7	1	9	5	3	7	7	5	-	0	7	7	2	3	3	5	-	7	5	5	3	5	**4.7**	**38**	**67**
4736	32036	7	5	1	7	9	5	5	1	-	3	1	5	9	5	1	5	7	7	5	3	5	3	5	**4.7**	**32**	**73**
5948	32986	3	3	3	5	1	5	7	7	5	5	0	7	9	4	1	7	3	9	5	3	7	5	5	**4.7**	**35**	**70**
5943	32983	0	3	5	9	5	5	7	1	5	5	0	5	9	3	3	7	5	3	7	7	5	5	5	**4.7**	**30**	**74**
5102	32827	3	1	2	9	7	5	5	7	5	-	0	7	5	2	3	3	7	9	5	5	5	5	5	**4.8**	**32**	**73**
5917	32062	9	3	3	5	9	3	3	1	5	1	3	3	7	3	3	7	5	5	7	7	7	7	5	**4.8**	**43**	**65**
5933	32065	1	3	5	9	9	5	5	3	5	7	0	7	7	4	1	7	5	5	5	7	3	3	5	**4.8**	**30**	**70**
TN1 (S)		9	5	5	9	9	9	9	7	7	7	7	9	9	7	5	7	9	9	9	9	7	5	5	**7.5**	**0**	**22**
RP Bio 226 (R)		9	3	3	7	5	5	5	7	5	7	5	3	7	5	5	3	5	3	5	5	3	7	-	**5.1**	27	**73**
LSI		**6.2**	**3.4**	**4.5**	**8.6**	**7.2**	**5.3**	**5.9**	**6.3**	**6.0**	**6.0**	**4.8**	**5.3**	**8.3**	**3.9**	**3.8**	**6.1**	**5.7**	**7.9**	**6.1**	**6.3**	**6.3**	**5.9**	**4.8**			

(SI-Susceptibility Index; *Promising index (PI): Percentage of locations based on no. of locations where the entry had scored ≤3 and ≤5

Table 6.2A: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-2, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)									
	ADT	BKG	CHT	CHP	CTK	GNV	IIRR	LDN	MNC	MSD
0	9	53	0	0	0	0	0	0	77	0
1	26	123	0	6	12	2	66	0	46	0
2	0	1	0	0	0	1	0	0	0	0
3	111	265	104	59	94	71	49	107	104	105
4	0	0	0	0	0	0	0	0	0	0
5	126	154	376	148	253	199	38	154	203	451
6	0	0	0	0	0	1	0	0	0	0
7	173	72	168	224	249	213	115	384	212	103
8	0	0	0	0	0	0	0	0	0	0
9	212	0	17	222	61	172	383	0	30	9
Total	**657**	**668**	**665**	**659**	**669**	**659**	**651**	**645**	**672**	**668**
LSI	**6.3**	**3.3**	**5.3**	**6.8**	**5.8**	**6.5**	**7.2**	**5.9**	**4.7**	**5.0**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(Contd.,) Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-2, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)									
	MTU	NLR	NVS	NWG	PNT	PTB	RPR	SBR	TTB	VRN
0	0	0	0	0	0	0	0	187	0	0
1	0	58	0	0	5	0	0	199	0	0
2	0	0	0	0	0	0	0	0	0	0
3	2	255	50	35	16	3	4	206	53	81
4	0	1	0	0	0	0	0	0	0	0
5	114	240	315	391	40	223	102	60	247	298
6	0	0	0	0	0	0	0	0	0	0
7	379	93	279	229	55	367	182	15	278	247
8	0	0	0	0	0	0	0	0	0	0
9	149	10	1	4	541	52	381	1	81	7
Total	**644**	**657**	**645**	**659**	**657**	**645**	**669**	**668**	**659**	**633**
LSI	**7.1**	**4.2**	**5.7**	**5.6**	**8.4**	**6.5**	**7.8**	**1.8**	**6.2**	**5.6**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 6.2B: NSN-2 entries with low susceptibility index (SI ≤4.7) with score ≤4.7 to BB at more than 65% of the locations

P.No.	Br No.	IET No.	Location/Frequency of scores (0-9)																			SI	PI (<-3)**	PI (<-5)**
			ADT	BKG	CHT	CHP	CTK	GNV	IIRR	LDN	MNC	MSD	MTU	NLR	NVS	NWG	PNT	PTB	RPR	TTB	VRN			
121	3658	32487	3	3	3	7	1	3	1	5	3	3	5	3	3	7	7	5	5	5	5	**4.1**	**53**	**84**
268	4008	32558	3	3	7	5	1	5	1	3	1	5	5	3	3	5	7	5	7	5	5	**4.2**	**42**	**84**
14	3414	32386	3	3	5	7	1	5	1	3	3	3	7	3	3	3	7	5	9	5	5	**4.3**	**53**	**79**
227	3830	32519	5	1	5	5	1	5	1	7	3	3	5	3	5	5	1	5	7	7	7	**4.3**	**37**	**79**
308	4048	32595	0	1	5	7	5	3	5	5	0	5	5	1	5	5	5	7	7	3	7	**4.3**	**32**	**79**
291	4031	32580	1	1	5	9	7	9	1	3	0	3	5	3	3	5	9	5	3	3	7	**4.3**	**53**	**74**
84	3621	32454	3	5	7	5	1	3	1	3	5	-	5	3	5	5	1	5	7	7	7	**4.3**	**39**	**78**
252	3855	32542	-	1	5	-	-	7	-	3	0	5	-	-	5	5	-	5	7	5	-	**4.4**	**27**	**82**
160	5034	32823	5	5	3	5	3	7	3	3	0	5	7	1	3	5	9	5	5	3	7	**4.4**	**42**	**79**
565	4638	32762	5	1	3	3	7	7	9	3	0	5	5	5	3	5	9	5	7	3	3	**4.6**	**42**	**74**
270	4010	32560	3	7	7	3	5	5	1	3	0	5	5	3	7	7	9	5	5	5	3	**4.6**	**37**	**74**
184	4821	32791	-	1	5	-	-	-	-	-	3	5	5	-	-	-	9	-	-	-	-	**4.7**	**33**	**83**
199	3802	32493	9	3	5	9	1	3	1	3	3	3	7	3	5	5	3	7	9	5	5	**4.7**	**47**	**74**
410	4412	32680	0	3	3	7	7	9	9	3	0	3	5	3	7	5	3	5	5	5	7	**4.7**	**42**	**68**
13	3413	32385	7	5	3	7	3	1	1	5	7	5	7	3	7	5	1	5	5	5	7	**4.7**	**32**	**68**
45	3445	32415	5	5	5	5	5	3	-	3	0	5	7	3	5	3	3	7	9	5	7	**4.7**	**33**	**78**
495	6022	32582	5	0	5	3	7	5	1	5	3	3	5	5	5	7	7	5	9	3	7	**4.7**	**32**	**74**
664	**TN1(S)**		9	7	9	9	9	9	9	7	7	9	9	7	7	9	9	7	9	7	7	**8.2**	**0**	**0**
663	**RP Bio 226** (R)		7	3	5	5	5	3	9	7	5	3	7	5	3	5	5	9	9	9	5	**5.7**	**21**	**63**
LSI			**6.3**	**3.3**	**5.3**	**6.8**	**5.8**	**6.5**	**7.2**	**5.9**	**4.7**	**5.1**	**7.1**	**4.2**	**5.7**	**5.6**	**8.4**	**6.5**	**7.8**	**6.2**	**5.6**			

(SI-Susceptibility Index; *Promising index (PI): Percentage of locations based on no. of locations where the entry had scored ≤3 and ≤5)

➢ **NSN-Hills**

The National Screening Nursery-Hills (NSN-Hills) consisted of 94 entries including different checks. The entries were evaluated at 4 BB hot spot locations across the country. The entries were evaluated using artificial inoculation at all the four locations. The frequency distribution of the disease scores and location severity indices are presented in Table 6.3A**.** The disease pressure was very high (LSI> 8) at IIRR, Hyderabad (8.6); high (LSI: 6-8) at Pantnagar (7.7) and Cuttack (7.3) and moderate (LSI: 3-6) at Karjat (3.4). The disease pressure at IIRR was very high where more than 93% of the entries showed susceptible BB reaction with a disease score of 7-9. For selection of best entries, the disease reactions from all the locations were considered. The promising entries which showed an SI of less or equal to 5.5 and which exhibited a disease score of 5 at or more than 50% locations are presented in Table 6.3B**.** Some of the highly promising entries which performed on par or better than the resistant check, Improved Samba Mahsuri were IET # 31386, 32371, 31413, 32363, 32364 and 32348. Some of the other promising entries were IET # 32317, 32359, 32358, 32362, 32333, 32335 and 31420.

➢ **NHSN**

The National Hybrid Screening Nursery (NHSN) consisted of 136 entries including different checks. The entries were evaluated at 23 BB hot spot locations across the country. The entries were evaluated using artificial inoculation at all the centres. The frequency distribution of the disease scores and location severity indices are presented in Table 6.4A**.** The disease pressure was very high (LSI>8) at Raipur (8.1); high (LSI: 6-8) at Pantnagar (7.8), Chinsurah (7.1), Maruteru (6.9), Titabar (6.9), Cuttack (6.9), Aduthurai (6.7), Pattambi (6.4), IIRR (6.4), Gangavathi (6.4), Ludhiana (6.3), Navsari (6.2) and Nawagam (6.1); moderate (LSI: 3-6) at Rajendranagar (5.8), Moncompu (5.8), Chatha (5.6), Varanasi (5.4), Masodha (5.2), New Delhi (4.7), Bankura (4.4), Bikramganj (4.0) and Karjat (3.6) and very low (LSI<3) at Arundhatinagar (2.0)

For selection of promising entries, data of Arundhatinagar were not considered as the disease pressure was very low (LSI-2.0). At Raipur, the disease pressure was very high (LSI-8.1) where more than 86% of the entries exhibited susceptible reaction with a disease score of 7-9. The promising entries with SI of 5.3 or less and which exhibited a score of 5 at or more than 55% of the locations are presented in Table 6.4B. Some of the promising entries which performed on par or better than the resistant check Improved Samba Mahsuri were IET # 33057, 33058, 33053, 33061, 33055, 33015, 33014, 33075, 33028, 33078, 33063, 33077 and 33064.

Table 6.3A: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-Hills, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)			
	CTK	KJT	IIRR	PNT
0	0	0	0	0
1	0	18	1	3
2	0	0	0	0
3	3	39	2	8
4	0	0	0	0
5	20	34	3	18
6	0	0	0	0
7	29	0	3	23
8	0	0	0	0
9	38	1	79	42
Total	**90**	**92**	**88**	**94**
LSI	**7.3**	**3.4**	**8.6**	**7.7**
Screening	**A**	**A**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 6.3B: NSN-Hills entries with low susceptibility index (SI ≤5.5) with score ≤5 to BB at or more than 50% of the locations

P No	Ent No.	IET NO.	Location/Frequency of scores (0-9)				SI	PI (<-3)**	PI (<-5)**
			CTK	KJT	IIRR	PNT			
21	2303	31386	5	3	3	3	**3.5**	**75**	**100**
50	2604	32371	9	3	-	1	**4.3**	**67**	**67**
58	2404	31413	5	-	7	1	**4.3**	**33**	**67**
10	2510	32363	5	1	9	3	**4.5**	**50**	**75**
11	2511	32364	9	1	3	5	**4.5**	**50**	**75**
71	2417	32348	7	3	1	7	**4.5**	**50**	**50**
23	2305	32317	5	3	9	3	**5.0**	**50**	**75**
5	2505	32359	3	1	9	7	**5.0**	**50**	**50**
4	2504	32358	5	1	9	5	**5.0**	**25**	**75**
9	2509	32362	5	1	9	5	**5.0**	**25**	**75**
41	2323	32333	3	3	9	7	**5.5**	**50**	**50**
43	2325	32335	9	3	7	3	**5.5**	**50**	**50**
2	2502	31420	5	3	9	5	**5.5**	**25**	**75**
84	**TN1 (S)**		9	5	9	9	**8.0**	**0**	**25**
92	**RP-BIO-226 (R)**		5	3	5	5	**4.5**	**25**	**100**
LSI			**7.3**	**3.4**	**8.6**	**7.0**			

(SI-Susceptibility Index; *Promising index (PI): Percentage of locations based on no. of locations where the entry had scored ≤3 and ≤5)

Table 6.4A: Location severity index (LSI) and frequency distribution of bacterial blight scores of NHSN, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)											
	ADT	ARD	BKG	BNK	CHN	CHT	CTK	GNV	IIRR	KJT	LDN	MNC
0	0	25	7	0	1	0	0	0	0	0	0	7
1	0	27	9	41	0	0	0	1	29	18	0	4
2	0	0	0	11	0	2	0	0	0	0	0	0
3	6	36	41	25	10	9	6	14	10	60	13	14
4	0	0	0	0	0	0	0	0	0	1	0	0
5	40	12	70	8	30	70	37	30	10	53	19	33
6	0	0	0	1	0	1	0	0	0	0	0	0
7	47	0	6	21	38	51	51	68	10	0	101	63
8	0	0	0	0	0	0	0	0	0	0	0	0
9	33	0	2	29	57	1	41	19	76	1	0	15
Total	**126**	**100**	**135**	**136**	**136**	**134**	**135**	**132**	**135**	**133**	**133**	**136**
LSI	**6.7**	**2.0**	**4.0**	**4.4**	**7.1**	**5.6**	**6.9**	**6.4**	**6.4**	**3.6**	**6.3**	**5.8**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(Contd.,) Location severity index (LSI) and frequency distribution of bacterial blight scores of NHSN, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)										
	MSD	MTU	NDL	NVS	NWG	PNT	PTB	RPR	RNR	TTB	VRN
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	3	0	0	0	0	0
2	0	0	6	0	0	0	0	0	0	0	0
3	18	0	8	3	6	6	5	0	4	5	24
4	0	0	61	0	0	0	0	0	0	0	0
5	90	34	38	45	52	13	39	19	73	27	62
6	0	0	0	0	0	0	0	0	0	0	0
7	24	73	17	82	72	22	78	22	55	69	43
8	0	0	0	0	0	0	0	0	0	0	0
9	3	27	4	0	5	85	12	95	3	30	4
Total	**135**	**134**	**134**	**130**	**135**	**129**	**134**	**136**	**135**	**131**	**133**
LSI	**5.2**	**6.9**	**4.7**	**6.2**	**6.1**	**7.8**	**6.4**	**8.1**	**5.8**	**6.9**	**5.4**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 6.4B: NHSN entries with low susceptibility index (SI ≤5.3) with score <u><</u>5 to BB at more than 55% of the locations

S. No	Br No.	IET No.	Location/Frequency of scores (0-9)																						SI	PI (<-3)**	PI (<-5)**
			ADT	BKG	BNK	CHN	CHT	CTK	GNV	IIRR	KJT	LDN	MNC	MSD	MTU	NDL	NVS	NWG	PNT	PTB	RPR	RNR	TTB	VRN			
79	3008	33057	5	3	1	3	5	7	3	1	1	3	5	3	5	4	7	5	5	7	7	5	7	3	**4.3**	**41**	**77**
80	3009	33058	7	5	1	3	5	9	3	1	3	3	7	5	5	3	7	7	1	7	5	5	7	5	**4.7**	**36**	**68**
74	3003	33053	5	3	1	5	5	5	3	3	3	7	0	5	5	4	7	5	9	5	7	5	5	7	**4.7**	**27**	**77**
84	3013	33061	7	5	1	3	7	9	3	1	1	7	5	5	7	4	7	5	1	7	5	5	5	7	**4.9**	**27**	**64**
77	3006	33055	5	3	1	5	3	5	7	1	3	3	9	5	5	4	7	7	5	9	7	5	5	5	**5.0**	**27**	**73**
27	2908	33015	7	5	1	7	3	7	7	5	3	5	0	5	7	4	5	5	9	7	5	7	3	3	**5.0**	**27**	**64**
26	2907	33014	5	3	2	7	5	7	7	1	1	7	0	5	5	4	7	7	5	7	9	7	5	5	**5.0**	**23**	**59**
100	3029	33075	5	5	1	5	5	9	5	1	3	7	7	3	5	4	7	5	5	5	5	7	7	5	**5.0**	**18**	**73**
43	2924	33028	5	5	2	0	5	7	7	1	3	5	9	5	5	4	5	7	-	7	9	7	3	5	**5.0**	**24**	**67**
103	3032	33078	5	5	3	5	5	3	5	7	3	5	1	5	7	5	7	5	9	7	5	5	5	5	**5.1**	**18**	**77**
86	3015	33063	5	5	1	5	7	3	3	5	1	7	5	5	7	4	7	5	7	5	7	7	5	7	**5.1**	**18**	**64**
102	3031	33077	7	0	7	5	5	5	7	1	4	7	7	-	5	4	7	5	7	7	5	5	5	5	**5.2**	**10**	**62**
87	3016	33064	-	3	1	7	5	7	7	1	5	7	5	3	7	4	5	7	9	7	5	5	7	5	**5.3**	**19**	**57**
123	TN1		-	9	7	7	7	9	9	9	5	7	7	9	9	7	7	9	9	7	9	9	-	7	**7.9**	**0**	**5**
70	RP-Bio-226		5	5	6	7	5	5	3	9	5	3	7	3	7	5	3	5	5	5	7	5	7	5	**5.3**	**18**	**68**
LSI			**6.7**	**4.0**	**4.4**	**7.1**	**5.6**	**6.9**	**6.4**	**6.4**	**3.6**	**6.3**	**5.8**	**5.2**	**6.9**	**4.7**	**6.2**	**6.1**	**7.8**	**6.4**	**8.1**	**5.8**	**6.9**	**5.4**			

(SI-Susceptibility Index; *Promising index (PI): Percentage of locations based on no. of locations where the entry had scored ≤3 and ≤5)

➢ **DSN**

The Donor Screening Nursery (DSN) consisted of 196 entries including different checks. The entries were evaluated at 22 BB hot spot locations across the country. The entries were evaluated using artificial inoculation at all the centres except at Arundhatinagar where the entries were evaluated under natural conditions. The frequency distribution of the disease scores and location severity indices are presented in Table 6.5A**.** The disease pressure was high (LSI: 6-8) at Raipur (7.6), Pantnagar (7.4), Gangavathi (7.2), Rajendranagar (6.7), Maruteru (6.6), Pattambi (6.6), Cuttack (6.4), Titabar (6.4), IIRR (6.1), Ludhiana (6.0) and Chiplima (6.0); moderate (LSI: 3-6) at Navsari (5.9), Nawagam (5.6), Aduthurai (5.6), Chatha (5.0), Masodha (4.9), Varanasi (4.8), Moncompu (4.4), Bikramganj (4.1) and Karjat (3.2) and very low (LSI <3) at Sabour (2.5) and Arundhatinagar (1.2).

For selection of the promising entries, data of those locations were considered where the disease pressure was moderate to very high. Accordingly, the data from Sabour and Arundhatinagar were not considered for selection of promising entries in DSN. The promising entries with SI less than or equal to 4.7 and which exhibited a score of 5 at or more than 65% of the locations are presented in Table 6.5B**.** Some of the highly promising entries which performed better than resistant check, Improved Samba Mahsuri were NWGR-17048, CBMASP 9014, CBMASP 9015, ISHB 11, ISHB 23, CBMASP 9016, GSB 7, RP Bio Patho 5, ISHB 30, RP Bio Patho 3, RP Bio Patho 9, ISHB 31, RP Bio Patho 8, ISHB 2, CBMASP 8021 and ISHB 28.

Table 6.5A: Location severity index (LSI) and frequency distribution of bacterial blight scores of DSN, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)										
	ADT	ARD	BKG	CHP	CHT	CTK	GNV	IIRR	KJT	LDN	MNC
0	0	58	6	0	0	0	0	0	0	0	38
1	8	20	4	4	0	0	0	57	48	0	15
2	0	0	0	0	0	0	0	0	0	0	0
3	43	22	89	24	43	16	2	6	70	28	23
4	0	0	0	0	0	0	0	0	0	0	0
5	62	9	63	59	102	66	29	15	66	39	47
6	0	0	0	0	0	0	0	0	0	0	0
7	35	0	30	79	45	68	100	8	0	128	60
8	0	0	0	0	0	0	0	0	0	0	0
9	40	0	0	21	1	43	56	107	1	0	13
Total	**188**	**109**	**192**	**187**	**191**	**193**	**187**	**193**	**185**	**195**	**196**
LSI	**5.6**	**1.2**	**4.1**	**6.0**	**5.0**	**6.4**	**7.2**	**6.1**	**3.2**	**6.0**	**4.4**
Screening	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

(Contd.,) Table 6.5A: Location severity index (LSI) and frequency distribution of bacterial blight scores of DSN, *Kharif'* 2024

Score	Location/Frequency of scores (0-9)										
	MSD	MTU	NVS	NWG	PNT	PTB	RPR	RNR	SBR	TTB	VRN
0	0	0	0	0	0	0	0	0	36	0	0
1	0	0	0	0	6	0	0	0	52	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	47	9	8	12	19	5	0	1	62	8	59
4	0	0	0	0	0	0	0	0	0	0	0
5	106	63	89	107	26	64	39	31	28	68	85
6	0	0	0	0	0	0	0	0	0	0	0
7	32	71	81	69	19	88	60	154	15	77	39
8	0	0	0	0	0	0	0	0	0	0	0
9	1	42	2	0	120	32	96	4	0	31	1
Total	**186**	**185**	**180**	**188**	**190**	**189**	**195**	**190**	**193**	**184**	**184**
LSI	**4.9**	**6.6**	**5.9**	**5.6**	**7.4**	**6.6**	**7.6**	**6.7**	**2.5**	**6.4**	**4.8**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 6.5B: DSN entries with low susceptibility index (SI ≤4.7) with score <5 to BB at or more than 65% of the locations

S. No.	Br. No.	Location/Frequency of scores (0-9)																				SI	PI (<-3)**	PI (<-5)**
		ADT	BKG	CHP	CHT	CTK	GNV	IIRR	KJT	LDN	MNC	MSD	MTU	NVS	NWG	PNT	PTB	RPR	RNR	TTB	VRN			
22	NWGR-17048	3	3	-	-	7	-	1	5	7	0	3	-	-	-	-	-	9	-	-	-	**4.2**	**56**	**67**
37	CBMASP 9014	5	5	5	3	5	5	1	5	3	0	3	5	5	3	3	5	7	5	7	5	**4.3**	**35**	**90**
38	CBMASP 9015	7	5	3	5	5	7	1	3	3	0	3	5	7	3	1	7	7	7	5	3	**4.4**	**45**	**70**
162	ISHB 11	3	3	5	7	3	7	1	1	7	0	5	3	7	5	3	5	5	7	5	5	**4.4**	**40**	**75**
174	ISHB 23	5	3	1	3	3	7	1	1	5	3	3	5	7	5	5	7	7	7	5	5	**4.4**	**40**	**75**
39	CBMASP 9016	3	3	7	3	5	9	1	3	3	0	3	5	5	3	5	7	5	7	7	5	**4.5**	**45**	**75**
133	GSB 7	3	3	3	7	3	9	7	3	5	0	5	3	5	5	5	5	5	5	3	5	**4.5**	**40**	**85**
107	RP Bio Patho 5	3	5	3	5	7	5	1	1	3	5	3	5	7	3	3	5	9	7	7	3	**4.5**	**45**	**75**
177	ISHB 30	1	5	3	5	9	7	1	1	3	5	3	7	7	7	3	5	5	5	5	3	**4.5**	**40**	**75**
105	RP Bio Patho 3	1	3	7	5	7	5	1	3	7	0	3	5	7	5	5	7	5	7	3	5	**4.6**	**35**	**70**
111	RP Bio Patho 9	9	-	3	5	3	3	1	3	5	1	5	5	5	5	3	5	7	7	5	7	**4.6**	**37**	**79**
178	ISHB 31	1	1	5	5	5	9	1	1	7	7	3	7	5	7	1	7	5	5	5	5	**4.6**	**30**	**70**
110	RP Bio Patho 8	7	0	7	5	3	7	1	3	3	1	5	7	5	5	7	5	7	7	5	3	**4.7**	**35**	**65**
153	ISHB 2	5	3	7	5	3	5	1	3	3	7	3	3	7	5	7	7	5	5	5	5	**4.7**	**35**	**75**
44	CBMASP 8021	7	3	7	3	5	7	1	5	3	1	5	5	5	5	1	5	7	7	5	7	**4.7**	**30**	**70**
175	ISHB 28	3	3	3	5	7	7	5	-	5	0	5	5	5	5	5	7	5	5	5	5	**4.7**	**21**	**84**
188	TN1	7	3	9	9	9	7	9	3	7	1	9	7	5	7	9	9	9	7	9	7	**7.1**	**15**	**20**
187	ISM	7	3	7	5	5	9	1	5	7	7	3	9	5	5	9	9	9	7	9	7	**6.4**	**15**	**40**
LSI		**5.6**	**4.1**	**6.0**	**5.0**	**6.4**	**7.2**	**6.1**	**3.2**	**6.0**	**4.4**	**4.9**	**6.6**	**5.9**	**5.6**	**7.4**	**6.6**	**7.6**	**6.7**	**6.4**	**4.8**			

(SI-Susceptibility Index; *Promising index (PI): Percentage of locations based on no. of locations where the entry had scored ≤3 and ≤5)

❖ TRIAL No.7: RICE TUNGRO VIRUS DISEASE (RTD)

➢ NSN-1

The National Screening Nursery - 1 (NSN-1) trial consisting of 481 entries including checks was proposed and conducted at two locations *viz*., Coimbatore and IIRR. At both the locations the nursery was evaluated artificially by insect transmission tests in the glass house. The frequency distribution of disease scores and location severity indices are presented in Table 7.1A. The disease pressure recorded was high with LSI 6.3 at IIRR and moderate at Coimbatore with LSI 5.7.

Table 7.1A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of NSN-1, *Kharif* 2024

Score	Location/Frequency of scores (0-9)	
	CBT	IIRR
1	0	0
3	42	14
5	244	140
7	180	324
9	13	0
Total	**479**	**478**
LSI	**5.7**	**6.3**
Screening method	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

The entries performed better than the resistant check Vikramarya and showed resistance reaction to rice tungro disease are IET 31462, IET 32036, IET 32036, IET 31481, IET 31693, IET 31804, IET 32845, IET 32846, IET 31004, IET 29560, IET 31982, IET 32983 and IET 31640 (Table 7.1B).

Table 7.1B: Promising entries with low susceptibility index (<=4.0) and high PI in NSN-1 to Rice tungro disease, *Kharif* 2024

P.No.	IET No.	Location/Frequency of scores (0-9)		SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CBT	IIRR						
110	31462 (H)	3	5	4	2	1	50	2	100
167	32036 NIL	5	3	4	2	1	50	2	100
176	32036	3	5	4	2	1	50	2	100
207	31481 (H)	3	5	4	2	1	50	2	100
214	31693	3	5	4	2	1	50	2	100
247	31804	3	5	4	2	1	50	2	100
290	32845	3	5	4	2	1	50	2	100
291	32846	5	3	4	2	1	50	2	100
314	31004 (R)	5	3	4	2	1	50	2	100
360	29560	5	3	4	2	1	50	2	100
363	31982	3	5	4	2	1	50	2	100
445	32983	3	5	4	2	1	50	2	100

P.No.	IET No.	Location/Frequency of scores (0-9)		SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CBT	IIRR						
468	31640	5	3	4	2	1	50	2	100
473	TN1	7	7	7	2	0	0	0	0
476	Vikramarya	5	3	4	2	1	50	2	100
	LSI	**5.7**	**6.3**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NSN-2**

The national screening nursery 2 (NSN-2) trial consisting of 672 entries including checks was conducted only at IIRR and only one line did not germinate. The disease pressure recorded was high with LSI 6.2 (Table 7.2A)

Table 7.2A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of NSN-2, *Kharif* 2024

Score	Location/Frequency of scores (0-9)
	IIRR
1	0
3	29
5	195
7	448
9	0
Total	672
LSI	**6.2**
Screening method	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Out of 672 lines tested, only 29 lines showed score 3 and 195 lines showed 5 score against RTD. The lines that was succumbed to RTD were 410. Best performing lines included IET Nos 32406, 32422, 32451, 32469, 32817, 32818, 32538, 32557, 32568, 32597, DRR DHAN 54, 31748 (R), 32648, 32666, 32684, WGL 14, 32715, DRRH-4, CR DHAN 702, 32952, 32747, PR 116 and 32865 (Table 7.2B).

Table 7.2B: NSN-2 entries with low susceptibility index (SI ≤ 3) against rice tungro disease, *Kharif*, 2024

P. No.	IET No.	IIRR	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
35	32406	3	3.0	1	1	100	1	100
52	32422	3	3.0	1	1	100	1	100
81	32451	3	3.0	1	1	100	1	100
102	32469	3	3.0	1	1	100	1	100

P. No.	IET No.	IIRR	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
154	32817	3	3.0	1	1	100	1	100
155	32818	3	3.0	1	1	100	1	100
248	32538	3	3.0	1	1	100	1	100
267	32557	3	3.0	1	1	100	1	100
278	32568	3	3.0	1	1	100	1	100
310	32597	3	3.0	1	1	100	1	100
355	DRR DHAN 54	3	3.0	1	1	100	1	100
370	31748 (R)	3	3.0	1	1	100	1	100
376	32648	3	3.0	1	1	100	1	100
396	32666	3	3.0	1	1	100	1	100
414	32684	3	3.0	1	1	100	1	100
430	WGL 14	3	3.0	1	1	100	1	100
447	32715	3	3.0	1	1	100	1	100
483	DRRH-4	3	3.0	1	1	100	1	100
503	CR DHAN 702	3	3.0	1	1	100	1	100
516	32952	3	3.0	1	1	100	1	100
547	32747	3	3.0	1	1	100	1	100
588	PR 116	3	3.0	1	1	100	1	100
650	32865	3	3.0	1	1	100	1	100

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NSN-H**

Ninety-four entries were screened against rice tungro disease at IIRR under moderate disease pressure with LSI 5.9 (Table 7.3A). Out of 94 entries tested only 4 lines (IET 32318, RCPL 1-464, IET 32326 and 32371) shown to be resistant for RTD.

Table 7.3A: Location severity index (LSI) and frequency distribution of rice tungro disease scores of NSN-H, *Kharif* 2024

Score	Location/Frequency of scores (0-9)
	IIRR
1	0
3	6
5	42
7	46
9	0
Total	**94**
LSI	**5.9**
Screening method	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

➢ **NHSN**

The National Hybrid Screening Nursery (NHSN) consisted of 136 entries including checks. The entries were tested at two centers viz., Coimbatore and IIRR. The frequency distribution of disease scores and LSI are presented in Table 7.4A. The disease pressure was moderate at CBT (LSI 5.4) and high at IIRR (LSI 6.3).

Table 7.4A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of NHSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)	
	CBT	IIRR
1	0	0
3	16	6
5	80	38
7	37	90
9	3	0
Total	136	134
LSI	**5.4**	**6.3**
Screening method	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

For the selection of promising entries both the locations were taken into consideration. The best entries which showed overall SI< 5.0 are listed in Table 7.4B. The promising entries are IET 33017, IET 32998, IET 33035, IET 33058, IET 33063 and IET 33083.

Table 7.4B: Promising entries with low susceptibility index (<=5.0) and high PI in NHSN to Rice tungro disease, *Kharif* 2024.

P. No.	IET No.	Location/Frequency of scores (0-9)		SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CBT	IIRR						
30	33017	3	3	3.0	2	2	100	2	100
4	32998	3	5	4.0	2	1	50	2	100
52	33035	3	5	4.0	2	1	50	2	100
80	33058	3	5	4.0	2	1	50	2	100
86	33063	5	3	4.0	2	1	50	2	100
113	33083	5	3	4.0	2	1	50	2	100

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3; **Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

➢ **DSN**

Donor screening nursery (DSN) comprising of 196 entries including checks were tested at Coimbatore and IIRR. The frequency distribution of disease scores and LSI are presented in Table 7.5A. The disease pressure was high at IIRR (LSI 6.5) and moderate at Coimbatore (LSI 5.9).

Table 7.5A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of DSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)	
	CBT	IIRR
1	0	0
3	8	4
5	102	41
7	80	147
9	6	0
Total	**196**	**192**
LSI	**5.9**	**6.5**
Screening method	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

The DSN entries that showed a moderate level of resistance to rice tungro disease are listed in Table 7.5B. The promising entries included are JGL 38889, RNR 51334, RP 6469-89 and RP Patho 2.

Table 7.5B: Promising entries with low susceptibility index (<=4.0) and high PI in DSN to rice tungro disease, *Kharif* 2024

E.No.	Designation	Location/Frequency of scores (0-9)		SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CBT	IIRR						
1	JGL 38889	5	3	4.0	2	1	50	2	100
49	RNR 51334	3	5	4.0	2	1	50	2	100
63	RP 6469-89	5	3	4.0	2	1	50	2	100
92	RP Patho 2	3	5	4.0	2	1	50	2	100
188	**TN1**	5	7	6.0	2	0	0	1	50
189	**Vikramarya**	5	3	4.0	2	1	50	2	100
LSI		**5.9**	**6.5**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

❖ GLUME DISCOLOURATION

Glume discolouration (GD) was observed at four locations viz., Chatha, Lonavala, Navasari, and Nawagam during *Kharif* 2024. National screening nurseries were tested for GD under natural conditions at all the four locations.

➢ NSN -1

In NSN-1, 481 entries including checks were screened against glume discolouration under natural conditions. Moderate disease pressure was observed at Navasari and Nawagam (LSI 5.1), Chatha (LSI 5.0) and Lonavala (LSI 4.4). The frequency distribution of glume discolouration scores are presented in the Table 7A.1 along with location severity indices.

Table 7A.1: Location severity index (LSI) and frequency distribution of glume discoloration scores of NSN-1, *Kharif* 2024

Score	Location/Frequency of scores (0-9)			
	CHT	LNV	NVS	NWG
1	5	0	1	0
3	60	138	127	59
5	250	314	200	330
7	71	0	148	88
9	3	0	0	0
Total	390	452	476	477
LSI	**5.0**	**4.4**	**5.1**	**5.1**
Screening method	**N**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

The promising entries found in NSN 1 for glume discolouration are IET nos. 30636, 31871, 31633, 30561 (H), 30165, 31998, 29558, 31975, 30605 (H) and 30957 (Table 7A.2).

Table 7A.2: Promising entries with low susceptibility index (<=3.5) and high PI in NSN-1 to glume discoloration, *Kharif* 2024

P.No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CHT	LNV	NVS	NWG						
4	30636	3	3	3	3	3.0	4	4	100	4	100
63	31871	1	5	3	3	3.0	4	3	75	4	100
187	31633	1	3	3	5	3.0	4	3	75	4	100
2	30561 (H)	3	5	3	3	3.5	4	3	75	4	100
133	30165	3	3	3	5	3.5	4	3	75	4	100
316	31998	3	3	5	3	3.5	4	3	75	4	100
343	29558	3	3	3	5	3.5	4	3	75	4	100
347	31975	3	3	3	5	3.5	4	3	75	4	100
173	30605 (H)	1	5	3	5	3.5	4	2	50	4	100
237	30957	1	5	3	5	3.5	4	2	50	4	100
473	**TN1**	**9**	**5**	**7**	**7**	**7.0**	**4**	**0**	**0**	**1**	**25**
	LSI	**5.0**	**4.4**	**5.1**	**5.1**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NSN-2**

The national screening nursery 2 (NSN-2) trial consisting of 672 entries including checks was conducted only at Chatha, Navasari and Navagam. The disease pressure recorded was moderate at Chatha (LSI 5.2), Nawagam (LSI 5.0) and Navasari (4.5) (Table 7A.3)

Table 7A.3: Location severity index (LSI) and frequency distribution of glume discoloration scores of NSN-2, *Kharif* 2024

Score	Location/Frequency of scores (0-9)		
	CHT	NVS	NWG
1	3	1	0
3	73	217	124
5	429	363	403
7	119	63	132
9	6	1	0
Total	**630**	**645**	**659**
LSI	**5.2**	**4.5**	**5.0**
Screening method	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Best performing lines against glume discolouration included IET 32390, 32804, 32777, 32518, 32668, 32742, Swarnadhan, 32591 and 32579 (Table 7A.4)

Table 7A.4: Promising entries with low susceptibility index (<=3.0) and high PI in NSN-2 to glume discoloration, *Kharif* 2024

P. No.	IET No.	Location/Frequency of scores (0-9)			SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CHT	NVS	NWG						
18	32390	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
139	32804	-	3	3	**3.0**	**2**	**2**	**100**	**2**	**100**
165	32777	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
226	32518	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
398	32668	-	3	3	**3.0**	**2**	**2**	**100**	**2**	**100**
542	32742	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
669	Swarnadhan	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
304	32591	1	5	3	**3.0**	**3**	**2**	**67**	**3**	**100**
290	32579	1	5	-	**3.0**	**2**	**1**	**50**	**2**	**100**
189	TN1	9	5	7	**7.0**	**3**	**0**	**0**	**1**	**33**
	LSI	**5.2**	**4.5**	**5.0**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **NSN-H**

A total of 94 lines from NSN hills nurseries were screened against GD only at Lonavala location where the disease pressure was moderate (LSI 3.9). Out of 94 lines tested, 51 lines showed score 3 and 42 lines showed 5 score against GD (Table 7A.5)

Table 7A.5: Location severity index (LSI) and frequency distribution of glume discoloration scores of NSN-H, *Kharif* 2024

Score	Location/Frequency of scores (0-9)
	LNV
1	0
3	51
5	42
7	0
9	0
Total	93
LSI	3.9
Screening method	N

(LSI-Location Severity Index; N-Natural; A-Artificial)

- **NHSN**

National Hybrid Screening Nursery (NHSN) consisted of 136 entries including checks were screened for glume discolouration reaction at 4 locations. The screening was done by natural conditions at Chatha, Lonavla, Navasari and Nawagam. The frequency distribution of disease scores and location severity indices are presented in Table 7A.6. The disease pressure was moderate at all locations *viz*., Nawagam and Chatha (LSI 5.0), Navasari (LSI 4.6) and Lonavala (LSI 4.3).

Table 7A.6: Location severity index(LSI) and frequency distribution of glume discoloration scores of NHSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)			
	CHT	LNV	NVS	NWG
1	3	1	0	0
3	20	45	39	20
5	89	90	79	92
7	16	0	12	23
9	4	0	0	0
Total	132	136	130	135
LSI	5.0	4.3	4.6	5.0
Screening method	**N**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Some of the promising entries selected from NHSN are IET Nos. 33074, 33055, 33016, 32996, 33000, 33001, 33003, 33008, 33012, 33014, 33018, 33022, 33027, 33033, 33035, 33038, 33040, 33041, 33042, 33043, 33050, 33076, 33078, 33080, 32995 (Table 7A.7).

Table 7A.7: Promising entries with low susceptibility index (<=4.0) and high PI in NHSN to glume discoloration, *Kharif* 2024

P.No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CHT	LNV	NVS	NWG						
99	33074	1	5	3	3	**3.0**	**4**	**3**	**75**	**4**	**100**
77	33055	-	3	3	5	**3.7**	**3**	**2**	**67**	**3**	**100**
28	33016	3	3	3	7	**4.0**	**4**	**3**	**75**	**3**	**75**
2	32996	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
7	33000	5	3	5	3	**4.0**	**4**	**2**	**50**	**4**	**100**
8	33001	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
11	33003	3	3	5	5	**4.0**	**4**	**2**	**50**	**4**	**100**
19	33008	-	5	-	3	**4.0**	**2**	**1**	**50**	**2**	**100**
23	33012	3	3	5	5	**4.0**	**4**	**2**	**50**	**4**	**100**
26	33014	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
31	33018	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
36	33022	3	3	5	5	**4.0**	**4**	**2**	**50**	**4**	**100**
42	33027	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
49	33033	3	5	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
52	33035	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
55	33038	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
57	33040	5	5	3	3	**4.0**	**4**	**2**	**50**	**4**	**100**
58	33041	5	5	3	3	**4.0**	**4**	**2**	**50**	**4**	**100**
59	33042	3	5	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
60	33043	5	3	5	3	**4.0**	**4**	**2**	**50**	**4**	**100**
67	33050	5	3	5	3	**4.0**	**4**	**2**	**50**	**4**	**100**
101	33076	5	5	3	3	**4.0**	**4**	**2**	**50**	**4**	**100**
103	33078	5	5	3	3	**4.0**	**4**	**2**	**50**	**4**	**100**
105	33080	3	5	5	3	**4.0**	**4**	**2**	**50**	**4**	**100**
1	32995	1	3	5	7	**4.0**	**4**	**2**	**50**	**3**	**75**
123	TN1	9	5	7	7	**7.0**	**4**	**0**	**0**	**1**	**25**
	LSI	**5.0**	**4.3**	**4.6**	**5.0**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

- **DSN**

Donor Screening Nursery (DSN) comprising of 212 entries including checks were tested against glume discolouration at 4 locations *viz.*, Chatha, Lonavala, Navasari and Nawagam. The frequency distribution of disease scores and LSI are presented in Table 7A.8. The disease pressure was moderate at Chatha (LSI 5.3) Nawagam (LSI 5.2) Navasari (LSI 4.7), and Lonavala (LSI 3.4)

Table 7A.8: Location severity index(LSI) and frequency distribution of glume discoloration scores of DSN, *Kharif* 2024

Score	Location/Frequency of scores (0-9)			
	CHT	LNV	NVS	NWG
1	0	0	1	0
3	27	146	47	19
5	74	41	108	135
7	44	0	24	33
9	3	0	0	1
Total	**149**	**187**	**180**	**188**
LSI	**5.3**	**3.4**	**4.7**	**5.2**
Screening method	**N**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Some of the entries that are found to be promising are NWGR-17008, RNR 51511, ISHB 29, CBMASP 8022, SM-SB-51-147-3, ISHB 12, ISHB 32, JGL 47856, ISHB 6 and CB 21505 (Table 7A.9)

Table 7A.9: Promising donors with low susceptibility index (<=3.5) and high PI in DSN to glume discoloration, *Kharif* 2024

S.No.	Designation	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CHT	LNV	NVS	NWG						
21	NWGR-17008	3	3	-	-	**3.0**	**2**	**2**	**100**	**2**	**100**
50	RNR 51511	3	3	3	3	**3.0**	**4**	**4**	**100**	**4**	**100**
176	ISHB 29	3	3	3	3	**3.0**	**4**	**4**	**100**	**4**	**100**
45	CBMASP 8022	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
144	SM-SB-51-147-3	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
163	ISHB 12	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
179	ISHB 32	5	3	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
4	JGL 47856	5	3	3	-	**3.7**	**3**	**2**	**67**	**3**	**100**
157	ISHB 6	-	3	3	5	**3.7**	**3**	**2**	**67**	**3**	**100**
27	CB 21505	5	0	3	7	**3.8**	**4**	**2**	**50**	**3**	**75**
188	TN1	9	3	3	7	**5.5**	**4**	**2**	**50**	**2**	**50**
	LSI	**5.3**	**3.4**	**4.7**	**5.2**						

(SI-Susceptibility Index; *No. of locations where the entry has scored ≤5 and ≤3;**Promising index (PI) based on no. of locations where the entry had scored ≤3 and ≤5)

➢ MULTIPLE DISEASE RESISTANCE

In NSN-1, a total of 11 entries had shown resistant/moderately resistant reaction to two or three diseases. All the entries showed moderate or resistant reaction against any of two diseases except IET# 32983 (MR to BB, ShR & RTD) which showed moderate resistant reaction to three diseases. Other entries under NSN-1 which showed moderate/resistant reaction to two diseases was listed below. Entries viz., IET # 30603 (MR to NB&BB), 30819 (MR to BS&RTD), 31120 (R to NB& MR to LB), 31461 (MR to NB &ShR), 31509 (MR to BS&ShR), 31693 (MR to ShR&RTD), 31733(MR to BS& R to ShR), 32036 (MR to BB&RTD), 32065(MR to BB& R to NB), 32844(MR to NB&ShR).

Multiple disease resistant lines in NSN-1, *Kharif* -2024

Sl. No.	IET No.	Disease susceptible/resistance reaction					
		LB	NB	BS	BB	ShR	RTD
1	30603 (H)	-	3.00	-	4.6	-	-
2	30819	-	-	4.4	-	-	4.0
3	31120	3.92	1.9	-	-	-	-
4	31461 (H)	-	3.3	-	-	3.9	-
5	31509	-	-	4.8	-	3.9	-
6	31693	-	-	-	-	3.1	4.0
7	31733	-	2.7	4.7	-	-	-
8	32036 NIL	-	-	-	4.7	-	4.0
9	32065	-	2.6	-	4.8	-	-
10	32844	-	3.1	-	-	3.6	-
11	32983	-	-	-	4.7	3.6	4.0

(LB-Leaf blast; NB-Neck blast; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro)

In NSN-2, one entry showed resistance or moderate resistance reaction to diseases. The entry *viz*., IET # 31733 showed resistance reaction to NB, MR to BS.

Multiple disease resistant lines in NSN-2, *Kharif* -2024

Sl. No.	IET No.	Disease susceptible/resistance reaction							
		LB	NB	ShB	BS	BB	ShR	RTD	GD
1	31733	-	2.71	-	4.68	-	-	-	-

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro; GD-Glume discouration)

In NSN-H, a total of thirteen entries showed moderate or resistant reaction to two or more than two diseases. Entry *viz*., IET# 32358 (R to NB& MR to LB, BS, BB&RTD) showed resistant/moderate resistant reaction to five diseases. IET# 31413 (MR to LB, BS&BB), 31415 (R to NB& MR to LB, BS), 31420 (R to NB& MR to LB, BB), 32344 (MR to LB, NB&BS), and 32362 (R to NB& MR to BS, BB) showed resistant/moderate resistant reaction to three diseases. Remaining all entries viz., IET# 31424 (MR to LB&BS), 32317(MR to LB&BB), 32329(R to NB& MR to BS), 32333 (MR to LB&BB), 32371(MR to BS&BB) and 32372(R to NB& MR to BS) showed resistant/moderate resistant reaction to two diseases.

Multiple disease resistant lines in NSN-H, *Kharif* -2024

Sl. No.	IET No.	Disease susceptible/resistance reaction						
		LB	NB	ShB	BS	BB	ShR	RTD
1	31413	4.3	-	-	5.4	4.33	-	-
2	31415	4.3	1.5	-	5.0	-	-	-
3	31420	3.9	2.33	-	-	5.5	-	-
4	31424	4.4	-	-	5.2	-	-	-
5	32317	3.5	-	-	-	5.0	-	-
6	32329	-	2.0	-	5.4	-	-	-
7	32333	4.0	-	-	-	5.5	-	-
8	32343	3.4	-	-	5.2	-	-	-
9	32344	4.1	3.0	-	5.4	-	-	-
10	32358	4.2	2.67	-	5.2	5.0	-	5.0
11	32362	-	2.0	-	5.2	5.0	-	-
12	32371	-	-	-	4.6	4.33	-	-
13	32372	-	2.0	-	5.4	-	-	-

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro)

In NHSN, a total of 27 entries found resistant or moderately resistant to two or more diseases. IET # 33048(MR to BS, ShR&RTD), 33053(MR to LB, BS&BB), 33058(MR to BB, ShR&RTD), 33063(MR to BS, BB&RTD) and 33078 (R to NB& MR to LB, BB) showed resistance to more than two diseases. Remaining entries IET # 32998(MR to LB&RTD), 33000(MR to ShR&RTD), 33006(R to NB& MR to LB), 33008(MR to ShR&RTD), 33015(MR to BB&ShR), 33017(MR to ShR&RTD), 33018(MR to LB&RTD), 33025(R to NB& MR to ShR), 33030(R to NB& MR to RTD), 33035(MR to LB&RTD), 33039(MR toNB&RTD), 33051(R to NB& MR to RTD), 33057(MR to BB&ShR), 33060(MR toNB&RTD), 33064(MR to BB&RTD), 33070(R to NB& MR to BS), 33066(MR to BS&RTD), 33077(MR to LB&BB), 33080(R to NB& MR to LB) and 33084 (MR to LB&BS) showed resistant to two diseases.

Multiple disease resistant lines in NHSN, *Kharif* -2024

Sl. No.	IET No.	Disease susceptible/resistance reaction						
		LB	NB	ShB	BS	BB	ShR	RTD
1	32998	4.11	-	-	-	-	-	4.0
2	33000	-	-	-	-	-	3.67	5.0
3	33006	4.08	2.4	-	-	-	-	-
4	33008	-	-	-	-	-	4.83	5.0
5	33015	-	-	-	-	5.0	4.22	-
6	33017	-	-	-	-	-	4.89	3.0
7	33018	3.89	-	-	-	-	-	5.0
8	33025	-	2.57	-	-	-	4.11	-
9	33030	-	2.43	-	-	-	-	5.0
10	33035	3.79	-	-	-	-	-	4.0
11	33039	-	3.0	-	-	-	-	5.0
12	33048	-	-	-	5.0	-	4.67	5.0
13	33051	-	2.86	-	-	-	-	5.0
14	33053	3.95	-	-	4.46	4.73	-	-

Sl. No.	IET No.	Disease susceptible/resistance reaction						
		LB	NB	ShB	BS	BB	ShR	RTD
15	33057	-	-	-	-	4.32	4.89	-
16	33058	-	-	-	-	4.73	4.89	4.0
17	33060	-	3.0	-	-	-	-	5.0
18	33063	-	-	-	5.08	5.14	-	4.0
19	33064	-	-	-	-	5.33	-	5.0
20	33070	-	2.57	-	5.08	-	-	-
21	33066	-	-	-	5.0	-	-	5.0
22	33077	3.95	-	-	-	5.24	-	-
23	33078	4.11	1.86	-	-	5.09	-	-
24	33080	3.84	2.0	-	-	-	-	-
25	33084	4.11	-	-	5.08	-	-	-

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro)

In DSN, a total of 28 donors were found resistant or moderate reaction to two or more diseases. **Seven donors exhibited resistant or moderate reaction to three and more diseases and that includes** CBMASP 9016(MR to LB, NB, BB&ShR), GLB 94(MR to LB, NB & BS), ISHB 30(MR to NB, BB & ShR), JGL 47870(MR to NB, BS & RTD), N 4933(R to BS & NB MR to RTD) and NWGR-17048(R to NB, BB & ShR and MR to BS). Other donors showing resistant or moderate reaction to two diseases was listed below.

Multiple disease resistant lines in DSN, *Kharif* -2024

Sl. No.	IET No.	Disease susceptible/resistance reaction						
		LB	NB	ShB	BS	BB	ShR	RTD
1	BPT 3507	-	3.0	-	-	-	3.29	-
2	CB 21515	3.9	-	-	3.4	-	-	-
3	CBMASP 9013	3.6	3.0	-	-	-	-	-
4	CBMASP 9014	3.1	-	-	-	2.2	-	-
5	CBMASP 9015	3.55	3.0	-	-	2.9	-	-
6	CBMASP 9016	3.4	3.0	-	-	3.1	3.43	-
7	GLB 94	3.58	3.0	-	3.4	-	-	-
8	GSB 10	3.95	-	-	-	-	3.57	-
9	GSB 7	-	-	-	3.3	3.3	-	-
10	HR-12	-	-	-	-	-	-	-
11	ISHB 11	-	3.0	-	-	3.0	-	-
12	ISHB 23	-	3.0	-	-	3.0	-	-
13	ISHB 30	-	3.0	-	-	3.4	3.43	-
14	ISHB 34	-	3.0	-	-	-	-	5.0
15	JGL 47849	3.45	-	-	-	-	-	5.0
16	JGL 47856	3.11	-	-	-	-	-	5.0
17	JGL 47870	-	3.0	-	3.5	-	-	5.0
18	N 4824	-	2.5	-	-	-	-	5.0
19	N 4925	-	2.5	-	2.1	-	-	-
20	N 4933	-	2.5	-	1.6	-	-	5.0
21	NLRBL 25	-	-	-	-	-	3.0	5.0
22	NWGR-17008	3.92	1.0	-	-	-	-	-
23	NWGR-17048	-	0.0	-	3.5	1.7	2.0	-

Sl. No.	IET No.	Disease susceptible/resistance reaction						
		LB	NB	ShB	BS	BB	ShR	RTD
24	RNR 51334	-	-	-	3.4	-	-	4.0
25	RP Bio Patho 3	-	-	-	-	3.4	3.29	-
26	RP Bio Patho 5	-	-	-	-	3.3	-	5.0
27	RP Bio Patho 8	-	-	-	-	3.5	-	5.0
28	RP Patho 1	-	-	-	3.3	-	-	5.0

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro)

II: FIELD MONITORING OF VIRULENCE

TRIAL No.8: Leaf Blast - *Pyricularia oryzae*

The experiment was conducted at 25 locations across India during *Kharif* 2024 to monitor the virulence pattern of *Pyricularia oryzae* population, the causal pathogen of rice blast. The nursery included 39 cultivars consisting of near isogenic lines, international differentials, donors and commercial cultivars possessing different gene/gene combinations for blast resistance. Susceptible checks (HR 12, CO-39) and resistant check (Tetep, Rasi, IR 64) were also included in the trial. The reaction of 39 differentials at twenty-five locations during the crop season on blast reaction is presented in Table 8.1. The disease pressure was high (LSI>6.0) at Ghagarghat (6.8), Lonavala (LSI 6.2), Cuttack (6.2), Uppershillong (6.1) and Almora (6.1). At Hazaribagh, Navasari, Gangavathi, Khudwani, Nawagam and Maruteru the LSI was recorded in between 5.0 to 6.0. The disease pressure was recorded as less than 5.0 at Bikramgunj, New Delhi, Pattambi, Imphal, Nellore Jagdalpur, Mandya, Coimbatore, Gudalur, Ranchi, Karjat, Ponnampet and IIRR. The severity trends are depicted in Table 8.1 and Fig. 8.1A.

Differentials such as Tetep, Raminad str-3, RP BioPath-3, PRS-58, RP BioPath-1, Dular, RP BioPath-2, and RP BioPath-4 exhibited moderate to high resistance across locations, with a severity index (SI) of ≤4.0. Tetep demonstrated high resistance at 14 locations and it was susceptible at Ghagarghat, Hazaribagh, Karjat, Almora, and Uppershillong (score 7.0) and moderately resistant (score 3.0–5.0) at Cuttack, Maruteru, Nawagam, Nellore, New Delhi, and Ranchi. Raminad str-3 showed high resistance at Coimbatore, Gudalur, IIRR, Jagdalpur, Karjat, Mandya, and New Delhi but was highly susceptible at Cuttack, Gangavathi, and Ghagarghat. Notably, RP BioPath-3, RP BioPath-1, and RP BioPath-2, which possess the Pi2 gene, exhibited a consistent reaction pattern across locations. This gene conferred resistance to most isolates except at Almora, Cuttack, Ghagarghat, and Lonavala, where it was ineffective. PRS-58, carrying the Pi9 gene, was resistant at eight locations, moderately resistant at 13, and susceptible at Almora, Lonavala, and Navsari. Differentials such as RP BioPath-2, RP BioPath-4, PRS-50, and RP BioPath-3, which possess the Pi54 gene, showed moderate resistance across locations with an SI of 4.0–4.1. The Pi54 gene conferred resistance at seven locations, moderate resistance at nine, and susceptibility at seven. Dular, with the Pi-ka+ gene, was susceptible at 14 locations but resistant at eight. Zenith, carrying a combination of three genes (Pi-z + Pi-a + Pi-i), exhibited resistance at seven locations but showed varying degrees of moderate resistance to susceptibility at most others.

The susceptible checks, HR-12 and Co-39, exhibited susceptibility at most locations. The resistant check, Rasi, showed a range of reactions from moderately resistant to susceptible across locations, with resistance observed at six locations. IR 64 was found to be highly susceptible at Almora, Bikramgunj, Cuttack, Ghagarghat, Gudalur, Lonavala, Navsari, New Delhi, and Uppershillong. Cluster analysis based on disease severity grouped the isolates from 25 locations into eight major clusters at a 30% dissimilarity coefficient (Fig 8.1B). The isolate from Gagharghat and Almora were unique and formed distinct clusters. Isolates from Coimbatore and Gudalur clustered together, suggesting similarity in virulence patterns. Isolates from Lonavala and Uppershillong showed a close relationship in pathogen reaction. Isolates from Nawagam and Navasari seems to be different with distinct cluster. The remaining 16 isolates formed a major cluster, showing a broadly similar reaction pattern across locations. The study highlights geographical variability in *Pyricularia oryzae* virulence, with Gagharghat and Almora emerging as hotspots for high disease pressure. While Tetep, Raminad str-3, RP BioPath-3, PRS-58, RP Bio Path-1, Dular, RP BioPath-2 and RP BioPath-4 demonstrated stable resistance, the breakdown of resistance in Rasi and IR 64 at certain locations suggests potential shifts in the pathogen population. This information is crucial for breeding programs and disease management strategies.

Table 8.1: Reaction of rice differentials to *Pyricularia oryzae* across the locations in India during *Kharif* -2024

P.NO	Differentials	Locations	ALM	BKG	CBT	CTK	GNV	GGT	GDL	HZB	IIRR	IMP	JDP	KJT	KHD	SI	<=3*	<=5*	Total	PI 3	PI 5
		Gene (s)/screening	N	N	A	A	N	N	N	N	A	N	N	A	N						
22	Tetep	*Pi-kh+*	6.5	1.0	2.0	5.0	3.0	7.0	2.0	7.0	1.0	3.0	0.7	7.0	1.0	**3.4**	**14**	**20**	**25**	**56**	**80**
12	Raminad -STR -3	-	4.5	5.0	0.0	7.0	9.0	7.0	0.0	5.0	1.0	3.5	2.1	1.5	5.0	**3.6**	**10**	**21**	**25**	**40**	**84**
34	RP Biopatho-3	*Pi2*	6.5	3.0	1.0	7.0	4.5	7.0	1.0	4.0	3.0	3.5	3.5	3.0	4.0	**3.7**	**11**	**18**	**25**	**44**	**72**
38	PRS-58	*Pi9*	6.0	3.0	4.0	5.0	5.0	5.0	4.0	5.0	3.0	4.0	3.7	3.5	5.0	**3.7**	**9**	**22**	**25**	**36**	**88**
32	RP Biopatho-1	*Pi2*	6.0	3.0	2.0	7.0	4.0	7.0	2.0	4.0	2.0	3.5	4.0	2.5	4.0	**3.8**	**9**	**20**	**25**	**36**	**80**
16	Dular	*Pi-ka+*	5.0	5.0	0.0	5.0	5.0	7.0	0.0	7.0	2.0	3.0	2.9	1.5	6.0	**4.0**	**9**	**17**	**25**	**36**	**68**
33	RP Biopatho-2	*Pi54*	6.5	3.0	2.0	5.0	5.0	7.0	2.0	4.0	3.0	4.0	3.0	3.5	4.0	**4.0**	**11**	**19**	**25**	**44**	**76**
35	RP Biopatho-4	*Pi54*	5.0	3.0	1.0	5.0	5.5	7.0	1.0	4.0	3.0	5.0	3.5	4.0	5.0	**4.0**	**9**	**20**	**25**	**36**	**80**
13	Zenith	*Pi-z + Pi-a + Pi-i*	5.5	5.0	4.0	5.0	5.0	7.0	4.0	6.0	3.0	6.0	0.7	4.0	3.0	**4.1**	**8**	**20**	**25**	**32**	**80**
37	PRS-50	*Pi54*	5.5	3.0	3.0	7.0	6.0	7.0	3.0	4.0	3.0	-	3.5	4.0	5.0	**4.1**	**10**	**18**	**24**	**42**	**75**
28	RP Patho-3	*Pi54*	5.5	4.0	4.0	5.0	5.0	7.0	4.0	4.0	3.0	5.0	3.7	3.5	5.0	**4.1**	**6**	**20**	**25**	**24**	**80**
20	Tadukan	*Pi-ta*	4.5	5.0	6.0	5.0	5.5	7.0	6.0	4.0	2.0	3.0	1.9	2.0	6.0	**4.1**	**8**	**18**	**25**	**32**	**72**
21	IR - 64	Resistant	7.0	7.0	0.0	7.0	4.0	7.0	0.0	5.0	3.0	-	2.9	0.5	4.0	**4.1**	**9**	**15**	**24**	**38**	**63**
39	PRS-59	*Pi9*	5.0	3.0	4.0	7.0	7.5	5.0	4.0	6.0	3.0	5.0	4.0	5.0	5.0	**4.2**	**8**	**19**	**25**	**32**	**76**
36	PRS-17	*(Pi9+Pi54)*	3.5	5.0	4.0	7.0	5.5	7.0	4.0	6.0	3.0	4.0	3.0	4.0	6.0	**4.3**	**6**	**18**	**25**	**24**	**72**
14	NP - 125	-	6.0	7.0	2.0	5.0	6.0	7.0	2.0	7.0	3.0	3.0	4.6	3.0	5.0	**4.3**	**8**	**17**	**25**	**32**	**68**
29	RP Patho-7	*Pi1*	5.5	5.0	3.0	5.0	5.0	7.0	3.0	5.0	3.0	4.0	2.3	3.0	7.0	**4.4**	**9**	**18**	**25**	**36**	**72**
8	BL-122	*Pi-1 + Pi-2*	6.5	4.0	4.0	7.0	4.0	7.0	4.0	5.0	3.0	3.0	3.5	2.0	5.0	**4.4**	**6**	**17**	**25**	**24**	**68**
7	*O. minuta*	*Pi-9*	8.0	7.0	3.0	5.0	5.0	5.0	3.0	4.0	3.0	6.0	2.8	4.5	5.0	**4.4**	**7**	**17**	**25**	**28**	**68**
27	RP Patho-2	*Pi2*	6.0	4.0	2.0	7.0	4.5	7.0	2.0	5.0	3.0	4.0	3.7	3.0	4.5	**4.4**	**7**	**18**	**25**	**28**	**72**
6	RIL - 29	*Pi-7*	7.0	5.0	0.0	7.0	5.0	7.0	0.0	4.0	3.0	4.0	5.8	3.5	6.0	**4.5**	**6**	**15**	**25**	**24**	**60**
17	Kanto - 51	*Pi-k*	6.0	6.0	0.0	7.0	7.0	7.0	0.0	6.0	2.0	5.5	3.5	2.0	7.0	**4.5**	**7**	**13**	**25**	**28**	**52**
26	RP Patho-1	*Pi1*	5.5	5.0	3.0	7.0	4.5	7.0	3.0	5.0	3.0	5.0	4.7	2.5	5.0	**4.5**	**7**	**18**	**25**	**28**	**72**
11	C101 PKT	*Pi-3*	6.5	6.0	4.0	5.0	5.0	7.0	4.0	6.0	3.0	3.0	3.8	0.5	5.0	**4.5**	**5**	**16**	**25**	**20**	**64**
30	RP Patho-8	*Pi2*	6.5	5.0	2.0	9.0	6.0	7.0	2.0	5.0	3.0	5.0	3.4	2.5	5.5	**4.6**	**8**	**16**	**25**	**32**	**64**
1	C101 LAC	*Pi-1*	6.0	5.0	3.0	5.0	5.0	7.0	3.0	6.0	3.0	5.0	4.4	3.5	6.0	**4.6**	**5**	**17**	**25**	**20**	**68**
5	RIL - 10	*Pi-12*	6.5	4.0	7.0	5.0	5.5	7.0	7.0	6.0	3.0	6.0	5.6	3.5	6.0	**4.7**	**4**	**15**	**25**	**16**	**60**
31	RP Patho-9	*Pi54*	6.0	5.0	4.0	5.0	3.5	7.0	4.0	5.0	2.0	4.0	4.1	3.0	5.0	**4.8**	**4**	**17**	**25**	**16**	**68**
2	C101 A51	*Pi-2*	5.5	5.0	1.0	5.0	4.0	7.0	1.0	9.0	3.0	6.0	4.5	3.5	6.0	**4.9**	**5**	**14**	**25**	**20**	**56**
24	Rasi	Resistant	7.0	6.0	3.0	7.0	5.5	7.0	3.0	7.0	3.0	5.0	6.7	2.5	3.0	**4.9**	**7**	**13**	**25**	**28**	**52**
9	BL-245	*Pi-2 + Pi-4*	6.0	3.0	6.0	7.0	8.0	5.0	6.0	7.0	2.0	3.5	2.4	4.0	5.0	**5.0**	**5**	**13**	**25**	**20**	**52**
4	C101 TTP	*Pi-4b*	7.0	6.0	3.0	5.0	4.0	7.0	3.0	6.0	3.0	5.0	5.6	3.5	6.0	**5.0**	**4**	**12**	**25**	**16**	**48**
19	Calaro	*Pi-ks*	6.5	7.0	6.0	5.0	7.0	7.0	6.0	7.0	3.0	5.0	4.3	3.0	7.0	**5.3**	**3**	**12**	**25**	**12**	**48**
10	A 57	*Pi-1 + Pi-2 + Pi-4*	6.0	4.0	9.0	7.0	8.0	7.0	9.0	7.0	3.0	5.0	4.5	4.0	5.0	**5.3**	**5**	**14**	**25**	**20**	**56**
15	USEN	*Pi-a+*	8.5	7.0	8.0	7.0	4.5	7.0	8.0	9.0	3.0	4.5	6.9	3.5	6.0	**5.8**	**2**	**11**	**25**	**8**	**44**
3	C104 PKT	-	6.5	7.0	6.0	5.0	5.0	7.0	6.0	9.0	3.0	3.0	5.9	6.0	5.0	**5.9**	**2**	**9**	**24**	**8**	**38**
25	Co - 39	Susceptible	7.0	5.0	8.0	9.0	8.5	7.0	8.0	8.0	3.0	3.0	8.0	4.0	7.0	**6.2**	**3**	**8**	**25**	**12**	**32**
18	Shi-tia-tao	*Pi-ks*	7.5	7.0	9.0	7.0	9.0	7.0	9.0	9.0	4.0	6.0	5.3	8.0	8.0	**6.3**	**1**	**8**	**25**	**4**	**32**
23	HR - 12	Susceptible	7.0	6.0	8.0	9.0	9.0	7.0	8.0	9.0	9.0	6.0	7.5	7.0	8.0	**7.5**	**1**	**1**	**25**	**4**	**4**
	Min score		**3.5**	**1.0**	**0.0**	**5.0**	**3.0**	**5.0**	**0.0**	**4.0**	**1.0**	**3.0**	**0.7**	**0.5**	**1.0**						
	Max Score		**8.5**	**7.0**	**9.0**	**9.0**	**9.0**	**7.0**	**9.0**	**9.0**	**9.0**	**6.0**	**8.0**	**8.0**	**8.0**						
	LSI		**6.1**	**4.8**	**3.6**	**6.2**	**5.6**	**6.8**	**3.6**	**5.9**	**2.9**	**4.4**	**4.0**	**3.5**	**5.3**						

(Contd.) Table 8.1: Reaction of rice differentials to *Pyricularia oryzae* at across the locations in India during *Kharif* -2024

P.NO	Differentials	Locations	LNV	MND	MTU	NVS	NWG	NLR	NDL	PTB	PNP	RNC	USG	WBL	SI	<=3*	<=5*	Total	PI 3	PI 5
		Gene (s)/screening	**N**	**N**	**N**	**N**	**A**	**A**	**A**	**N**	**N**	**N**	**N**	**N**						
22	Tetep	*Pi-kh+*	2.5	0.0	4.0	3.0	4.0	4.0	5.0	3.0	2.0	5.0	7.0	0.0	**3.4**	**14**	**20**	**25**	**56**	**80**
12	Raminad -STR -3	-	5.5	1.0	4.5	4.0	4.0	5.0	0.0	3.0	3.5	5.0	3.0	1.0	**3.6**	**10**	**21**	**25**	**40**	**84**
34	RP Biopatho-3	*Pi2*	6.0	1.0	4.0	6.5	5.5	4.5	1.0	3.0	2.0	1.0	6.0	0.0	**3.7**	**11**	**18**	**25**	**44**	**72**
38	PRS-58	*Pi9*	7.0	1.0	4.0	6.0	5.0	1.5	2.0	3.0	2.0	1.0	5.0	0.0	**3.7**	**9**	**22**	**25**	**36**	**88**
32	RP Biopatho-1	*Pi2*	6.0	1.0	4.5	5.0	5.5	5.0	2.0	4.0	2.0	5.0	5.0	0.0	**3.8**	**9**	**20**	**25**	**36**	**80**
16	Dular	*Pi-ka+*	6.5	1.0	5.5	5.5	5.5	3.5	5.0	3.0	3.5	5.0	7.0	0.0	**4.0**	**9**	**17**	**25**	**36**	**68**
33	RP Biopatho-2	*Pi54*	7.0	1.5	5.5	6.0	5.0	3.0	5.0	3.0	2.5	2.0	7.0	1.0	**4.0**	**11**	**19**	**25**	**44**	**76**
35	RP Biopatho-4	*Pi54*	7.0	1.0	4.5	6.5	5.5	3.0	5.0	4.0	3.0	3.0	5.0	1.0	**4.0**	**9**	**20**	**25**	**36**	**80**
13	Zenith	*Pi-z + Pi-a + Pi-i*	5.0	4.5	5.5	4.0	4.5	3.5	3.0	5.0	2.5	3.0	3.0	0.0	**4.1**	**8**	**20**	**25**	**32**	**80**
37	PRS-50	*Pi54*	7.0	1.5	5.0	4.0	5.0	2.0	2.0	4.0	2.5	3.0	8.0	0.0	**4.1**	**10**	**18**	**24**	**42**	**75**
28	RP Patho-3	*Pi54*	7.5	3.5	5.0	3.5	5.5	3.0	2.0	4.0	2.5	1.0	7.0	0.0	**4.1**	**6**	**20**	**25**	**24**	**80**
20	Tadukan	*Pi-ta*	6.5	1.0	3.5	3.5	3.5	4.0	5.0	3.0	2.5	5.0	7.0	1.0	**4.1**	**8**	**18**	**25**	**32**	**72**
21	IR - 64	Resistant	7.0	1.5	5.0	6.0	5.5	4.0	7.0	4.0	3.0	2.0	7.0	0.0	**4.1**	**9**	**15**	**24**	**38**	**63**
39	PRS-59	*Pi9*	6.5	1.0	3.5	5.0	5.5	1.5	2.0	3.0	3.5	1.0	7.0	1.0	**4.2**	**8**	**19**	**25**	**32**	**76**
36	PRS-17	*(Pi9+Pi54)*	6.5	1.5	4.5	5.5	5.0	1.0	5.0	4.0	3.5	3.0	5.0	0.0	**4.3**	**6**	**18**	**25**	**24**	**72**
14	NP - 125	-	6.0	1.5	5.0	5.5	4.0	4.0	5.0	4.0	4.0	3.0	6.0	0.0	**4.3**	**8**	**17**	**25**	**32**	**68**
29	RP Patho-7	*Pi1*	6.5	1.0	4.5	7.0	4.0	5.0	7.0	3.5	2.5	2.0	7.0	1.0	**4.4**	**9**	**18**	**25**	**36**	**72**
8	BL-122	*Pi-1 + Pi-2*	4.5	5.5	5.5	5.5	6.5	5.0	4.0	6.0	2.0	5.0	3.0	0.0	**4.4**	**6**	**17**	**25**	**24**	**68**
7	*O. minuta*	*Pi-9*	5.0	5.5	5.5	6.0	6.0	4.0	1.0	6.0	3.5	5.0	2.0	0.0	**4.4**	**7**	**17**	**25**	**28**	**68**
27	RP Patho-2	*Pi2*	7.5	3.5	5.5	5.0	5.0	5.0	2.0	5.5	2.5	5.0	9.0	0.0	**4.4**	**7**	**18**	**25**	**28**	**72**
6	RIL - 29	*Pi-7*	6.0	5.5	5.0	5.5	5.5	4.5	7.0	5.0	2.0	5.0	2.0	1.0	**4.5**	**6**	**15**	**25**	**24**	**60**
17	Kanto - 51	*Pi-k*	7.0	1.0	5.0	4.5	5.5	4.0	7.0	4.5	3.0	4.0	7.0	1.0	**4.5**	**7**	**13**	**25**	**28**	**52**
26	RP Patho-1	*Pi1*	7.0	3.5	4.5	6.5	4.5	4.5	5.0	6.0	2.0	0.0	9.0	0.0	**4.5**	**7**	**18**	**25**	**28**	**72**
11	C101 PKT	*Pi-3*	5.0	5.5	5.5	7.0	4.0	4.0	7.0	4.0	4.5	0.0	8.0	0.0	**4.5**	**5**	**16**	**25**	**20**	**64**
30	RP Patho-8	*Pi2*	7.0	1.5	5.5	6.0	5.0	4.5	4.0	3.0	2.5	5.0	8.0	0.0	**4.6**	**8**	**16**	**25**	**32**	**64**
1	C101 LAC	*Pi-1*	5.0	5.5	6.0	6.5	4.5	5.0	5.0	7.0	3.5	2.0	4.0	0.0	**4.6**	**5**	**17**	**25**	**20**	**68**
5	RIL - 10	*Pi-12*	5.5	4.5	5.0	5.0	4.0	5.0	3.0	3.5	2.0	4.0	5.0	0.0	**4.7**	**4**	**15**	**25**	**16**	**60**
31	RP Patho-9	*Pi54*	7.0	9.0	6.5	4.5	6.0	3.5	7.0	5.0	2.5	4.0	7.0	0.0	**4.8**	**4**	**17**	**25**	**16**	**68**
2	C101 A51	*Pi-2*	6.0	4.5	6.0	6.0	4.0	6.0	5.0	5.0	7.5	2.0	8.0	1.0	**4.9**	**5**	**14**	**25**	**20**	**56**
24	Rasi	Resistant	6.5	5.5	5.0	7.5	5.5	3.5	5.0	4.5	3.5	3.0	6.0	1.0	**4.9**	**7**	**13**	**25**	**28**	**52**
9	BL-245	*Pi-2 + Pi-4*	7.0	6.5	5.0	5.5	6.0	5.0	5.0	6.0	2.0	5.0	6.0	0.0	**5.0**	**5**	**13**	**25**	**20**	**52**
4	C101 TTP	*Pi-4b*	8.0	5.5	5.5	5.5	5.0	4.0	7.0	6.0	4.5	5.0	6.0	0.0	**5.0**	**4**	**12**	**25**	**16**	**48**
19	Calaro	*Pi-ks*	6.0	7.5	4.5	6.0	6.0	4.0	5.0	4.0	3.5	5.0	6.0	0.0	**5.3**	**3**	**12**	**25**	**12**	**48**
10	A 57	*Pi-1 + Pi-2 + Pi-4*	6.0	3.0	4.5	6.5	7.0	4.0	5.0	3.0	3.0	5.0	8.0	0.0	**5.3**	**5**	**14**	**25**	**20**	**56**
15	USEN	*Pi-a+*	5.0	9.0	5.5	7.0	6.0	4.0	7.0	4.0	3.5	5.0	5.0	0.0	**5.8**	**2**	**11**	**25**	**8**	**44**
3	C104 PKT	-	4.0	8.5	6.5	6.5	6.0	5.0	7.0	8.0	4.5	5.0	6.0	-	**5.9**	**2**	**9**	**24**	**8**	**38**
25	Co - 39	Susceptible	6.5	6.5	5.0	7.5	6.5	6.5	9.0	7.0	4.5	5.0	6.0	0.0	**6.2**	**3**	**8**	**25**	**12**	**32**
18	Shi-tia-tao	*Pi-ks*	8.0	9.0	5.0	6.5	5.0	3.5	7.0	4.0	3.5	6.0	5.0	0.0	**6.3**	**1**	**8**	**25**	**4**	**32**
23	HR - 12	Susceptible	7.0	9.0	6.5	7.0	9.0	7.5	9.0	7.5	8.5	6.0	9.0	0.0	**7.5**	**1**	**1**	**25**	**4**	**4**
	Min score		**2.5**	**0.0**	**3.5**	**3.0**	**3.5**	**1.0**	**0.0**	**3.0**	**2.0**	**0.0**	**2.0**	**0.0**						
	Max Score		**8.0**	**9.0**	**6.5**	**7.5**	**9.0**	**7.5**	**9.0**	**8.0**	**8.5**	**6.0**	**9.0**	**1.0**						
	LSI		**6.2**	**3.8**	**5.0**	**5.6**	**5.3**	**4.1**	**4.8**	**4.5**	**3.2**	**3.6**	**6.1**	**0.3**						

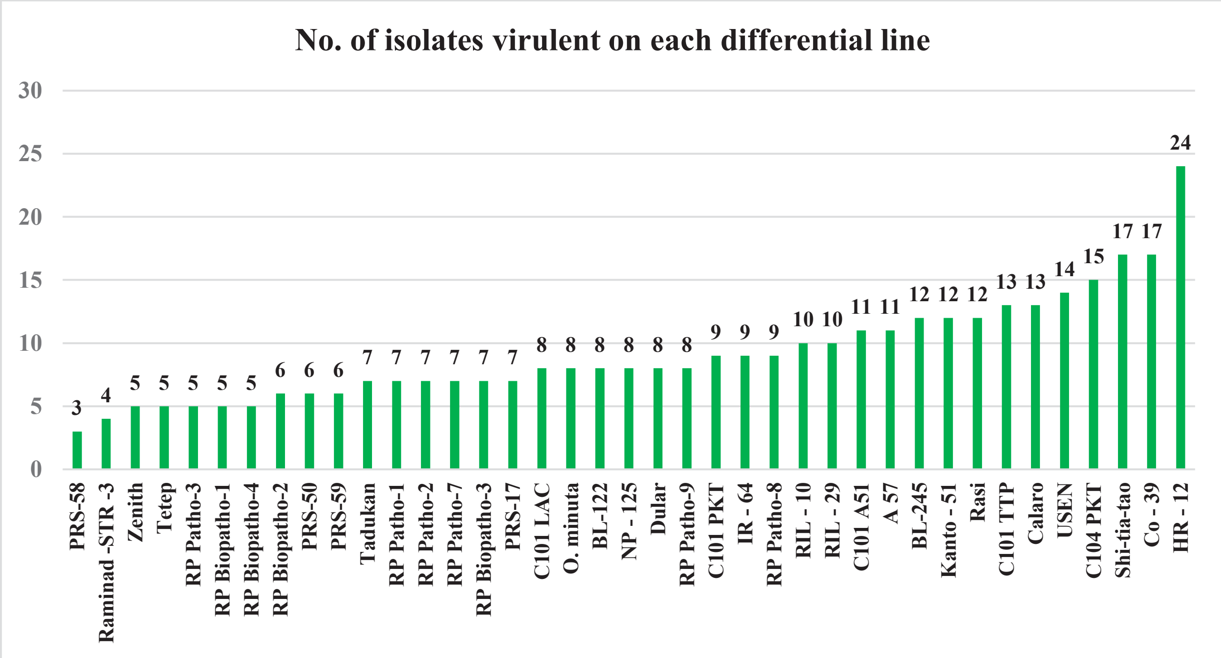

Figure 8.1A: Differential reaction of hosts to rice blast pathogen (*Pyricularia oryzae)* at different locations - *Kharif* 2024

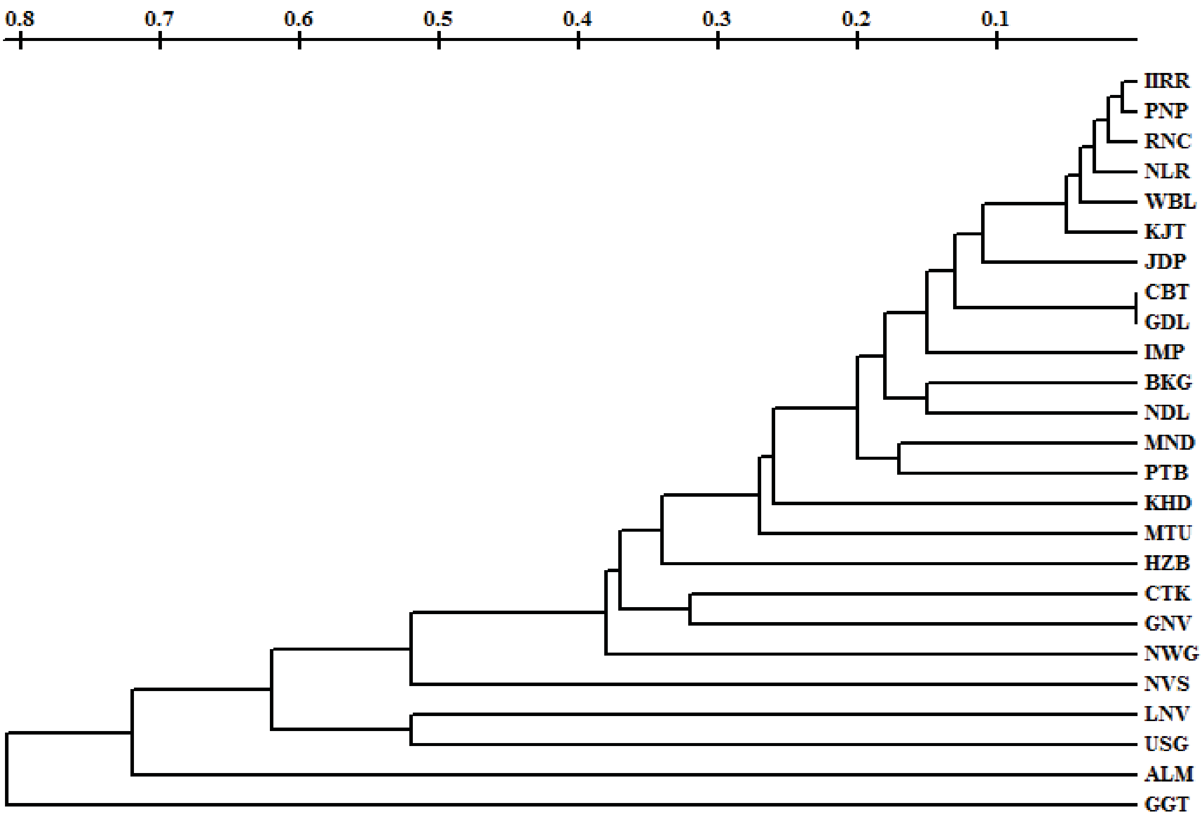

Figure 8.1B: Dendrogram showing relatedness of different reactions of *P. oryzae* at different locations during *Kharif* -2024

TRIAL No.9: Bacterial Blight (BB) - *Xanthomonas oryzae* pv. *oryzae* (*Xoo*)

Trial on monitoring virulence of bacterial blight (BB) pathogen, *Xanthomonas oryzae* pv. *oryzae* (*Xoo*) was proposed at 30 hot spot locations across India during *Kharif* season of 2024. However, data were received from 23 locations. At Ludhiana, the trial was conducted with 10 established strains of Xoo. The rice differentials used in this trial consisted of eleven near isogenic lines (IRBB lines) possessing different single BB resistance genes in the genetic background of rice cultivar IR 24. The virulence analyses and categorization of the isolates was done based on the reaction of *Xoo* isolates on differentials possessing single BB resistance genes (Table 9.1). Reactions of the *Xoo* isolates were also recorded on differentials possessing combinations of different BB resistance genes. Susceptible checks like IR 24 and TN1 and resistant check like Improved Samba Mahsuri were included in the trial. Based on the reactions of the isolates on differentials possessing single BB resistance genes, the isolates from IIRR, Hyderabad, Chinsurah, Chiplima, Pantnagar and Raipur were categorized as highly virulent as they produced LSI (Location Severity Index) greater than 7. All these isolates produced a highly susceptible reaction on susceptible check TN1 with a disease score of 9. These isolates produced susceptible reactions on 11-13 differentials out of 13 differentials. Out of these five isolates, isolates from Chinsurah and Pantnagar produced susceptible score of 7 or more on IRBB21 possessing BB resistance gene, *Xa21*. The isolate from Raipur was unique and produced highly susceptible reaction on IRBB 13 possessing BB resistance gene, *xa13*. The isolate from Raipur also produced susceptible reaction (average score of 8) on resistant check Improved Samba Mahsuri possessing three BB resistance genes viz., *Xa21*, *xa13* and *xa5*.

The isolates from Bikramgunj, Navsari, New Delhi, Pattambi, Titabar, Rajendranagar, Sabour, Nellore, Gangavathi, Masodha, Nawagam, Chatha, Cuttack, Aduthurai, Coimbatore and all the strains from Ludhiana were categorized as moderately virulent and these isolates produced an LSI ranging from 4.8-6.9. These isolates produced susceptible reactions on 3-13 differentials. Majority of these isolates (except isolates from Bikramgunj, Navsari, Rajendranagar, Masodha, Nawagam, Chatha and Ludhiana-Strain LDN Xo-8) showed moderate to high level of resistance to IRBB13. However, many of these isolates showed moderate to high susceptibility on IRBB21 possessing BB resistance gene, *Xa21*. The isolates from Karjat and Moncompu were categorized as less virulent as they produced an LSI of below 3 and produced BB disease score of less than 5 on all differentials except TN1. The reactions of all these isolates to differentials possessing different combinations of BB resistance genes are presented in Table 9.2**.** Most of the differentials possessing different combination of BB resistance genes (except IRBB 50 possessing *Xa4* and *xa5* and IRBB 51 possessing *Xa4* and *xa13*) showed moderate to good level of resistance across the locations (Table 9.2). Cluster analysis of *Xoo* reaction on differentials possessing different single BB resistance genes at various locations was done and is presented in Figure 9.1A. The isolate from Raipur and strain 8 from Ludhiana were unique and formed separate cluster (Figure 9.1B). Most of the isolates which were categorized as highly virulent were grouped nearby except isolate from Raipur. Both the least virulent isolates (Moncompu and Karjat) grouped together.

Table 9.1: Reaction of rice differentials possessing different single BB resistance genes to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif*'2024

Differentials	Highly virulent					Moderately virulent										
	IIRR	CHN	CHP	PNT	RPR	BKGJ	NVS	NDL	PTB	LDN-9	TTB	LDN-7	RNR	LDN-10	LDN-5	LDN-4
IR 24	9	7	7	9	8	9	7	7	8	7	7	7	6	7	-	7
IRBB 1	9	9	9	9	9	7	8	9	7	7	8	7	7	7	-	7
IRBB 3	9	9	9	7	9	6	7	7	7	7	8	7	6	7	-	7
IRBB 4	9	9	8	9	8	7	7	7	6	7	7	-	7	7	-	-
IRBB 5	9	5	9	7	4	6	8	7	6	7	6	7	7	7	7	7
IRBB 7	9	9	8	8	6	6	6	7	7	7	5	7	7	7	7	7
IRBB 8	9	9	7	9	7	7	6	9	7	7	8	7	7	7	7	-
IRBB 10	9	9	8	6	6	9	7	7	7	7	7	7	6	7	7	7
IRBB 11	9	7	9	6	9	7	8	9	7	7	7	7	6	7	7	7
IRBB 13	3	5	6	6	8	7	7	5	5	3	4	3	7	3	3	3
IRBB 14	9	9	9	6	8	7	6	1	7	7	7	7	7	7	7	7
IRBB 21	5	7	6	8	4	5	7	7	6	7	6	7	6	5	7	7
ISM	3	5	4	5	8	5	4	5	5	5	3	5	5	5	5	3
TN1	9	9	9	9	9	9	8	9	9	7	9	7	7	7	7	7
LSI	**7.9**	**7.7**	**7.7**	**7.4**	**7.4**	**6.9**	**6.9**	**6.9**	**6.7**	**6.6**	**6.6**	**6.5**	**6.5**	**6.4**	**6.4**	**6.3**
Min Score	**3**	**5**	**4**	**5**	**4**	**5**	**4**	**1**	**5**	**3**	**3**	**3**	**5**	**3**	**3**	**3**
Max Score	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**7**	**9**	**7**	**7**	**7**	**7**	**7**
# of entries>5	**11**	**11**	**13**	**13**	**12**	**12**	**13**	**11**	**12**	**12**	**11**	**11**	**13**	**11**	**8**	**10**

(Contd.,) Table 9.1: Reaction of rice differentials possessing different single BB resistance genes to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif*'2024

Differentials	Moderately virulent														Less virulent	
	LDN-3	LDN-6	LDN-8	SBR	NLR	GNV	LDN-1	MSD	NWG	CHT	LDN-2	CTK	ADT	CBT	KJT	MCP
IR 24	7	-	7	9	8	8	-	6	6	7	-	5	-	6	2	2
IRBB 1	7	-	7	9	8	7	-	7	7	6	-	7	-	4	3	3

Differentials	Moderately virulent														Less virulent	
	LDN-3	**LDN-6**	**LDN-8**	**SBR**	**NLR**	**GNV**	**LDN-1**	**MSD**	**NWG**	**CHT**	**LDN-2**	**CTK**	**ADT**	**CBT**	**KJT**	**MCP**
IRBB 3	-	-	7	9	6	8	-	6	6	5	-	7	7	5	3	3
IRBB 4	-	-	3	5	7	6	-	7	5	4	-	5	3	6	1	3
IRBB 5	7	7	3	3	5	5	7	6	5	5	3	3	3	4	2	4
IRBB 7	5	7	7	7	5	6	7	6	6	5	5	5	3	3	3	0
IRBB 8	-	7	7	9	5	6	-	5	4	5	5	3	3	4	4	4
IRBB 10	7	7	7	9	5	4	7	6	4	5	7	5	3	4	3	3
IRBB 11	7	7	7	5	6	5	7	5	5	5	7	5	5	7	3	2
IRBB 13	3	3	7	3	5	6	3	7	7	7	3	3	5	5	4	0
IRBB 14	7	7	7	5	5	6	7	5	5	4	7	3	7	6	3	2
IRBB 21	7	7	7	1	4	4	5	4	3	5	5	3	3	3	2	1
ISM	5	3	3	3	6	3	3	3	5	3	3	5	7	3	4	0
TN1	7	7	7	9	9	9	7	9	9	8	7	9	9	7	4	9
LSI	**6.3**	**6.2**	**6.1**	**6.1**	**6.0**	**5.9**	**5.9**	**5.9**	**5.5**	**5.3**	**5.2**	**4.9**	**4.8**	**4.8**	**2.9**	**2.6**
Min Score	**3**	**3**	**3**	**1**	**4**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**0**
Max Score	**7**	**7**	**7**	**9**	**9**	**9**	**7**	**9**	**9**	**8**	**7**	**9**	**9**	**7**	**4**	**9**
# of entries>5	**8**	**8**	**11**	**7**	**7**	**9**	**6**	**9**	**6**	**4**	**4**	**3**	**4**	**5**	**0**	**1**

Table 9.2: Reaction of rice differentials possessing different combinations of BB resistance genes to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif*'2024

Differentials	Moderately virulent															
	RPR	**RNR**	**NWG**	**ADT**	**BKGJ**	**CHN**	**PTB**	**CHT**	**CHP**	**NDL**	**CBT**	**GNV**	**MSD**	**NVS**	**LDN-5**	**SBR**
IR 24	8	6	6	-	9	7	8	7	7	7	6	8	6	7	-	9
IRBB 50	7	6	5	5	5	5	5	4	6	5	2	4	4	6	7	7
IRBB 51	5	6	5	7	5	5	5	5	5	5	4	4	5	6	-	7
IRBB 52	5	6	6	3	7	5	6	7	4	5	3	4	5	5	3	5
IRBB 53	8	7	5	3	7	5	5	3	6	5	5	4	5	4	3	5
IRBB 54	5	7	6	3	6	5	5	5	6	7	4	1	4	3	5	5
IRBB 55	7	6	7	5	3	3	5	7	4	5	4	6	4	3	3	5
IRBB 56	4	6	5	3	5	3	5	4	4	5	6	4	5	2	-	5
IRBB 57	5	7	6	5	5	5	5	5	5	5	4	6	4	4	5	5
IRBB 58	4	6	6	5	3	3	5	4	3	5	5	3	4	3	3	1
IRBB 59	7	7	5	9	3	5	5	5	4	1	7	3	3	4	3	3

Differentials	Moderately virulent															
	RPR	RNR	NWG	ADT	BKGJ	CHN	PTB	CHT	CHP	NDL	CBT	GNV	MSD	NVS	LDN-5	SBR
IRBB 60	5	6	5	5	4	5	4	3	3	1	5	6	3	3	-	1
IRBB 61	8	5	4	3	4	7	5	4	5	5	4	5	5	5	7	5
IRBB 62	8	6	5	3	4	7	4	5	4	7	4	2	5	6	-	3
IRBB 63	9	5	5	3	4	5	3	5	5	5	3	3	4	4	3	1
IRBB 64	5	6	5	5	5	5	3	4	4	5	6	6	3	4	3	3
IRBB 65	5	6	6	7	3	3	3	3	3	1	4	3	3	3	3	1
IRBB 66	5	6	3	7	5	3	3	4	3	1	3	3	3	3	-	1
ISM	8	5	5	7	5	5	5	3	4	5	3	3	3	4	5	3
TN1	9	7	9	9	9	9	9	8	9	9	7	9	9	8	7	9
LSI	**6.4**	**6.1**	**5.5**	**5.1**	**5.1**	**5.0**	**4.9**	**4.8**	**4.7**	**4.7**	**4.5**	**4.4**	**4.4**	**4.4**	**4.3**	**4.2**
Min Score	**4**	**5**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**3**	**2**	**3**	**1**
Max Score	**9**	**7**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**7**	**9**	**9**	**8**	**7**	**9**
# of entries>5	**10**	**17**	**8**	**6**	**5**	**4**	**3**	**4**	**5**	**4**	**5**	**6**	**2**	**5**	**3**	**4**

(Conti.,) Table 9.2: Reaction of rice differentials possessing different combinations of BB resistance genes to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif*'2024

Differentials	Moderately virulent														Less virulent	
	NLR	LDN-10	IIRR	TTB	LDN-9	LDN-3	LDN-4	LDN-7	LDN-6	PNT	LDN-1	LDN-8	LDN-2	KJT	CTK	MCP
IR 24	8	7	9	7	7	7	7	7	-	9	-	7	-	2	5	2
IRBB 50	5	3	7	5	-	3	3	5	5	6	3	3	3	3	3	1
IRBB 51	6	3	3	4	3	-	3	3	-	5	-	5	-	1	1	1
IRBB 52	5	7	5	4	5	3	3	3	3	6	3	3	3	3	1	2
IRBB 53	6	3	3	3	3	3	3	3	3	4	3	3	3	4	1	1
IRBB 54	5	3	5	4	3	7	7	3	5	3	3	5	3	1	1	0
IRBB 55	4	3	1	4	3	3	3	3	3	1	3	7	-	4	1	2
IRBB 56	3	3	1	3	3	3	3	3	-	1	3	3	-	3	3	2
IRBB 57	3	3	3	3	3	3	3	3	3	1	3	3	3	3	1	2
IRBB 58	3	3	3	4	3	3	3	3	3	1	3	3	3	1	1	1
IRBB 59	5	3	1	3	3	3	3	3	3	1	3	3	-	4	1	2
IRBB 60	1	3	1	3	3	3	3	3	-	1	3	3	-	3	1	2
IRBB 61	2	7	9	3	7	3	3	5	3	7	7	1	3	4	3	3
IRBB 62	3	5	7	3	3	-	-	3	-	1	-	1	3	3	3	4
IRBB 63	2	3	1	4	3	3	3	3	3	7	3	3	-	3	1	2
IRBB 64	2	3	3	3	3	3	3	3	3	1	3	3	3	3	3	2
IRBB 65	2	3	1	3	3	3	3	1	3	1	3	1	3	3	3	4
IRBB 66	1	3	3	3	3	-	-	-	-	1	-	3	-	3	3	1
ISM	6	5	3	3	5	5	3	5	3	5	3	3	3	4	5	0
TN1	9	7	9	9	7	7	7	7	7	9	7	7	7	4	9	9
LSI	**4.1**	**4.0**	**3.9**	**3.9**	**3.8**	**3.8**	**3.7**	**3.6**	**3.6**	**3.6**	**3.5**	**3.5**	**3.3**	**3.0**	**2.5**	**2.2**
Min Score	**1**	**3**	**1**	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**1**	**0**
Max Score	**9**	**7**	**9**	**9**	**7**	**7**	**7**	**7**	**7**	**9**	**7**	**7**	**7**	**4**	**9**	**9**
# of entries>5	**5**	**4**	**5**	**2**	**3**	**3**	**3**	**2**	**1**	**6**	**2**	**3**	**1**	**0**	**1**	**1**

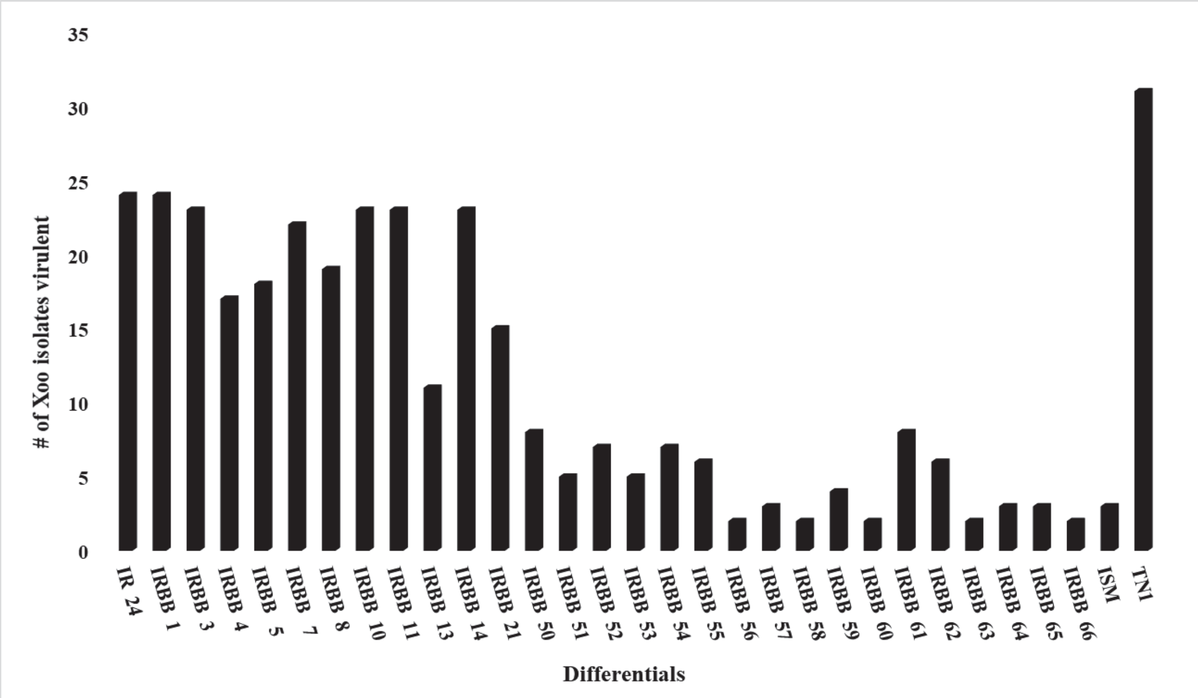

Figure 9.1A: Number of *Xoo* isolates showing moderate to high virulence on different BB resistance genes and their combinations during *Kharif'*2024

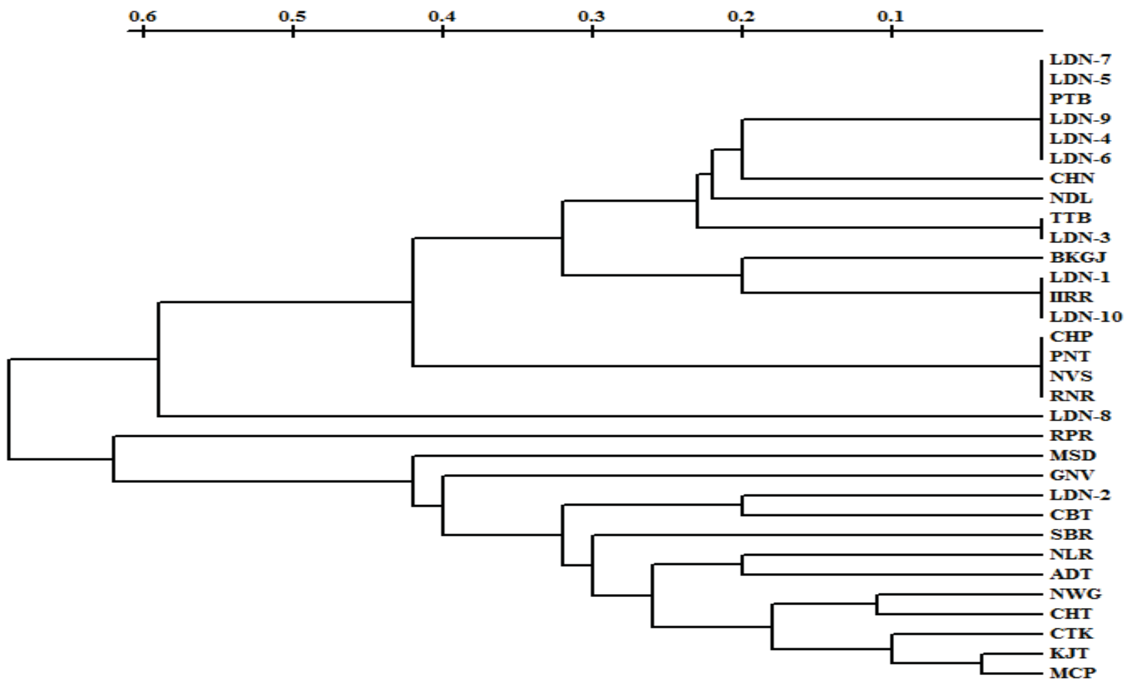

Figure 9.1B: Dendrogram (based on reactions of differentials possessing single BB resistance genes) showing the relatedness of different *Xanthomonas oryzae* pv. *oryzae* isolates from various locations during *Kharif'* 2024

III. DISEASE OBSERVATION NURSERY – *Kharif*-2024

Disease observation nursery (DON) trials were conducted at different locations with different sowing dates viz., early, normal and late with relevance to the respective locations, with an aim to estimate the effect of such varied sowing/planting dates on the occurrence and severity of the disease in the respective endemic regions. This trial was constituted to study the effect of different dates of sowings on the prevalence of different diseases in different rice growing systems like transplanted and directed seeded rice. It is generally known that the availability of susceptible host, virulent pathogen and prevalence of favorable weather conditions play important role in the process of disease development. In this context the trial was formulated with a susceptible variety (location specific) to take up sowing in three different dates to collect the information on the incidence of the disease and data was recorded as percent disease index of various rice diseases throughout the cropping period. Knowledge on the occurrence of particular disease in specific location based on susceptible host and time of sowing may help to formulate the best management strategy. Bankura and Pusa centres were conducted in one system (transplanted) and remaining all centres were conducted in both the systems viz., transplanted and direct seeded rice conditions. The trial was proposed at 11 locations *i.e.,* Bankura, Chatha, Chinsurah, Kaul, Malan, Mandya, Maruteru, Moncompu, Nawagam, Pusa and Raipur. The data however was received from 9 centres for this trial. The salient features of this study are presented on location-wise below.

BANKURA:

Three different sowing dates i.e., 14.06.2024 (early), 01.07.2024 (normal) and 16.07.2024 (late) were followed to study the effect of date of sowings on the progression of the leaf blast, brown spot and bacterial leaf blight and sheath blight diseases by using the susceptible variety of this region *i.e.,* TN-1. The late sown crop of variety TN-1 showed escaping to blast (7% PDI) as compared to the early (26.8% PDI) and normal sown crops (11.2% PDI) in this particular center (Table 10.1). The early sown crop showed the highest disease progression (0 to 26.8% PDI) compared to the normal and late sown crops. The incidence of Bacterial leaf blight was more in normal sown crop (7.2- 61.3% PDI) followed by the late sown crop (10.9-40.3% PDI). The early sown crop showed less incidence of BLB compared to normal and late sown crops. The brown spot incidence was more in early sown crop (57.6% PDI) followed by the normal sown crop (47.3% PDI).

Table 10.1: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024 - Bankura

Location/ Date of sowing	Percentage of Disease Index												
		Leaf blast			BLB			Brown spot			Sheath blight		
V/DOS	DAT	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
TN 1	30 DAT	0.0	0.5	2.2	2.3	7.2	10.9	12.3	14.7	8.1	8.3	3.3	6.3
E:14-06-2024	40 DAT	2.7	1.9	3.6	4.7	30.9	24.9	34.6	25.3	16.5	32.9	18.4	23.5
N:01-07-2024	50 DAT	13.6	6.0	5.9	10.7	49.5	34.2	45.1	34.4	26.3	42.4	27.0	34.3
L:16-07-2024	60 DAT	26.8	11.2	7.0	19.4	61.3	40.3	57.6	47.3	36.4	50.9	34.3	40.4
	70 DAT												
	80 DAT												
	90 DAT												
	100 DAT												
	110 DAT												

(E=Early; N=Normal; L=Late)

CHATHA:

In Chatha centre three different sowing dates i.e., 05-06-2024 (early), 20-06-2024 (normal) and 05-07-2024 (late) were followed to study the progression of the brown spot, bacterial leaf blight and grain discoloration diseases by using the most susceptible variety of the location Basmati 370 in both the cultivation systems like transplanted and direct seeded conditions. Under transplanted conditions, the severity of the brown spot was more in late sown crop (57.8% PDI) compared to the early sown (48.5% PDI) and normal sown crops (32.8% PDI). The bacterial leaf blight and grain discoloration also showed the same trend that late sown crop (48.3% and 25.3% PDI respectively) has more disease severity compared to the early and normal sown crops (Table 10.2).

Table 10.2: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024 – Chatha-transplanted rice

Location/ Date of sowing	Percentage of Disease Index									
		Brown spot			BLB			Grain discoloration		
V/DOS	DAT	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
Basmati 370	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E:05-06-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0
N:20-06-2024	50 DAT	3.5	0.0	8.0	3.0	0.0	11.2	0.0	0.0	0.0
L:05-07-2024	60 DAT	10.8	3.3	14.8	8.3	4.3	19.3	0.0	0.0	0.0
	70 DAT	18.0	8.5	24.3	15.5	8.8	27.3	0.0	0.0	0.0
	80 DAT	26.0	13.5	31.0	22.5	13.9	35.1	0.0	0.0	0.0
	90 DAT	38.5	19.3	42.5	27.3	19.8	40.3	0.0	0.0	0.0
	100 DAT	44.8	27.3	47.9	31.3	26.0	44.3	0.0	0.0	3.3
	110 DAT	48.5	32.8	57.8	37.8	31.1	48.3	8.0	5.5	16.8
	120 DAT	-	-	-	-	-	-	15.0	15.3	25.3

E=Early; N=Normal; L=Late

Under direct seeded rice conditions, the brown spot, bacterial leaf blight and grain discoloration were more in late sown crops (73.1%, 60% and 38.3% PDI respectively) compared to the early and normal sown crops (Table 10.3). Compared to the both the systems, the direct seeded rice has infected more with the brown spot, BLB and grain discoloration in this particular centre.

Table 10.3: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024 – Chatha- Direct seeded rice

Location/ Date of sowing	Percentage of Disease Index									
		Brown spot			BLB			Grain discoloration		
V/DOS	DAT	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
Basmati 370	30 DAT	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0
E:05-06-2024	40 DAT	0.0	0.0	3.1	3.3	5.9	10.2	0.0	0.0	0.0
N:20-07-2024	50 DAT	7.8	4.3	14.4	10.2	13.3	17.8	0.0	0.0	0.0
L:05-07-2024	60 DAT	14.5	9.1	23.5	17.8	20.9	26.3	0.0	0.0	0.0
	70 DAT	21.9	14.1	36.5	26.3	28.0	37.3	0.0	0.0	0.0
	80 DAT	32.8	25.5	48.3	33.5	34.0	43.5	0.0	0.0	0.0
	90 DAT	43.8	33.1	54.9	38.8	38.3	49.8	0.0	0.0	0.0
	100 DAT	52.5	42.9	62.9	43.3	42.3	53.4	0.0	8.0	13.1
	110 DAT	61.0	48.8	73.1	46.9	48.3	60.0	9.6	18.1	26.9
	120 DAT	-	-	-				19.4	27.0	38.3

E=Early; N=Normal; L=Late

CHINSURAH:

In Chinsurah, three different sowing dates viz., 28.06.24, 12.07.24 and 30.07.24 were followed as early, normal and late sowing periods respectively. The variety MTU 7029 was used to study the disease progress of different diseases in both transplanted and direct seeded rice conditions. The diseases that were prevalent in this centre were Sheath blight, Sheath rot, brown spot and bacterial leaf blight (BLB). The observations were taken at 10 days interval from 30 DAT to 110 DAT. Higher incidence of Sheath blight was observed in the normal and early sowing periods (4.5 to 69% PDI and 2.5 to 62.5 % PDI respectively) and significantly less incidence was observed during the late sown crop i.e., 2.5 to 22.5 % PDI. Sheath rot disease was present in the panicle initiation and grain filling stages in all the sowing periods (80 to 110 DAT) and relatively more in late and normal sown crops (12.5 to 37.5% and 9.0 to 27.5.5% PDI respectively), when compared to the early sown crop (5.0 to 22.5% PDI) (Table 10.4).

Brown spot disease was generally less in all the sowings, was generally found to occur in the tillering to grain filling stages (70 to 100 DAT) and more in the late sown crop (2.5 to 22.5% PDI) when compared to early sown crop (2.5 to 5.0% PDI). Similarly, BLB severity more in normal sown crop (17.5% PDI) as compared to the early sown crop (5% PDI) (Table 10.4).

TABLE 10.4: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Chinsurah- transplanted rice

Location/ Date of sowing	Percentage of Disease Index												
		Sheath blight			Sheath rot			Brown spot			BLB		
V/DOS	DAT	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
MTU 7029	30 DAT	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E:28-06-2024	40 DAT	5.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N:12-07-2024	50 DAT	10.0	9.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
L:30-07-2024	60 DAT	12.0	13.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
	70 DAT	20.0	22.5	13.5	0.0	0.0	0.0	0.0	0.0	2.5	0.0	13.5	0.0
	80 DAT	40.0	47.5	22.5	0.0	0.0	12.5	2.5	4.5	6.5	2.0	17.5	0.0
	90 DAT	52.5	62.5	-	5.0	9.0	27.5	5.0	9.0	12.5	5.0	-	0.0
	100 DAT	62.5	69.0	-	16.5	22.5	37.5	-	11.5	17.5	-	-	0.0
	110 DAT	-	-	-	22.5	27.5	-	-	-	22.5	-	-	0.0

(E=Early; N=Normal; L=Late)

Similarly, the sheath blight, brown spot and sheath rot diseases were studied under the direct seeded rice conditions using the same variety MTU 7029. Under DSR conditions, the more sheath blight severity was observed in early sown crop (66.5% PDI) followed by the normal sown crop (52.5% PDI). In case of sheath rot disease, the normal sown crop showed highest disease severity (37.5% PDI) followed by the early sown crop (20% PDI) and the least disease severity was observed in late sown crop (16.5% PDI). The late sown crop showed less disease may be the cool temperatures prevail during the maturity stage in the month of November in the North eastern region of the country. very less incidence of BLB was observed in direct seeded rice cropping system.

TABLE 10.5: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Chinsurah- direct seeded rice

Location/ Date of sowing	DAT	Percentage of Disease Index											
		Sheath blight			Sheath rot			Brown spot			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
MTU 7029	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-
E:28-06-2024	40 DAT	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	-	-
N:12-07-2024	50 DAT	9.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	-	-
L:30-07-2024	60 DAT	19.0	5.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	-	-
	70 DAT	32.5	12.5	11.0	0.0	0.0	0.0	0.0	0.0	5.0	-	-	-
	80 DAT	51.5	29.0	14.5	0.0	6.0	5.0	2.5	5.0	11.0	-	-	-
	90 DAT	59.0	42.5	-	5.0	22.5	13.5	4.0	10.0	19.0	-	-	-
	100 DAT	66.5	52.5	-	15.0	27.5	16.5	7.5	15.0	27.5	-	-	-
	110 DAT	-	-	-	20.0	37.5	-	-	-	-	-	-	-

(E=Early; N=Normal; L=Late)

MARUTERU:

Two varieties viz., BPT5204 and Swarna (MTU 7029) were tested in Maruteru under three different sowing dates i.e, 15.07.2024 (early), 11.08.2024 (normal) and 16.09.2024 (late), for the variations in the percent disease incidence of the two major rice diseases of this region i.e., Sheath blight and BLB. The crop sown in the early season was having more disease severity (sheath blight) than the crops sown during the normal and late periods.

Among the two varieties tested, the variety Swarna was found to be more susceptible to BLB viz., BLB (68.4% PDI), when compared to the variety MTU 7029 56.6% PDI. Sheath blight severity was more in early sown crop (53 % in MTU 7029) compared to normal and late sown crops of variety MTU 7029. but in the variety Swarna, the sheath blight severity was more in normal sown crop (60.4% PDI) followed by late sown crop (Table 10.6).

The bacterial leaf blight severity was more in early sown crop of variety MTU 7029 (56.6% PDI) followed by the normal sown crop. In case of variety swarna, bacterial blight severity was more in normal sown crop (68.4% PDI) followed by the early sown crop (58.5% PDI) (Table 10.6).

TABLE 10.6: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Maruteru- transplanted rice

Location/ Date of sowing	DAT	Percentage of Disease Severity					
		SHB			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
BPT 5204	30 DAT	0.0	0.0	-	0.0	0.0	0.0
E:26-06-2024	40 DAT	0.0	0.0	-	0.0	0.0	0.0
N:12-07-2024	50 DAT	0.0	0.0	-	0.0	0.0	0.0
L:29-07-2024	60 DAT	0.0	0.0	-	0.0	0.0	0.0
	70 DAT	7.4	8.2	28.1	33.6	-	-
	80 DAT	-	24.8	30.0	-	-	21.5
	90 DAT	43.7	-	-	34.4	-	-
	100 DAT	45.9	36.3	44.1	36.9	19.7	32.4
	110 DAT	53.0	48.5	-	56.6	47.6	-

Location/ Date of sowing	DAT	Percentage of Disease Severity					
		SHB			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
	120 DAT				-	-	-
Swarna	30 DAT	0.0	0.0	-	0.0	0.0	0.0
E:26-06-2024	40 DAT	1.3	0.0	-	0.0	0.0	0.0
N:12-07-2024	50 DAT	3.6	3.7	1.9	0.0	0.0	0.0
L:29-07-2024	60 DAT	4.4	51.5	-	0.0	0.0	0.0
	70 DAT	51.5	28.2	30.7	2.8	-	-
	80 DAT	-	32.2	33.7	-	-	-
	90 DAT	51.9	-	-	17.4	-	-
	100 DAT	53.0	37.0	54.8	18.5	13.8	11.1
	110 DAT	45.6	60.4	-	58.5	68.4	-
	120 DAT				-	-	-

(E=Early; N=Normal; L=Late)

Under direct seeded rice conditions, the variety swarna more susceptible to sheath blight and BLB compared to the variety MTU 7029. sheath blight severity was more in early sown crop of both the varieties (57.8% PDI in MTU 7029 & 71.5% PDI in swarna) compared to the normal and late sown crops. the severity of BLB was more in normal sown crops (51.7% in MTU 7029 & 70.1% PDI in Swarna) as compared to early and late sown crops (Table 10.7).

TABLE 10.7: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Maruteru- Direct seeded rice

Location/ Date of sowing	DAT	Percentage of Disease Severity					
		SHB			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
BPT 5204	30 DAT	0.0	0.0	-	0.0	0.0	0.0
E:26-06-2024	40 DAT	0.0	0.0	17.8	0.0	0.0	0.0
N:12-07-2024	50 DAT	0.0	0.0	10.0	0.0	0.0	0.0
L:29-07-2024	60 DAT	31.3	50.9	-	0.0	0.0	0.0
	70 DAT	71.1	15.2	5.2	0.0	0.0	0.0
	80 DAT	69.6	-	-	0.0	0.0	0.0
	90 DAT	-	19.6	32.6	0.0	0.0	0.0
	100 DAT	64.8	9.6		0.0	0.0	0.0
	110 DAT	48.1	38.2	33.0	6.8	0.0	37.3
	120 DAT	57.8	37.8	55.6	10.7	25.2	38.8
	130 DAT				50.2	51.7	-
Swarna	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0
E:26-06-2024	40 DAT	0.0	0.0	18.0	0.0	0.0	0.0
N:12-07-2024	50 DAT	0.0	3.6	0.0	0.0	0.0	0.0
L:29-07-2024	60 DAT	78.2	65.8	0.0	0.0	0.0	0.0
	70 DAT	75.6	68.2	0.0	0.0	0.0	0.0
	80 DAT	76.3	-	0.0	0.0	0.0	0.0
	90 DAT	-	62.6	29.3	0.0	0.0	0.0
	100 DAT	65.6	27.0	0.0	0.0	0.0	0.0
	110 DAT	71.5	23.7	14.4	0.0	0.0	0.0
	120 DAT	71.1	38.9	58.2	10.5	24.9	55.0
	130 DAT				35.5	70.1	-

(E=Early; N=Normal; L=Late)

MONCOMPU-TP

Two different varieties i.e., Pournami and Uma were sown on different dates i.e, 01.06.2024 (early), 16.06.2024 (normal) and 02.07.2024 (late) for the studies on the effect of the different time of sowing on Sheath blight and BLB incidence on rice. The intensity of the disease was very less this year, may be because of the relatively dry weather conditions during the entire cropping seasons. Among the different sowing period, Sheath blight disease severity was relatively high during the fag end of the crop in the late sown crop of uma and pournami compared to early and normal sown crops (19.3% and 7.2% PDI). The incidence of BLB was very less this year and late sown crop effected much compared to early and normal sown crops (Table 10.8).

TABLE 10.8: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Moncompu- transplanted rice

Location/ Date of sowing	DAT	Percentage of Disease Severity					
		SHB			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
Pournami	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0
E:01-06-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0
N:16-06-2024	50 DAT	0.0	0.0	0.0	0.0	0.0	0.1
L:02-07-2024	60 DAT	0.0	0.6	0.5	0.0	2.5	6.5
	70 DAT	0.3	1.7	1.3	0.8	6.4	11.1
	80 DAT	2.7	2.6	2.6	2.0	11.6	17.9
	90 DAT	3.2	4.6	4.8	4.2	16.5	27.1
	100 DAT	4.9	5.9	6.0	5.6	18.1	30.3
	110 DAT	5.4	6.8	7.2	5.8	19.1	32.0
	120 DAT				-	-	-
Uma	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0
E:01-06-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0
N:16-06-2024	50 DAT	0.0	0.0	0.0	0.0	0.0	0.1
L:02-07-2024	60 DAT	0.6	1.5	1.6	0.9	1.1	3.7
	70 DAT	1.8	2.2	4.1	4.1	3.5	9.0
	80 DAT	4.3	3.4	10.3	6.2	5.9	14.8
	90 DAT	6.1	5.5	14.0	8.8	8.8	20.8
	100 DAT	9.0	7.8	17.5	9.5	10.4	24.5
	110 DAT	10.6	9.2	19.3	10.0	11.2	26.3

(E=Early; N=Normal; L=Late)

MONCOMPU-DSR

In direct seeded rice (DSR) conditions, the incidence of sheath blight and BLB was comparatively more in comparison to the transplanted crop of rice in the Moncompu center. Sheath blight disease severity was more in both the varieties in late sown crop of DSR (20% and 23% PDI respectively) and in the case of BLB, early sown crop of both the varieties Pournami and Uma (42.9% & 39.7% PDI respectively) showed higher disease incidence compared to the normal and late sown crop (Table 10.9).

TABLE 10.9: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Moncompu- direct seeded rice

Location/ Date of sowing	DAT	Percentage of Disease Severity					
		SHB			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
Pournami	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0
E:01-06-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0
N:16-06-2024	50 DAT	0.0	0.0	0.1	1.3	1.0	0.0
L:02-07-2024	60 DAT	1.5	2.9	3.9	7.0	8.0	7.9
	70 DAT	3.3	5.9	6.5	13.1	15.0	11.9
	80 DAT	5.3	7.8	11.0	29.1	22.8	22.8
	90 DAT	7.0	12.3	16.3	35.0	26.4	26.8
	100 DAT	8.4	15.1	18.0	40.5	30.5	36.3
	110 DAT	9.5	16.6	20.0	42.9	32.4	39.6
Uma	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0
E:01-06-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0
N:16-06-2024	50 DAT	0.0	0.4	0.1	1.0	1.8	0.0
L:02-07-2024	60 DAT	1.4	1.8	3.0	8.2	5.1	4.6
	70 DAT	2.8	4.7	8.1	15.0	7.2	9.8
	80 DAT	5.5	9.5	12.3	22.4	21.9	17.3
	90 DAT	7.8	13.9	16.8	32.0	24.4	23.6
	100 DAT	12.3	16.2	20.5	37.9	27.6	29.6
	110 DAT	12.7	17.0	23.0	39.7	28.9	32.2

(E=Early; N=Normal; L=Late)

NAWAGAM

Two varieties viz., Gurjari and P-203 were used as test varieties for the purpose of estimating the effects of sowing period viz., early (05.06.2024), normal (20.06.2024) and late (05.07.2024) on the occurrence of Sheath rot disease in Nawagam.

In the case of variety Gurjari, it was observed that the incidence of the disease was relatively more in the late stages of the crop (60 to 100 DAT) in late sown crop (13.3 to 48.3% PDI) and normal (5 to 45.7% PDI) and comparatively low incidence was observed from 60 to 100 DAT in early sowing periods (6.7 to 31.9% PDI). Among the three sowing periods, the incidence of Sheath rot was found to be maximum in the late sown crop (48.3% PDI). The disease was significantly less in the variety P-203 compared to Gurjari, with the initial symptoms started to appear about 60 DAT in the early and at 50 DAT in normal sown crops, progressing gradually thereafter. But in case of late sown crop, symptoms appear at 50 DAT. Further, the percentage disease index was relatively less in the case of the variety P-203 (maximum of 42.9% PDI) when compared to the variety Gurjari (maximum of 48.3% PDI). (Table 10.10). The same trend was followed in the case of variety P-203 like the late sown crop was more effected by the sheath rot incidence compared to normal and early sown crops. In case of direct seeded rice conditions, the late sown crop (37.3% PDI) showed the highest disease incidence as compared to the early and normal sown crops (Table 10.10).

TABLE 10.10: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Nawagam- transplanted and direct seeded rice

Location/ Date of sowing	Percent Disease Index								
	Nawagam								
	Sheath rot								
	transplanted				Direct seeded rice				
V/DOS	DAT	(E)	(N)	(L)	V/DOS	DAT	(E)	(N)	(L)
Gurjari	30 DAT	0.0	0.0	0.0	Gurjari	30 DAT	0.0	0.0	0.0
E:05-06-2024	40 DAT	0.0	0.0	0.0	E:05-06-2024	40 DAT	0.0	0.0	0.0
N:20-06-2024	50 DAT	0.0	5.0	0.0	N:20-06-2024	50 DAT	0.0	0.0	0.0
L:05-07-2024	60 DAT	6.7	13.3	13.3	L:05-07-2024	60 DAT	0.0	0.0	0.0
	70 DAT	20.7	16.7	19.0		70 DAT	0.0	0.0	0.0
	80 DAT	22.0	19.0	26.3		80 DAT	0.0	6.7	18.7
	90 DAT	29.9	31.4	43.6		90 DAT	0.0	25.7	27.0
	100 DAT	31.9	45.7	48.3		100 DAT	6.7	28.0	34.9
	110 DAT	-	-	-		110 DAT	21.0	32.0	37.3
P-203	30 DAT	0.0	0.0	0.0					
E:05-06-2024	40 DAT	0.0	0.0	0.0					
N:20-06-2024	50 DAT	0.0	5.0	5.0					
L:05-07-2024	60 DAT	5.0	13.3	16.7					
	70 DAT	13.3	23.3	22.0					
	80 DAT	18.3	27.0	31.4					
	90 DAT	23.0	33.6	37.9					
	100 DAT	28.7	37.9	40.0					
	110 DAT	32.9	40.0	42.9					

(E=Early; N=Normal; L=Late)

PUSA

Variety Sugandha was used as the susceptible variety against brown leaf spot and the crop was sown in i.e., 15.06.2024 (early), 01.07.2024 (normal) and 18.07.2024 (late). The incidence of brown leaf spot was started at 50 days after transplanting. The incidence of brown leaf spot was more in late sown crop (31% PDI) compared to normal (11% PDI) and early sown crops (5% PDI) (Table 10.11).

TABLE 10.11: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Pusa-Transplanted

BROWN LEAF SPOT				
Location/date of sowing	Percentage of Disease severity			
V/DOS	DAT	(E)	(N)	(L)
Sugandha	**30 DAT**	0.0	0.0	0.0
E:15-06-2024	**40 DAT**	0.0	0.0	2.5
N:01-07-2024	**50 DAT**	0.0	0.0	5.0
L:18-07-2024	**60 DAT**	0.0	0.0	11.0
	70 DAT	0.0	1.5	19.0
	80 DAT	2.5	8.0	25.0
	90 DAT	5.0	11.0	31.0
	100 DAT	-	-	-
	110 DAT	-	-	-

(E=Early; N=Normal; L=Late)

RAIPUR

The variety Swarna was tested in Raipur under three different sowing dates i.e.,14-06-2024 (early), 09-07-2024 (normal) and 04-08-2024 (late), for the variation in the percent disease incidence of the major rice disease of this region i.e., Sheath blight under transplanted and direct seeded rice (DSR) conditions.

The incidence of sheath blight was more in early sown crop in both the cultivations systems i.e., transplanted and direct seeded rice conditions (22.7% PDI in transplanted & 15.9% PDI in direct seeded rice) compared to the normal and late sown crops (Table 10.12). the sheath blight severity is more in transplanted condition compared to the direct seeded rice.

TABLE 10.12: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Raipur-Transplanted and direct seeded

Location/ Date of sowing	DAT	Percentage of Disease Severity					
		Sheath blight-transplanted			Sheath blight-DSR		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
Swarna	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0
E: 14.06.24	40 DAT	0.7	0.0	0.0	0.0	0.0	0.0
N: 09.07.24	50 DAT	1.5	0.3	0.0	1.2	0.0	0.0
L: 04.08.24	60 DAT	3.3	1.1	0.9	3.3	1.3	0.0
	70 DAT	6.0	2.7	3.0	4.2	3.7	1.1
	80 DAT	9.0	4.2	5.4	8.8	6.5	3.7
	90 DAT	12.3	8.7	8.8	11.9	11.0	9.4
	100 DAT	18.2	11.5	12.4	13.5	11.4	10.1
	110 DAT	22.7	14.6	20.4	15.9	11.4	12.5

(E=Early; N=Normal; L=Late)

MANDYA

The progression of three diseases (leaf blast, neck blast and sheath blight) were studied at three different sowing dates i.e., 15-07-2024 (early), 10.08.2024 (normal) and 11.09.2024 (late) by using two different susceptible varieties like MTU-1001 and IR-64 under transplanted conditions. MTU 1001showed better tolerance for leaf blast disease and normal sown crop effected much (3.5%PDI) compared to early (2.5%PDI) and late sown crop (1.5%PDI). In case of IR-64, the early sown crop showed more disease incidence compared to the normal and late sown crops (Table 10.13). The variety MTU-1001 showed more susceptible reaction to sheath blight disease compared to the variety IR-64. sheath blight severity was more severe in early sown crop of both the varieties (77% PDI in MTU-1001 and 97% in IR-64) compared to the normal and late sown crops (Table 10.13). The neck blast severity was more in early sown crop (13.5% PDI in MTU-1001 and 33% in IR-64) (Table 10.13).

TABLE 10.13: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Mandya-Transplanted

Location/ Date of sowing	Percentage of Disease Index									
		Leaf blast			Sheath blight			Neck blast		
V/DOS	DAT	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
MTU-1001	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E:15-07-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N:10-08-2024	50 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L:11-09-2024	60 DAT	0.0	1.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0
	70 DAT	0.0	1.0	0.0	16.0	20.0	0.0	0.0	0.0	0.0

Location/ Date of sowing	Percentage of Disease Index									
		Leaf blast			Sheath blight			Neck blast		
	80 DAT	1.0	1.0	1.0	22.5	25.0	15.5	0.0	0.0	0.0
	90 DAT	1.5	1.5	1.0	47.0	34.0	30.0	0.0	0.0	0.0
	100 DAT	1.5	2.0	1.5	70.5	60.0	53.5	6.0	6.5	6.5
	110 DAT	2.5	3.5	-	77.0	67.0		13.5	14.0	-
	120 DAT	-	-	-	-	-	-	-	-	-
IR-64	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E:15-07-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N:10-08-2024	50 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L:11-09-2024	60 DAT	0.0	1.0	0.0	0.0	17.0	0.0	0.0	0.0	0.0
	70 DAT	0.0	1.0	0.0	30.0	30.0	0.0	0.0	0.0	0.0
	80 DAT	1.0	1.5	0.5	58.5	43.5	18.5	0.0	2.5	0.0
	90 DAT	2.0	2.0	1.5	72.0	49.0	44.0	3.5	4.5	3.5
	100 DAT	2.5	2.0	2.5	84.5	79.5	73.0	11.5	13.0	13.5
	110 DAT	5.0	2.5	-	97.0	88.0	-	33.0	29.5	-
	120 DAT	-	-	-	-	-	-	-	-	-

Under direct seeded rice conditions, the progression of the sheath blight severity was more in late sown crop (88% PDI) as compared to the normal (75% PDI) and early (71.5% PDI) sown crop of variety IR-64. The neck blast severity was more in late sown crop of both the varieties (15% PDI in MTU-1001 and 30% PDI in IR-64) compared to the normal and early sown crop of the both the verities. The leaf blast incidence was very low in both the systems in this particular year due to the unfavorable conditions (dry weather) during the early growth stages of the crop (Table 10.14).

TABLE 10.14: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* – 2024-Mandya-direct seeded rice

Location/ Date of sowing	Percentage of Disease Index									
		Leaf blast			Sheath blight			Neck blast		
V/DOS	**DAT**	**(E)**	**(N)**	**(L)**	**(E)**	**(N)**	**(L)**	**(E)**	**(N)**	**(L)**
MTU-1001	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E:19-07-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N:12-08-2024	50 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L:11-09-2024	60 DAT	0.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0	0.0
	70 DAT	0.0	1.0	0.0	17.0	12.5	21.5	0.0	0.0	0.0
	80 DAT	1.0	1.0	0.0	18.0	17.5	27.5	0.0	2.5	0.0
	90 DAT	1.0	1.5	1.0	33.0	24.5	28.5	2.5	5.0	0.0
	100 DAT	1.0	1.5	1.0	49.0	44.0	46.5	4.5	6.5	6.0
	110 DAT	2.0	2.5	1.5	52.5	49.5	52.0	6.0	8.5	15.0
	120 DAT	-	-	-	-	-	-	-	-	-
IR-64	30 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E:19-07-2024	40 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N:12-08-2024	50 DAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L:11-09-2024	60 DAT	0.0	0.0	0.0	0.0	11.5	0.0	0.0	0.0	0.0
	70 DAT	0.0	1.0	0.0	24.0	14.0	23.0	0.0	0.0	0.0
	80 DAT	1.0	1.5	0.0	30.5	19.0	39.0	0.0	3.5	0.0
	90 DAT	1.0	2.5	1.0	46.0	30.0	33.5	3.5	4.5	0.0
	100 DAT	1.0	2.5	1.5	57.5	62.5	62.5	3.5	7.0	12.5
	110 DAT	5.0	3.5	2.0	71.5	75.0	88.0	12.0	12.0	30.0
	120 DAT	-	-	-	-	-	-	-	-	-

IV. DISEASE MANANGMENT TRIALS-2024

Trial No.11: EVALUATION OF COMBINATION FUNGICIDES AGAINST LOCATION SPECIFIC DISEASES

The trial was conducted with an objective to evaluate commercially available combination fungicides those are registered under Central Insecticides Board (CIB), Goverment of India (GOI) against various rice diseases. During *Kharif* 2024 repeated the experiment to confirm the last year results. Seven different fungicides viz., mancozeb 50% + thiophanate methyl 25% WG (3.0 g/l), kasugamycin 5% + copper oxychloride 45% WP (1.5 g/l), azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l), fenoxanil 5% + isoprothiolane 30% EC (2 ml/l), azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l), picoxystrobin 7.05% + propiconazole 11.7% SC (2 ml/l), and tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) were used for the study. These products bio-efficacy were tested against fungal diseases of rice which are locally important in a particular rice growing region. The recommended dose of each product was applied to the diseased plants at the rate of two sprays with an intravel of 10-15 days. These molecules comprise of different formulations such as suspension concentrates (SC), wettable powder (WP), wettable granuales (WG) and emulsifyable concentrates (EC). The trail was conducted during *Kharif*-2024 (2024) by using Randomised Block Design (RBD) as a statistical method with four or three replications in each centre.

The trial was proposed at 35 centres viz., Aduthurai, Bankura, Chatha, Chinsurah, Chiplima, Coimbatore, Cuttack, Faizabad, Gangavati, Gerua, Ghaghraghat, Hazaribagh, ICAR-IIRR, Jagdalpur, Kaul, Lonavala, Ludhiana, Malan, Mandya, Maruteru, Moncompu, Mugad, Navsari, Nawagam, Pantnagar, Pattambi, Ponnampet, Pusa, Raipur, Rajendranagar, Ranchi, Rewa, Sabour, Titabar and Varanasi across the rice growing regions in India. Similar to the last year about 31 centres had conducted the experiment except 4 centres ie., Gerua, Hazaribagh, Malan and Mugad. The experiment was conducted with locally popular rice varieties among the farmers at each testing location. In general, sowings were taken up during June and July across the locations except in Gangavati, Mandya and Ponnampet, where sowing was done in the month of August. At Aduthurai sowing was done late in the month of September. At Moncompu, sowing was done early, in the month of May. The details related to diseases against these chemicals were tested, test variety used, date of sowing, date of transplanting, method of screening, date of initial symptoms observed, number of spray, spraying dates, disease observation and date of harvesting are mentioned in the Table 11.1.

In general, fungicides were sprayed after noticing the initial symptoms at all the locations. Each combination fungicide was applied at the rate of two sprays with an interval of 15 days in all the test centres except Aduthurai and Moncompu where one spray was given. At locations Jagadalpur and Mandya, the fungicide was sprayed thrice. The fungicides were evaluated against leaf blast (9 locations), neck blast (10 locations), sheath blight (14 locations), brown spot (7 locations), sheath rot (4 locations), grain discoloration (2 locations) and stem rot (one location).

Table 11.1: Experimental details of fungicidal evaluation against location-specific diseases of rice during, *Kharif*-2024

S. No	Location	Disease Recorded	Test Variety	Screening	Date of activities						
					Sowing/ Transplanting	Inoculation	Initial symptom	No of Spray	Spraying	Observation	Harvesting
1	Aduthurai	Brown spot/ Sheath rot	ADT-38	Natural	13.09.2024/ 14.10.2024	-	18.12.2024	1	19.12.2024	02.01.2025	20.01.2025
2	Bankura	Sheath blight/ Brown spot	Swarna (MTU7029)	Artificial	19.06.2024/ 15.07.2024	20.09.2024	26.09.2024	2	24.09.2024 03.10.2024	23.09.2024 02.10.2024 13.11.2024	22.11.2024
3	Chatha	Brown spot	Basmati-370	Natural	14.06.2024/ 11.07.2024	-	16.09.2024	2	18.09.2024 04.10.2024	-	18.11.2024
4	Coimbatore	Leaf blast	CO39	Natural	15.07.2024/ 08.08.2024	-	01.09.2024	2	03.09.2024 18.09.2024	06.09.2024 25.09.2024	03.11.2024
5	Chinsurah	Sheath blight	Swarna (MTU 7029)	Artificial	11.06.2024/ 09.07.2024	29.08.2024	07.09.2024	2	10.09.2024 20.09.2024	-	06.11.2024
6	Chiplima	Sheath blight/ Neck blast	Swarna	Artificial/ Natural	26.06.2024/ 19.07.2024	19.09.2024	30.09.2024/ 18.10.2024	2	05.10.2024 21.10.2024	21.10.2024 06.11.2024	21.11.2024
7	Cuttack (ICAR-NRRI)	Sheath blight	Tapaswini	Artificial	20.06.2024/ 6.08.2024	10.09.2024	21.09.2024	2	30.09.2024 01.10.2024	12.10.2024 23.10.2024	28.11.2024
8	ICAR-IIRR	Leaf blast	HR-12	Artificial	15.06.2024/ 25.07.2024	28.08.2024 05.09.2024 10.09.2024	12.09.2024	2	13.09.2024 23.09.2024	15.09.2024 25.09.2024 05.10.2024	10.11.2024
		Sheath blight	BPT-5204	Artificial	26.06.2024 29.07.2024	23.10.2024	26.10.23	2	26.10.2024	05.11.2024 12.11.2024	23.12.2024
9	Faizabad (Masodha)	Sheath blight	BPT-5204	Artificial	29.06.2024/ 28.07.2024	03.10.2024	11.10.2024	2	14.10.2024 28.10.2024	26.10.2024 10.11.2024	20.11.2024
10	Gangavati	Sheath blight	GNV-1089	Artificial	08.08.2024/ 04.09.2024	06.11.2024	11.11.2024	2	13.11.2024 28.11.2024	12.11.2024 19.112024 28.11.2024	20.12.2024
11	Ghagraghat	Leaf Blast/ Neck Blast	Jalpriya	Natural	05.07.2024/ 02.08.2024	-	-	2	25.09.2024 23.10.2024	- / 15.12.2024	22.12.2022
12	Jagadalpur	Leaf blast/ Neck blast	Swarna	Natural	25.06.2024/ 17.07.2024	-	15.08.2024	3	02.09.2024 12.09.2024 18.10.2024	01.09.2024 11.09.2024 17.10.2024	15.12.2024
13	Kaul	Neck blast	CSR-30	Natural	11.06.2024 21.07.2024	-	11.10.2024	2	13.10.2024 28.10.2024	14.11.2024	22.11.2024
14	Lonavala	Leaf Blast/ Neck Blast	EK-70	Natural	28.06.2024/ 21.07.2024	-	09.09.2024	2	09.09.2024 30.09.2024	09.09.2024 / 30.09.2024	04.11.2024
15	Ludhiana	Sheath blight	PR114	Artificial	11.06.2024/ 13.07.2024	09.10.2024	-	2	13.09.2024 23.09.2024	18.10.2024	05.11.2024
16	Mandya	Sheath blight/ Neck blast	Jyothi	Natural /Artificial	05.08.2024/ 30.08.2024	- / 05.11.2024	14.10.2024 / 22.10.204	2	13.10.2024 16.11.2024 30.11.2024	20.10.2024 13.11.2024 28.11.2024	28.12.2024
17	Maruteru	Sheath blight/ Neck blast	Swarna (MTU 7029)	Artificial	03.07.2024/ 27.07.2024	24.08.2024	02.09.2024	2	12.09.2024 27.09.2024	02&/20.09.2024 28.09.2024 07.10.2024 14.10.2024	25.11.2024

S. No	Location	Disease Recorded	Test Variety	Screening	Date of activities						
					Sowing/ Transplanting	Inoculation	Initial symptom	No of Spray	Spraying	Observation	Harvesting
18	Moncompu	Sheath blight/ Grain discoloration	Uma (MO-16)	Natural	16.05.2024/ 08.06.2024	-	31.07.2024	1	07.08.2024	SHB 02.08.2024 05.10.2024/ GD 06.08.2024 05.10.2024	22.10.2024
19	Navasari	Sheath rot	GR-11	Natural	16.07.2024/ 14.08.2024	-	03.10.2024	2	11.10.2024 23.10.2024	18.10.2024 30.10.2024	13.12.2024
20	Nawagam	Leaf blast/ Sheath rot	GR-11	Artificial/ Natural-Shrt	23.07.2024/ 23.08.2024	03.10.2024 -	14.10.2024/ 13.10.2024	2	16.10.2024 30.10.2024	15.10.2024 30.10.2024 15.11.2024	26.12.2024
21	Pantnagar	Sheath blight	Pant Dhan-4	Artificial	21.06.2024/ 13.07.2024	29.08.2024	03.09.2024	2	04.09.2024 19.09.2024	26.09.2024 03.10.2024	02.11.2024
22	Pattambi	Brown Spot	Uma	Natural	11.07.2024/ 12.08.2024	-	15.10.2024	2	17.10.2024 31.10.2024	17.10.2024 10.11.2024	23.11.2024
23	Ponnampet	Leaf blast/ Neck blast	Intan	Natural	10.08.2024/ 05.09.2024	-	22.09.2024/ 10.12.2024	2	26.09.2024 16.12.2024	15.10.2024 02.01.2025	22.01.2025
24	Pusa	Brown spot	Rajerndra Mahsuri-1 (HS)	Natural	15.06.2024/ 10.07.2024	17.09.2024	-	2	21.09.2024 08.10.2024	-	03.12.2024
25	Raipur	Sheath blight	Swarna	Artificial	07.06.2024 08.07.2024	16.09.2024	-	2	15.10.2024 23.10.2024	24.10.2024	27.11.2024
26	Rajendranagar	Neck blast/ Sheath blight/ Grain discolouration	Tellahamsa	Artificial- SHB, NB Nat-,GD	16.07.2024/ 13.08.2024	03.10.2024 20.10.2024	07.10.2024	2	08.10.2024 23.10.2024	SHB 15.10.2024 21&30.10.2024 06.11.2024/ NB 14.11.2024 15.11.2024	04.12.2024 05.12.2024
27	Ranchi	Leaf blast/ Neck blast	Pusa sugandha-3	Artificial	16.07.2024/ 14.08.2024	12.09.2024	15.09.2024	2	17.09.2024 27.09.2024	12.10.2024	29.11.2024
28	Rewa	Leaf blast	PS4	Artificial	03.07.2024/ 28.08.2024	08.09.2024	17.09.2024	2	20.09.2024 05.10.2024	02.10.2024 15.10.2024	27.11.2024
29	Sabour	Brown spot	RajendraShweta	Natural	25.06.2024/ 28.07.2024	-	28.08.2024	2	01.09.2024 15.09.2024	10.10.2024	12.11.2024
30	Titabar	Sheath rot	Gitesh	Artificial	08.07.2024/ 20.08.2024	07.10.2024	17.10.2024	2	19.10.2024 04.11.2024	28.10.2024 17.11.2024 17.12.2024	24.12.2024
		Stem rot	Basundhara	Artificial	08.07.2024/ 21.08.2024	26.09.2024	11.10.2024	2	22.10.2024 06.11.2024	30.11.2024	24.12.2024
31	Varanasi	Brown spot	HUR156	Natural	18.07.2024/ 10.08.2024	-	12.09.2024	2	25.09.2024 11.10.2024	04.10.2024	02.11.2024

Leaf blast: The fungicides were evaluated against leaf blast disease at nine locations across the rice growing region of the country. In all the centres uniformly two sprays of fungicides were applied except for Jagadalpur three sprays of fungicide was applied. Both disease severity and incidence were observed at Lonavala, Nawagam, and Rewa. The test fungicidal products were evaluated against the disease under artificial inoculation of blast pathogen at IIRR, Nawagam, Ranchi and Rewa and natural infection at Coimbatore, Ghaghraghat, Jagdalpur, Lonavala, and Ponnampet. Disease severity at test locations in check plots varied from 26.1% (Rewa) to 82.2% (IIRR). Severity on check plot was very high (>50%) at IIRR (82.2%), Jagdalpur (70.6%) and Ghaghraghat (68.4%), high (30-50%) at and Nawagam (47.8%), Ranchi (45.1%), Ponnampet (43.5%), Lonavala (34%), Coimbatore (34%) and moderate (20-30%) at Rewa (26.1%). Disease incidence was very high at Nawagam (85.6%); moderate at Rewa (27%) and low at Lonavala (13.5%) in the check plots.

All seven fungicidal treatments were significantly reduced the disease severity and incidence at all test locations when compared to control. The combination product *viz.*, trifloxystrobin 25% + tebuconazole 50% WG (0.4g/l) was statistically reduced the severity at five locations *viz*., Ghaghraghat (16.6%), Lonavala (11%), Nawagam (22.2%), Ponnampet (16.2%), and Rewa (11.1%). Besides, it efficacy was on par with best treatment at Ranchi (10.1) against severity. However, other combi-product azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) also significantly reduced the leaf blast severity at IIRR (20%) and on par with other fungicides at Ranchi (9.5%). Besides, the treatment (T7) showed low mean disease severity (19.5%) from all the test centres followed by treatment azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) (T3) (Mean DS: 21.2%). Regarding disease incidence, treatment (T7) trifloxystrobin 25% + tebuconazole 50% WG (0.4g/l) was significantly reduced the incidence at Lonavala (5.5%) and on par with other fungicides at locations, Nawagam (65%) and Rewa (13.5%). The average minimum disease incidence from three locations was observed at tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) treatment (28%) followed by Mancozeb 50% + Thiophanate methyl 25% WG (3.0 g/l) (Fig.11.1A and Table 11.2).

The grain yield data was recorded at all the test locations and observed that all treated plots was superior to check plot (3523 Kg/ha). Treatment (T7) tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) was superior in increasing the yield (4713 Kg/ha) compared to the other treatments (Table 11.3).

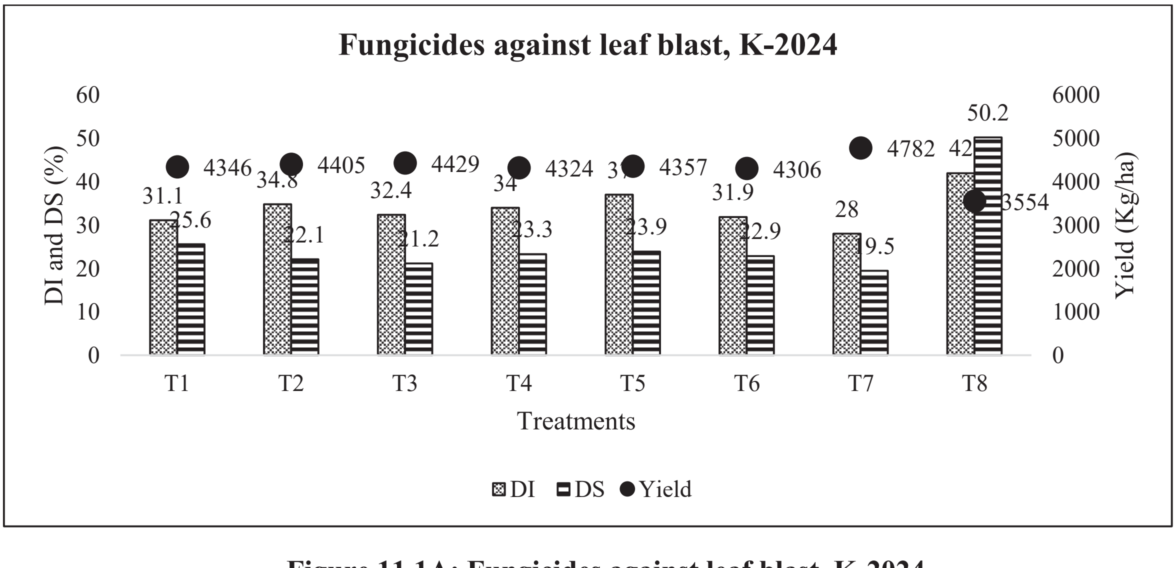

Figure 11.1A: Fungicides against leaf blast, K-2024

Table 11.2: Evaluation of fungicides against leaf blast disease of rice, *Kharif,* 2024

Treatments	Dosage /L	Leaf blast disease severity DS (%)										LB – DI (%)			
		CBT	**GGT**	**JDP**	**LNV**	**IIRR**	**NWG**	**PNP**	**RCI**	**REW**	**Mean**	**LNV**	**NWG**	**REW**	**Mean**
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g**	17 (24.3)	23.6 (29)	27.8 (31.8)	18 (25.0)	54.8 (47.7)	22.2 (28)	25.5 (30.3)	21.7 (27.5)	19.7 (4.5)	**25.6**	10.2 (3.3)	61.3 (51.6)	21.8 (4.8)	**31.1**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g**	13.2 (21.1)	28.8 (32.5)	26.1 (30.7)	16 (23.5)	24.0 (29.3)	31.5 (34.1)	28.7 (32.4)	13.5 (21.4)	17.3 (4.3)	**22.1**	9.3 (3.1)	75 (60.1)	20 (4.6)	**34.8**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml**	20.5 (26.8)	26.6 (31)	38.9 (38.6)	14 (21.9)	20 (26.5)	26.4 (30.7)	19.8 (26.4)	9.5 (17.5)	15.4 (4.1)	**21.2**	7.5 (2.8)	71.6 (57.8)	18 (4.4)	**32.4**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml**	18.1 (25.1)	27.6 (31.7)	40 (39.2)	13 (21.0)	23.3 (28.8)	33.6 (35.4)	22.8 (28.5)	16.4 (23.8)	14.7 (4.0)	**23.3**	6.5 (2.7)	78.8 (62.7)	16.7 (4.2)	**34**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml**	19.8 (26.4)	24.6 (29.7)	33.3 (35.2)	19 (25.8)	27.0 (31.3)	38.8 (38.5)	23.7 (29.1)	15 (22.6)	13.9 (3.9)	**23.9**	10 (3.3)	85 (67.6)	16 (4.1)	**37**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml**	15.9 (23.5)	18.4 (25.4)	37.2 (37.6)	21 (27.2)	32.2 (34.4)	29.4 (32.8)	21.4 (27.4)	17.7 (24.7)	12.9 (3.7)	**22.9**	7.5 (2.8)	73.1 (58.8)	15.2 (4)	**31.9**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g**	17.9 (24.9)	16.6 (24.2)	30.6 (33.5)	11 (19.2)	40.3 (39.4)	22.2 (27.9)	16.2 (23.7)	10.1 (18)	11.1 (3.5)	**19.5**	5.5 (2.5)	65 (53.8)	13.5 (3.8)	**28**
T8 - Untreated control	-	34 (35.6)	68.4 (55.8)	70.6 (57.1)	34 (35.6)	82.2 (65.0)	47.8 (43.7)	43.5 (41.3)	45.1 (42.1)	26.1 (5.2)	**50.2**	13.5 (3.7)	85.6 (68.5)	27 (5.3)	**42**
General Mean		**19.5**	**29.3**	**38.1**	**18.3**	**38.0**	**31.5**	**25.2**	**18.6**	**16.4**	**-**	**8.8**	**74.4**	**18.5**	**-**
LSD @ 5% *(P=0.05)*		**1.3**	**0.4**	**2.7**	**0.3**	**3.4**	**3.7**	**2.7**	**6.6**	**0.3**	**-**	**0.2**	**4.6**	**0.3**	**-**
C.V.		3.5	0.9	4.8	0.9	5.0	7.3	6.0	18.1	4.0	-	3.4	5.1	4.1	-
Transformation		AT	AT	AT	AT	AT	AT	AT	AT	ST	-	ST	AT	ST	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

Table 11.3: Effect of fungicides on grain yield with respect to rice leaf blast, *Kharif*-2024

Treatments	Dosage/L	Leaf blast grain yield (Kg/ha)									
		CBT	GGT	IIRR	JDP	LNV	NWG	PNP	RCI	REW	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g**	4150	2094	4167	5531	4150	7307	3278	4724	3520	**4325**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g**	4100	2388	4257	5753	4275	5870	3478	5633	3586	**4371**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml**	4211	2175	4320	4373	4450	6229	4159	5926	3797	**4404**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml**	4168	2038	4390	3931	4575	6401	4036	5372	3847	**4306**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml**	4236	2175	4337	4850	4275	6321	3478	5487	3929	**4343**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml**	4198	2256	4330	4464	4275	6244	3836	5017	4022	**4294**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g**	4155	2690	4350	5005	4550	7396	4386	5686	4195	**4713**
T8 - Untreated control	-	3276	1888	3923	3522	3850	5374	2297	4202	3373	**3523**
General Mean		**4061**	**2213**	**4259**	**4678**	**4300**	**6393**	**3619**	**5256**	**3784**	-
LSD @ 5% *(P=0.05)*		**148.3**	**64.3**	**146.1**	**55.6**	**66.6**	**951.5**	**244.2**	**1030.0**	**126.3**	**-**
C.V.		2.5	2.0	1.9	0.8	1.0	10.1	4.6	13.2	1.9	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

Neck blast: The trails were conducted at ten locations to know the efficacy of the test product against neck blast disease. Two sprays of fungicidal treatments were given at all the centres. The test fungicidal products were evaluated against the disease incidence under natural condition at all the centers except Rajendranagar and Ranchi. Both disease incidence and severity was recorded at Mandya, only severity was recorded at Ghaghraghat and other locations only incidence was recorded. Disease incidence was very high (>50%) at Jagadalpur (65.4%), and Kaul (51.4%); High (30-50%) at Mandya (48.7%), Ponnampet (40.7); moderate (20-30%) at Chiplima (27.2%); and low (<20%) at Ranchi (19.0%), Rajendranagar (15.1%), Maruteru (13.4%) and Lonavala (12.5%) in check plot. Neck blast severity was very high at Ghaghraghat (58.6%) and moderate at Mandya (25.5%). The performance of all the six fungicidal treatments were superior in reducing the neck blast incidence at all the test locations except Maruteru compare to control plot (DI: 32.6%).

The formulations *viz.*, azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC was significantly reduced the incidence of the neck blast at two locations viz., Kaul (14.2) and Rajendranagar (1%). The same treatment showed low disease at Chiplima (11.6%), Mandya (6.9%), and Ranchi (4.3%) and low severity at Mandya (5.2%) when compared to other treatments. Besides, the same combination fungicide was statistically on par with the best treatments at Ponnampet (15.2%).

However, tebuconazole 50% + trifloxystrobin 25% w/w WG sprayed (T7) showed best in reducing the incidence at three locations viz., Lonavala (4%), Maruteru (8.3%), and Ponnampet (13.9%), and on par with other fungicides at Chiplima (15.3%), Mandya (8.8%) and Ranchi (5%). The low mean disease incidence (11.7%) was observed from the treatment (T3) azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 g/l) applied plots followed by treatment tebuconazole 50% + trifloxystrobin 25% w/w WG (0.4g/l) sprayed (T7) plot (12.5%) (Fig. 11.1B; Table 11.4). Both the fungicides were also found effective in reducing the neck blast diseases severity at Ghaghraghat and Mandya.

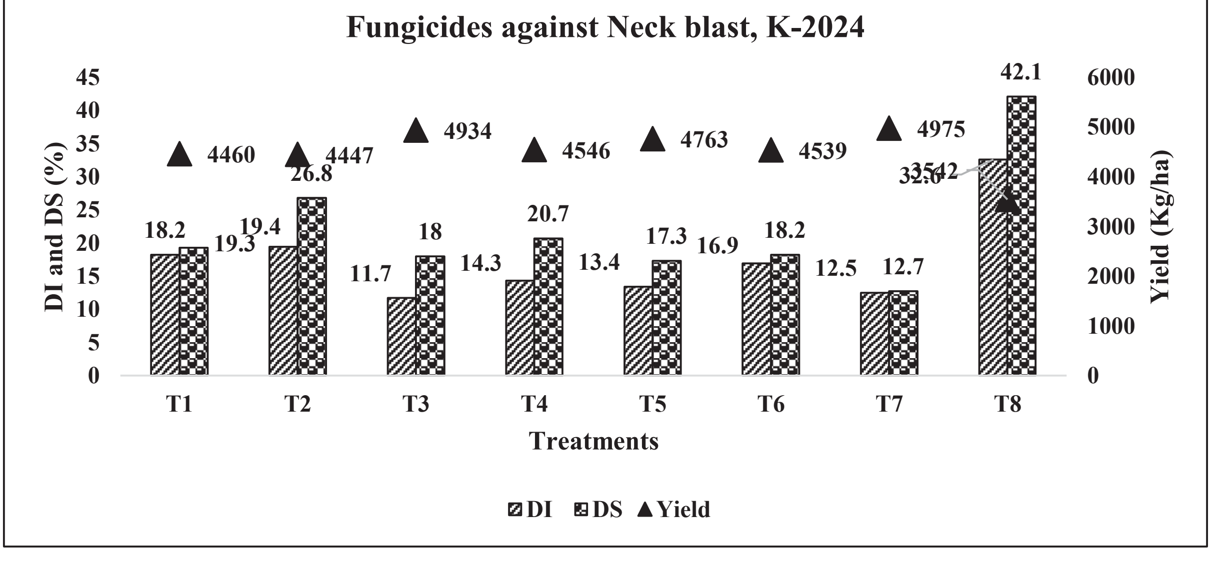

Figure 11.1B: Fungicides against leaf blast, K-2024

All the 10 locations were recorded the grain yield. The mean yield across the locations in check plot was 3542 kg/ha. Among eight fungicidal treatments, tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) sprayed plot produced highest grain yield (4975 Kg/ha) followed by azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) (4934 Kg/ha) when compared to other combination fungicidal treatments (Table 11.5).

Table 11.4: Evaluation of fungicides against Neck blast disease of rice, *Kharif*, 2024

Treatments	Dosage /L	Neck blast incidence (%)										NB-DS (%)		
		CHP	JDP	KUL	LNV	MND	MTU	PNP	RCI	RNR	Mean	GGT	MND	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g**	15.2 (22.7)	23.5 (29.0)	32 (34.4)	9 (3.1)	28.1 (32.0)	10.6 (3.4)	25.3 (26.2)	11.3 (3.4)	8.9 (3.1)	**18.2**	23.5 (29.0)	15.1 (4.0)	**19.3**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g**	19.7 (26.2)	22.3 (28.1)	35.6 (36.6)	8.2 (3.0)	43.6 (41.2)	9.7 (3.2)	23.7 (29.1)	6.0 (2.6)	5.8 (2.5)	**19.4**	32.6 (34.8)	21.1 (4.6)	**26.8**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml**	11.6 (19.8)	33.4 (35.3)	14.2 (22.1)	7.2 (2.8)	6.9 (15.1)	11.2 (3.5)	15.2 (22.9)	4.3 (2.2)	1.0 (1.4)	**11.7**	30.8 (33.7)	5.2 (2.4)	**18**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml**	16.6 (23.9)	35.1 (36.3)	17.9 (25.0)	5.2 (2.4)	12.5 (20.6)	8.6 (3.0)	19.4 (26.1)	8.3 (3.0)	5.2 (2.5)	**14.3**	29.1 (32.6)	12.2 (3.6)	**20.7**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml**	14.7 (22.4)	29.9 (33.1)	21.3 (27.5)	9 (3.1)	10.7 (19.1)	11.4 (3.5)	14.8 (22.5)	6.8 (2.7)	2.3 (1.8)	**13.4**	25.8 (30.5)	8.8 (3.1)	**17.3**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml**	18.8 (25.6)	31.3 (34.0)	28.7 (32.3)	8.2 (3.0)	16.7 (24.1)	14.09 (3.8)	18.4 (24.0)	10.5 (3.3)	5.7 (2.5)	**16.9**	21.7 (27.8)	14.8 (3.9)	**18.2**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g**	15.3 (22.9)	26.4 (30.9)	25.0 (30)	4 (2.2)	8.8 (17.1)	8.3 (3.0)	13.9 (21.7)	5.0 (2.4)	5.6 (2.5)	**12.5**	16.6 (24.1)	8.8 (3.1)	**12.7**
T8 - Untreated control	-	27.2 (31.3)	65.4 (54.0)	51.4 (45.8)	12.5 (3.6)	48.7 (44.2)	13.4 (3.8)	40.7 (39.9)	19.0 (4.4)	15.1 (4.0)	**32.6**	58.6 (49.9)	25.5 (5.1)	**42.1**
General Mean		**17.4**	**33.4**	**28.3**	**8**	**22**	**11**	**21.4**	**9**	**6.2**	**-**	**29.9**	**14**	**-**
LSD @ 5% *(P=0.05)*		**4.7**	**2.7**	**2**	**0.1**	**4.4**	N/A	**2.6**	**0.8**	**0.9**	**-**	**0.4**	**0.6**	**-**
C.V.		13.1	5.1	4.9	2.9	9.3	14.5	6.7	17.3	24.2	-	0.8	8.6	-
Transformation		AT	AT	AT	ST	AT	ST	AT	ST	ST	-	AT	ST	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

Table 11.5: Evaluation of fungicides against Neck blast disease of rice, *Kharif*, 2024

Treatments	Dosage/L	Neck blast grain yield (Kg/ha)										
		CHP	**GGT**	**JDP**	**KUL**	**LNV**	**MND**	**MTU**	**PNP**	**RCI**	**RNR**	**Mean**
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g**	5815	2094	5531	4130	4150	4261	4929	3278	4724	5683	**4460**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g**	5187	2388	5753	4060	4275	2765	5191	3478	5633	5743	**4447**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml**	5960	2175	4373	4668	4450	6365	5254	4159	5926	6012	**4934**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml**	5655	2038	3931	4604	4575	5214	4790	4036	5372	5246	**4546**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml**	6343	2175	4850	4522	4275	5320	5196	3478	5487	5984	**4763**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml**	5758	2256	4464	4292	4275	4897	4567	3836	5016	6030	**4539**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g**	5800	2690	5005	4400	4550	5932	5228	4386	5685	6076	**4975**
T8 - Untreated control	-	4625	1888	3522	3352	3850	2690	4313	2297	4201	4686	**3542**
General Mean		**5643**	**2213**	**4678**	**4253**	**4300**	**4680**	**4933**	**3618**	**5255**	**5683**	**-**
LSD @ 5% *(P=0.05)*		**437.3**	**64.3**	**55.6**	**251.2**	**66.6**	**799.0**	**N/A**	**244.2**	**1030.0**	**396.4**	**-**
C.V.		5.2	2.0	0.8	4.0	1.0	9.7	12.9	4.6	13.24	4.7	-

Sheath blight: Commercially available combination fungicides were evaluated against sheath blight disease at 14 hot spot locations. The experiment was conducted under artificial inoculation at all the test locations except Moncompu. Both disease severity and incidence was observed at eight locations *viz.,* Bankura, Cuttack, Faizabad (Masodha), Ludhiana, Mandya, Maruteru, Pantnagar and Rajendranagar. Only disease severity was observed at other six locations viz., Chinsurah, Chiplima, Gangavathi, IIRR, Moncompu, Raipur and. Two sprays of fungicidal treatments were given at all the centres except Moncompu where one spray was given. Severity in check plots was varied between 59.9% (Raipur) and 88.1% (Gangavathi). Disease severity on untreated plot was very high (>50%) at 13 centres viz., Gangavathi (88.1%), Ludhiana (84%), Mandya (73.3), Chinsurah (72.7%), Pantnagar (72.2%), Masodha (70.9%), IIRR (69.4%), Bankura (68.7%), Cuttack (68.2%), Moncompu (64.1%) Maruteru (63.1%), Chiplima (62.2%), Raipur (59.9%); and low at Rajendranagar (12.9%). Disease incidence was varied between 54.3% (Masodha) and 100% (Bankura and Ludhiana). It was very high at Ludhiana (100%), Bankura (100%), Pantnagar (91.2%), Mandya (80.7%), Maruteru (75.5%), Cuttack (72.6%), Rajendranagar (66.1%) and Masodha (54.3%).

All fungicidal applications significantly reduced the disease compared to control (DS: 66.4%; DI: 80.1%) across the test locations. In Rajendranagar, observed that all the treatments were statistically non-significant. The combination fungicide azoxystrobin 14% + epoxiconazole 9% SC (1.5 ml/l) maximum reduced the disease severity at four locations *viz.,* Chiplima (15.3), IIRR (24.2%), Masodha (25.1%) and Raipur (34.0%). It was on par with other best treatment in minimising the severity at three other locations, like Cuttack (20.4%), Moncompu (11.4%) and Maruteru (30.4%). On the other side, treatment (T3) *ie.,* azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC 9 (3.5 ml/l) effectively reduced the severity at six locations viz., Cuttack (18.2%), Gangavathi (28.3%), Moncompu (5.7%), Mandya (18.5%), Maruteru (30.4%), Pantnagar (34.7%) and on par with other fungicide at Raipur (42.9%) (Fig.11.1C)

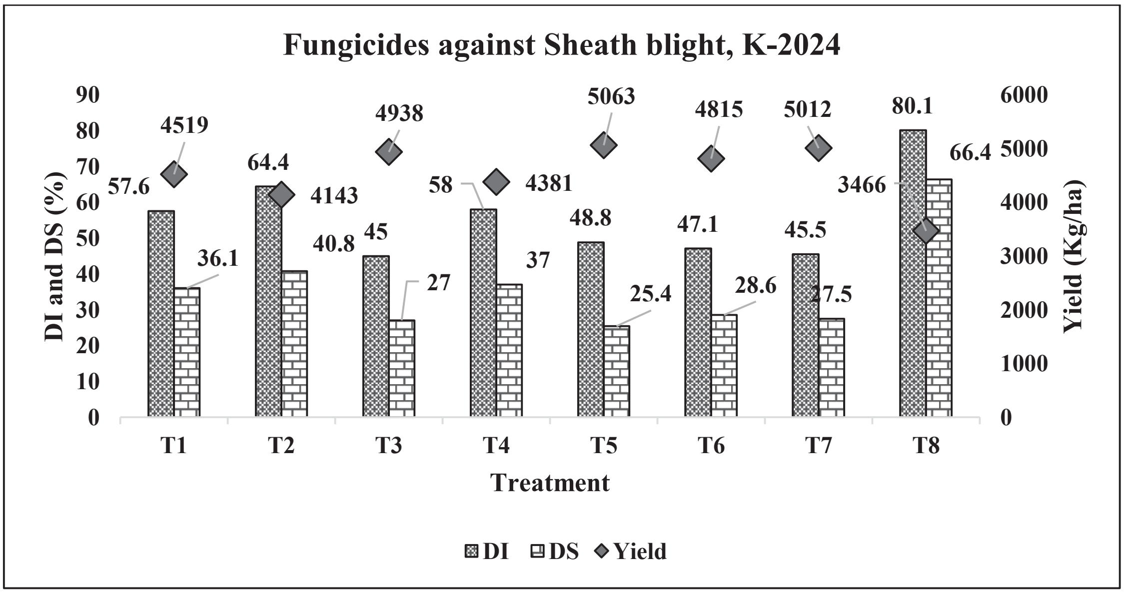

Figure 11.1C: Fungicides against sheath blight, K-2024

Another treatment like, picoxystrobin 7.05% + propiconazole 11.7% SC (2ml/l) and Mancozeb 50% + Thiophanate methyl 25% WG were significantly minimised the severity at

Bankura (26%) and Chinchura (24.7%), respectively. The mean disease severity (25.4%) was low at azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l) followed by azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) treatment followed by (27%) (Fig. 3 and Table 6). Among all the fungicidal treatments kasugamycin 5% + copper oxychloride 45% WP (1.5g/l) showed highest mean disease severity (43.1%) compared to other treatments followed by fenoxanil 5% + isoprothiolane 30% EC (2 ml/l) (Table 11.6).

In regards to disease incidence, combination fungicide azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) showed low incidence at five locations viz., Rajendranagar (23.8%), Cuttack (22%), Maruteru (43.9%), and Mandya (18.5%), and significant to other treatments at Pantnagar (53.7%). In addition, tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) showed low intensity at on par with the best molecule in Mandya (24.4%) and Rajendranagar (26.2%). The average disease incidence was low (45.0%) at azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) treatment compared to other commercial products (Fig. 11.1C and Table 11.7).

Grain yield in the experimental plots recorded at all the test locations. It was observed that grain yield was more in fungicide treated plots compared to check plot (3466 Kg/ha). Highest yield was recorded in the plots where azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l) sprayed (5063 Kg/ha) plot followed by tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) sprayed plot (5012 Kg/ha) (Table 11.8).

Table 11. 6: Evaluation of fungicides on sheath blight disease severity of rice, *Kharif*, 2024

Treatments	Dosage /L	Sheath blight disease severity-DS (%)														
		BNK	CHN	CHP	CTK	GNV	IIRR	LDN	MNC	MND	MSD	MTU	PNT	RNR	RPR	Mean
T1 - Mancozeb + Thiophanate methyl	**3.0 g**	41.7 (40.2)	24.7 (29.7)	26.1 (30.5)	34.3 (35.7)	47.8 (43.7)	40.4 (39.4)	38.3 (38.2)	24.4 (29.4)	31.8 (34.2)	42.2 (40.5)	48.5 (44.1)	45.3 (42.3)	9.7 (2.9)	49.6 (44.7)	**36.1**
T2 - Kasugamycin + copper oxychloride	**1.5 g**	46.6 (43.0)	41.7 (40.2)	39.7 (39.0)	37 (37.3)	46.4 (42.9)	40.3 (39.3)	49.5 (44.7)	35.4 (36.4)	34.8 (36.0)	41.3 (39.9)	46.5 (43)	47.3 (43.4)	11.0 (3.2)	54.0 (47.3)	**40.8**
T3 - Azoxysrobin + Tebuco. + Prochloraz	**3.5 ml**	31.5 (34.1)	40.2 (39.3)	20.8 (27.1)	18.2 (25.0)	28.3 (32.1)	33.3 (35.2)	32.3 (34.6)	5.7 (13.3)	18.5 (25.4)	32.6 (34.7)	30.4 (33.4)	34.7 (36)	9.1 (3.1)	42.9 (40.9)	**27.0**
T4 - Fenoxanil + Isoprothiolane	**2 ml**	52.1 (46.2)	49.2 (44.5)	30.2 (33.2)	25.6 (30.3)	41.3 (40)	35.7 (36.3)	29.6 (32.9)	27.4 (31.4)	39.2 (38.6)	36.9 (37.3)	42.6 (40.7)	47.5 (43.5)	13.9 (3.8)	47.4 (43.4)	**37.0**
T5 - Azoxystrobin + Epoxiconazole	**1.5 ml**	29.4 (32.8)	29.5 (32.8)	15.3 (22.9)	20.4 (26.7)	33.7 (35.4)	24.2 (29.4)	16.5 (23.9)	11.4 (19.2)	37.7 (37.8)	25.1 (30)	31 (33.8)	38.9 (38.5)	9.2 (3.1)	34.0 (35.6)	**25.4**
T6 - Picoxystrobin + Propiconazole	**2 ml**	26.0 (28.4)	39.5 (39.0)	24.4 (29.4)	23.8 (29)	44 (41.5)	31.6 (34.2)	13.3 (21.3)	14.5 (22.3)	24.4 (29.5)	31.9 (34.3)	40.7 (39.5)	42.1 (40.4)	9.7 (3.2)	34.8 (36.0)	**28.6**
T7 - Tebuconazole + Trifloxystrobin	**0.4 g**	34.2 (35.8)	33.2 (35.1)	25.5 (30.2)	30.6 (33.4)	33 (35)	26.1 (30.6)	12.2 (20.4)	17.3 (24.4)	27.4 (31.5)	26.2 (30.7)	32.8 (34.8)	37 37.4)	12.6 (3.6)	37.7 (37.7)	**27.5**
T8 - Untreated control	-	68.7 (56)	72.7 (58.5)	62.2 (52)	68.2 (55.7)	88.1 (69.9)	69.4 (56.4)	84 (66.4)	64.1 (53.4)	73.3 (58.9)	70.9 (57.3)	63.1 (52.7)	72.2 (58.2)	12.9 (3.6)	59.9 (50.8)	**66.4**
General Mean		**41.2**	**41.4**	**30.6**	**32.3**	**45.4**	**37.7**	**34.5**	**25.1**	**35.9**	**38.4**	**42.0**	**45.7**	**11.0**	**45.1**	-
LSD @ 5% *(P=0.05)*		**1.6**	**4.1**	**4.8**	**6.0**	**4.1**	**2.5**	**3.8**	**7.2**	**5.3**	**1.8**	**4.5**	**1.0**	**N/A**	**9.9**	-
C.V.		2.2	7.0	9.9	11.8	5.4	4.6	6.0	16.9	8.1	3.2	7.5	1.4	12.8	13.3	-
Transformation		AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	ST	AT	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

Table 11.7: Evaluation of fungicides on sheath blight disease incidence of rice, *Kharif,* 2024

Treatments	Dosage /L	Sheath blight disease incidence-DI (%)								
		BNK	**CTK**	**LDN**	**MSD**	**MND**	**MTU**	**PNT**	**RNR**	**Mean**
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g**	98.4 (71.3)	37.6 (37.8)	61.7 (51.7)	41.4 (40)	55.6 (48.2)	58 (49.6)	68.2 (55.6)	40.1 (39.3)	**57.6**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g**	85.4 (67.6)	45.4 (42.3)	92.3 (74.2)	39.5 (38.9)	64.4 (53.4)	55.3 (48.1)	75.3 (60.2)	57.7 (49.5)	**64.4**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml**	86.9 (54.9)	22 (27.8)	77 (61.3)	34.2 (35.7)	18.5 (25.4)	43.9 (41.6)	53.7 (47.1)	23.8 (29.2)	**45.0**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml**	96.1 (67.4)	33.4 (35.2)	76 (60.7)	37.1 (37.5)	40.7 (39.5)	50.7 (45.4)	71.2 (57.5)	59.1 (50.3)	**58.0**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml**	91.9 (64)	25.2 (30)	65 (53.7)	26 (30.6)	42.2 (40.5)	48.7 (44.2)	61.0 (51.3)	30.7 (33.2)	**48.8**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml**	96.6 (59.3)	28.8 (32.3)	39 (38.6)	32.9 (34.9)	24.4 (29.6)	51 (45.6)	64.7 (53.5)	39.2 (38.6)	**47.1**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g**	99 (66.8)	36.3 (36.9)	42.7 (40.8)	27.4 (31.5)	24.4 (29.6)	50.8 (45.5)	56.9 (49)	26.2 (30.6)	**45.5**
T8 - Untreated control	-	100 (86.7)	72.6 (58.5)	100 (90)	54.3 (47.4)	80.7 (64.5)	75.5 (60.6)	91.2 (72.9)	66.1 (54.4)	**80.1**
General Mean		**94.3**	**37.6**	**69.2**	**36.6**	**44.0**	**54.2**	**67.8**	**42.9**	**-**
LSD @ 5% *(P=0.05)*		**0.2**	**5.4**	**3.6**	**1.5**	**6.1**	**6.9**	**2.0**	**7.4**	**-**
C.V.		1.4	9.7	3.5	2.8	8.3	9.8	2.1	12.3	-
Transformation		ST	AT	AT	AT	AT	AT	AT	AT	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

Table 11.8: Effect of fungicides on grain yield with respect to rice sheath blight, *Kharif*-2024

Treatments	Dosage /L	Sheath blight grain yield (Kg/ha)														
		BNK	CHN	CHP	CTK	GNV	IIRR	LDN	MND	MSD	MTU	MNC	PNT	RNR	RPR	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g**	4550	5592	5815	4020	5578	3325	6315	4661	3512	4929	3512	4939	5683	847	**4519**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g**	4380	3785	5188	3990	5153	3275	5780	4165	3575	5191	3575	3417	5743	790	**4143**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml**	5110	3990	5960	5080	6296	3850	6366	6235	4012	5254	4012	6161	6012	795	**4938**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml**	4100	3500	5655	4240	5047	3550	6840	5514	3750	4790	3750	4528	5246	828	**4381**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml**	5300	5307	6343	4860	5728	4100	7316	5420	4512	5196	4512	5528	5984	787	**5063**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml**	5700	4082	5758	4550	5366	3625	7561	5865	4125	4567	4125	5261	6030	795	**4815**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g**	4950	4805	5800	4170	6091	3937.5	7911	5889	4350	5228	4350	5822	6076	793	**5012**
T8 - Untreated control	-	3350	2907	4625	3520	4301	2650	4938	3690	2825	4313	2825	3194	4686	707	**3466**
General Mean	-	**4680**	**4246**	**5643**	**4303**	**5445**	**3539**	**6628**	**5179**	**3832**	**4933**	**3832**	**4856**	**5683**	**793**	**-**
LSD @ 5% *(P=0.05)*	-	**229.2**	**463.0**	**437.3**	**826.0**	**611.2**	**407**	**822.0**	**618.0**	**190.0**	**N/A**	**N/A**	**255.3**	**396.4**	**45.5**	**-**
C.V.	-	2.8	7.4	5.2	13.0	6.4	7.8	7.0	6.7	3.3	12.9	19.4	3.0	4.7	3.2	-

Brown spot: Test fungicidal products were evaluated against brown spot at seven different locations. Only disease severity was recorded from all the seven locations. Disease severity in control plot was very high (>50%) at Bankura (72.6%), Pattambi (67.0%), Chatha (64.0%), Varanasi (52.3%) and high (30-50%) at Sabour (49.3%), Aduthurai (45.0%), and Pusa (39.2%). Bio-efficacy of the fungicides was tested under artificial inoculation of brown spot pathogen at only Bankura centre. All eight combi-products were performed statistically better in reducing the brown spot disease severity at all the centres compared to untreated control.

Among all the treatment, combination fungicide azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) was statistically significant at two locations viz., Pattambi (49.7%) and Sabour (16.5%) in terms of reducing the disease severity. The same treatment (T3) showed less severity at Chatha (16.5%), Pusa (15.2%), and Varanasi (19.1%). The same treatment (T3) showed minimum average disease severity (23.4%) from all seven-test locations. In addition, less disease was observed at Aduthurai (23.1%) and Bankura (16.2%) from tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) and azoxystrobin 14% + epoxiconazole 9% SC (1.5 ml/l) treatments, respectively (Fig. 11.1D and Table 11.9). Grain yield data was recorded at all the seven centres. Fungicide sprayed plots showed significantly higher yield when compared to control plot (3540 Kg/ha). Highest yield (4687 Kg/ha) was obtained from the plots where azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) sprayed (Table 11.10).

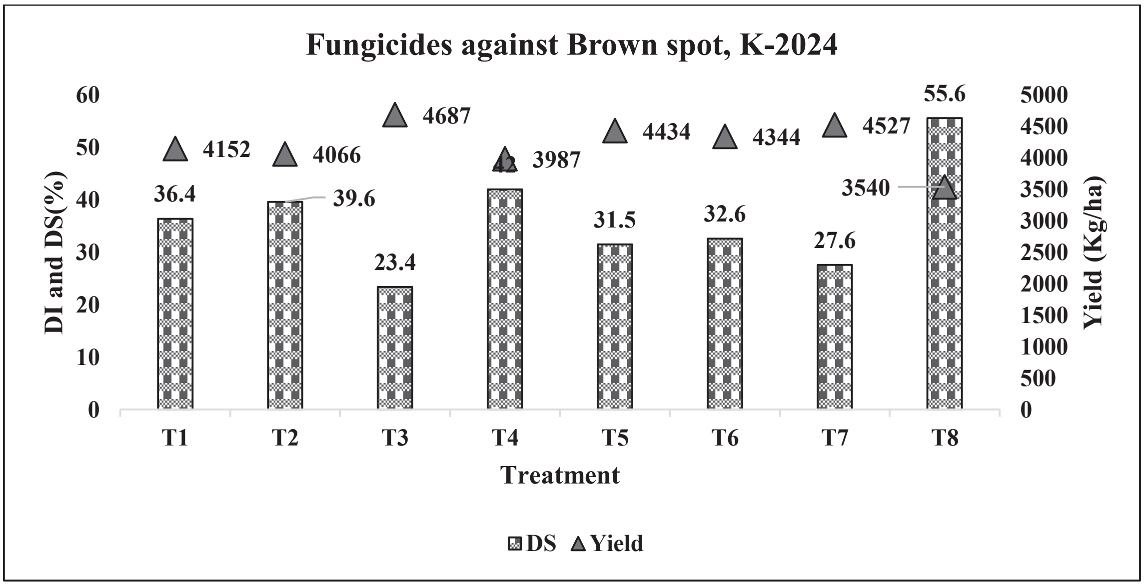

Figure 11.1D: Fungicides against brown spot, K-2024

Table 11.9: Evaluation of fungicides on Brown spot disease of rice, *Kharif*, 2024

Treatments	Dosage/L	Brown spot disease severity-DS (%)							
		ADT	**BNK**	**CHT**	**PTB**	**PSA**	**SAB**	**VRN**	**Mean**
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g**	25.6 (30.3)	39.1 (38.7)	26.5 (30.9)	57.7 (49.4)	31.2 (33.9)	37.4 (37.7)	37.1 (37.5)	**36.4**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g**	30.1 (33.3)	43.5 (41.2)	39 (38.5)	65.8 (54.2)	26.2 (30.7)	40.4 (39.4)	32.2 (34.5)	**39.6**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml**	23.1 (28.7)	23.6 (29.0)	16.5 (23.9)	49.7 (44.8)	15.2 (22.8)	16.5 (24.0)	19.1 (25.8)	**23.4**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml**	42.1 (40.4)	46.3 (42.8)	40 (39.2)	64.97 (53.7)	30 (33.1)	36.3 (37.0)	34.1 (35.6)	**42**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml**	26.5 (30.9)	16.2 (23.7)	36.5 (37.1)	62.7 (52.3)	22 (27.9)	29.3 (32.7)	27.4 (31.5)	**31.5**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml**	31.38 (34.0)	22.2 (28.0)	29.8 (33.0)	64.7 (53.5)	19 (25.7)	30.5 (33.5)	30.3 (33.3)	**32.6**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g**	20.5 (26.9)	21.4 (27.5)	22 (27.9)	55.8 (48.3)	27.5 (31.5)	22.3 (28.2)	23.4 (28.9)	**27.6**
T8 - Untreated control	-	45.0 (42.1)	72.6 (58.4)	64 (53.1)	67.0 (54.9)	39.2 (38.6)	49.3 (44.6)	52.3 (45.3)	**55.6**
General Mean		**30.6**	**35.6**	**34.3**	**61.7**	**26.3**	**32.8**	**32.0**	-
LSD @ 5% *(P=0.05)*		**3.4**	**2.0**	**3.1**	**2.9**	**4.5**	**1.4**	**3.2**	-
C.V.		**6.9**	**3.1**	**5.9**	**3.8**	**9.9**	**2.3**	**5.3**	-
Transformation		AT	AT	AT	AT	AT	AT	AT	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

Table 11.10: Effect of fungicides on grain yield with respect to rice brown spot, *Kharif*-2024

Treatments	Dosage/L	Brown spot grain yield (Kg/ha)							
		ADT	BNK	CHT	PTB	PSA	SBR	VRN	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g/l**	4492	4750	2650	3580	4613	4400	4577	**4152**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g/l**	4268	4475	2480	3185	5045	4333	4679	**4066**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml/l**	4591	5500	3180	3703	5630	5267	4940	**4687**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml/l**	4083	4350	2435	3387	4833	4400	4424	**3987**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml/l**	4349	6050	2500	3305	5263	4767	4807	**4434**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml/l**	4206	5670	2620	3252	5430	4633	4595	**4344**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g/l**	4824	5710	2790	3520	4928	5033	4887	**4527**
T8 - Untreated control	-	3934	3125	2405	3110	4435	4033	3736	**3540**
General Mean		**4343**	**4953**	**2632**	**3380**	**5022**	**4608**	**4580**	**-**
LSD @ 5% *(P=0.05)*		**175.5**	**163.4**	**64.3**	**278.8**	**590.8**	**627.7**	**290.0**	**-**
C.V.		2.7	1.9	1.6	5.6	7.9	7.7	3.6	-

Sheath rot: The fungicidal molecules were tested against sheath rot disease at four locations namely Aduthurai, Navasari, Nawagam and Titabar. Both disease severity and incidence was recorded at all locations except Aduthurai, where only disease incidence was recorded. The test fungicidal products were evaluated against the disease under natural infestation at most of the locations except Titabar, where the disease was augmented through artificial inoculation. Disease severity in check plots was high (30-50%) at Nawagam (47.3%), Titabar (46.0%), and Navasari (36.1%). Incidence in check plots was varied from 86.2% to 42.6%. Incidence was very high at Nawagam (86.2%), Titabar (53.6%) and Aduthurai (52.2%); high at Navasari (42.6%). In all the centres uniformly two sprays of fungicides were applied except Aduthurai, where only one spray was applied. All the combination fungicides were significantly reduced the disease incidence (58.7%) and severity (43.1%) when compared to control plot.

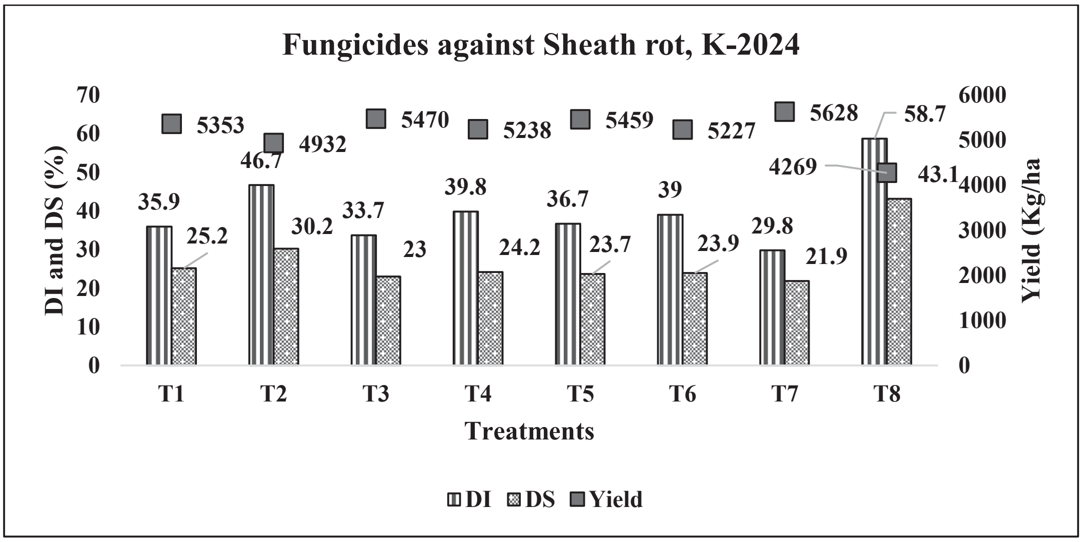

Figure 11.1E: Fungicides against sheath rot, K-2024

The combination fungicide, tebuconazole 50% + trifloxystrobin 25% w/w WG (0.4 g/l) (T7) showed less sheath rot severity at Nawagam (20.4%) and incidence at Aduthurai (13.7%) and Nawagam (51.2%). The same treatment (T7) showed minimum average disease severity and incidence of 21.9% and 29.8%, respectively from the test locations. Besides, treatment (T3) ie., azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) showed less disease incidence at Navasari (22.8%) and average disease severity and incidence of 23.0% and 33.7% from the test locations. However, these two test products *viz.*, tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) found better in reducing the disease incidence as well as severity (Fig. 11.1E and Table 11.11). The mean yield across the experimental locations in check plot was 4269 Kg/ha. Among the treatments, tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) yielded more (5628 Kg/ha) when compare to other treatments (Table 11.11) followed by azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l).

Table 11.11: Evaluation of fungicides against sheath rot disease of rice, *Kharif*, 2024

Treatments	Dosage /L	Sheath rot severity DS (%)				Sheath rot incidence-DI (%)					Sheath rot grain yield (Kg/ha)				
		NVS	NWG	TTB	Mean	NVS	NWG	TTB	ADT	Mean	NVS	NWG	TTB	ADT	MEAN
T1-Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g	24.0 (29.3)	20.6 (26.8)	30.9 (33.8)	**25.2**	31 (33.8)	51.8 (46.1)	39.8 (39)	21 (27.3)	**35.9**	4979	7306	4636	4492	**5353**
T2-Kasugamycin 5% + copper oxychloride 45% WP	1.5 g	26.0 (30.6)	36.2 (36.8)	28.5 (32.2)	**30.2**	35.7 (36.7)	85.6 (67.8)	37 (37.4)	28.6 (32.2)	**46.7**	4825	5869	4766	4268	**4932**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml	17.9 (24.9)	26.2 (30.7)	24.8 (29.9)	**23.0**	22.8 (28.5)	63.7 (52.9)	31.1 (33.9)	17.2 (24.5)	**33.7**	6189	6229	4872	4591	**5470**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml	23.2 (28.7)	33.5 (35.3)	15.9 (23.4)	**24.2**	29.9 (33.1)	75.6 (60.7)	22.8 (28.5)	30.8 (33.3)	**39.8**	5208	6400	5261	4083	**5238**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml	20.8 (27.1)	36.4 (37.1)	14.0 (22.0)	**23.7**	23.5 (28.9)	80.6 (63.9)	21.1 (27.3)	21.5 (27.6)	**36.7**	5790	6321	5378	4349	**5459**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml	22.1 (28.0)	29.2 (32.6)	20.6 (26.9)	**23.9**	26.9 (31.2)	66.8 (54.8)	24.2 (29.4)	38.2 (38.1)	**39**	5453	6243	5008	4206	**5227**
T7 - Tebuconazole 50% + Trifloxystrobin 25% WG	0.4 g	22.2 (28.0)	20.4 (26.8)	23.1 (28.7)	**21.9**	27.5 (31.6)	51.2 (45.6)	26.7 (31.1)	13.7 (21.3)	**29.8**	5331	7396	4961	4824	**5628**
T8 - Untreated control	-	36.1 (36.9)	47.3 (43.4)	46.0 (42.7)	**43.1**	42.6 (40.7)	86.2 (68.8)	53.6 (47.0)	52.2 (46.2)	**58.7**	3983	5374	3786	3934	**4269**
General Mean		**24.0**	**31.2**	**25.5**	-	**30**	**70.2**	**30.1**	**27.8**	-	**5219**	**6392**	**4833**	**4343**	-
LSD @ 5% *(P=0.05)*		**2.1**	**2.7**	**1.6**	-	**2.9**	**4.7**	**2.1**	**5.8**	-	**676.7**	**951.5**	**366.3**	**175.5**	-
C.V.		4.7	5.4	3.6	-	5.9	5.5	4.2	12.5	-	8.7	10.1	5.1	2.7	-
Transformation		AT	AT	AT	-	AT	AT	AT	AT	-	-	-	-	-	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

Glume/grain discolouration: The fungicides were evaluated against glume discoloration at Moncompu, and Rajendranagar. Panicle disease incidence at control plot was moderate (29.3%) at Rajendranagar. At Moncompu, high level of spikelet incidence (34.9%) was recorded in the control plot. All the fungicides reduced the grain dicoloration incidence compared to check. Treatment (T4) fenoxanil 5% + isoprothiolane 30% EC (2 ml/l) showed less panicle disease incidence (10.0%) at Rajendranagar and the same treatment showed significantly less spikelet disease severity at Moncompu (16.4%) compared over other treatments. In case of reducing the panicle disease severity at Moncompu was non-significant among the fungicides. Treatment (T3) azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) produced highest grain yield (6054 Kg/ha) compared to all other treatments and check (4316 Kg/ha) (Table 11.12).

Stem rot: The chemicals were evaluated against stem rot disease through artificial inoculation at Titabar and recorded the disease incidence and severity. All seven fungicidal treatments were reduced the disease incidence compare to control. Among all treatment, azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l) treatment reduced the disease severity at 20.7% disease incidence at 24.1% and produced the highest yield of 3970 Kg/ha (Table 11.12).

Table 11.12: Evaluation of fungicides against Grain discolouration and Stem rot diseases of rice, *Kharif,* 2024

Treatments	Dosage /L	Grain discolouration						Stem rot		
		Panicle-DS(%)	Spikelet DS (%)	Panicle DI (%)	Grain Yield (Kg/ha)			(DS %)	(DI %)	(GY kg/ha)
		MNC	MNC	RNR	MNC	RNR	Mean	TTB	TTB	TTB
T1-Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g	2.5 (1.8)	21.5 (27.5)	18.8 (25.6)	5589	5683	**5636**	34.2 (35.8)	41.1 (39.9)	3042
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g	1.2 (1.4)	18.8 (25.5)	17.3 (24.2)	6162	5743	**5953**	31.8 (34.3)	36.3 (37)	3197
T3 - Azoxysrobin 5.1% + Tebuco. 9.1% + Pro.18.2% EC	3.5 ml	2.7 (1.7)	20.9 (27.2)	17.3 (24.4)	6095	6012	**6054**	27.6 (31.7)	32.3 (34.6)	3325
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml	1.2 (1.4)	16.4 (23.7)	10.0 (18.3)	5246	5246	**5246**	21.9 (27.9)	25.3 (30.2)	3872
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml	0.6 (1.2)	19.0 (25.8)	14.5 (22)	6116	5984	**6050**	20.7 (26.7)	24.1 (29.4)	3970
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml	1.8 (1.6)	23.3 (28.8)	16.3 (23.3)	5654	6030	**5842**	23.1 (28.7)	29.6 (32.9)	3677
T7-Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g	2.6 (1.7)	19.5 (26.1)	11.8 (19.9)	5461	6076	**5769**	26.7 (31.1)	30.6 (33.6)	3483
T8 - Untreated control	-	5.0 (2.4)	34.9 (36.2)	29.3 (32.7)	3945	4686	**4316**	58.9 (50.1)	64.4 (53.3)	2605
General Mean		**2.2**	**21.7**	**16.9**	**5533**	**5682**	**-**	**30.6**	**35.5**	**3396**
LSD @ 5% *(P=0.05)*		**N/A**	**3.3**	**5.7**	**N/A**	**396.4**	**-**	**1.4**	**2.6**	**274.5**
C.V.		30.4	8.2	16.1	19.3	4.7	-	2.8	4.7	5.4
Transformation		ST	AT	AT	-	-	-	AT	AT	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation)

TRIAL No. 12: EVALUATION OF BIO-CONTROL FORMULATIONS AGAINST FUNGAL DISEASES

The integrated disease management (IDM) trials were initiated with the identification and characterization of an efficient strain of *Trichoderma asperellum viz*., *T. asperellum* Strain TAIK1 by ICAR-IIRR. The trials were conducted in the institute research farm and in the farmer's fields over a period of 4 years have established the plant growth capabilities and biocontrol efficiency against major pathogens of rice. With the objective of studying the efficiency of two formulations of the strain viz., a liquid and solid bio formulation in different rice growing regions of the country, the formulations were tested against naturally occurring diseases of about seven centres.

The experiment was conducted with 8 different treatments *viz*., T1=Seed treatment followed by seedling dip @ 10 g/l of solid Formulation, T2= Seed treatment followed by seedling dip @ 10 g/l of liquid Formulation, T3= T1 followed by foliar Spray @ 5g/l of solid Formulation, T4=T2 followed by foliar Spray @ 5g/l of liquid Formulation, T5=T1 followed by fungicide for the respective disease, T6=T2 followed by fungicide for the respective disease, T7= Only the fungicide for the respective disease and T8=Control (No treatment). the respective fungicides for each disease is as follows, for sheath blight diseases Hexaconazole @ 2ml/l at tillering stage, for neck blast disease isoprothiolane @1.5 ml/l at panicle emergence and for false smut disease propiconazole @1ml/l at booting stage was recommended in this experiment.

This trial was proposed in 11 centers and results were obtained from seven centres, 5 centres viz., Maruteru, Moncompu, Navsari, Pantnagar and Varanasi reporting on sheath blight disease; false smut, sheath rot and neck blast from Karaikal, leaf blast from Rewa and neck blast from Maruteru. Results obtained from different centres are discussed below.

Leaf blast:

The effectivity of *T.asperellum* Strain TAIK1 either alone or in combination of the fungicide against the leaf blast disease was reported by the Rewa centre. Results indicated that the treatment T6 viz., seed treatment plus seedling dip (10g/l liquid formulation) and foliar spray of fungicide was the best in controlling the leaf blast disease which is reducing the 49.17% of the disease when compared to the untreated control (T8) (Table 12.1) followed by the treatment T5 (45.86% decrease over control) and T4 (40.88% decrease over control).There was a significant variation existed among the treatments for the grain yield, the treatement T7 fungicide alone has given the higher yields when compared to the remaining treatment combinations. among the biocontrol agent combinations, T5 and T6 are on par in increasing the grain yield of the treated plants *viz.,* 20.41 and 20.24% respectively (Table 12.1).

Table 12.1: Evaluation of bio control formulations against Leaf blast at Rewa

S.No	Treatments	Leaf blast						
		DS (%)	% Decrease over control (DS)	No of tillers	1000 grain weight	Grain yield (Kg/ha)	% Increase in Grain Yield	DI (%)
T1	ST + SD @ (10 g/l) (Solid Formulation)	16.70 (24.12)	7.73	9	26.03	4068	15.63	16.70 (24.12)
T2	ST + SD @ (10 g/l) Liquid Formulation)	13.20 (21.30)	27.07	9	26.13	4062	15.46	14.90 (22.71)
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	11.60 (19.91)	35.91	9	27.13	4173	18.62	14.20 (22.14)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	10.70 (19.09)	40.88	9	27.80	4196	19.27	11.20 (19.55)
T5	T1+ Fungicide for the respective disease	9.80 (18.24)	45.86	10	26.90	4236	20.41	11.30 (19.64)
T6	T2+ Fungicide for the respective disease	9.20 (17.66)	49.17	11	27.90	4230	20.24	10.40 (18.81)
T7	Fungicide for the respective disease	10.80 (19.19)	40.33	10	27.47	4597	30.67	14.70 (22.54)
T8	Control	18.10 (25.18)		9	25.47	3518		26.70 (31.11)
C.D.		1.694		0.887	1.118	356.451		1.769
SE(m)		0.553		0.29	0.365	116.389		0.578
SE(d)		0.782		0.41	0.516	164.599		0.817
C.V.		7.656		5.399	2.354	4.875		6.666

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Neck blast:

In the study of IDM against Neck blast disease using the bioagent *T.asperellum* Strain TAIK1 and the fungicide Isoprothiolane @1.5ml/l at panicle emergence, there was no significant variation observed among the treatments for the disease incidence (DI) and grain yield. The treatment T7 fungicide alone has better control of neck blast disease (24.89% decrease over control) which is giving a higher grain yield (5144 kg/ha) with 25.25% increase over the untreated control (Table 12.2). The biocontrol and fungicide treatment combinations T6 (23.11% decrease over control) and T5 (22.11% decrease over control) are on par in controlling the neck blast disease incidence in Maruteru centre (Table 12.2).

Table 12.2: Evaluation of bio control formulations against Neck blast at Maruteru

S.No	Treatments	Neck blast			
		DI (%)	% Decrease over control (DI)	Grain Yield	% Increase in Grain Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	8.67 (17.12)	3.67	4830	17.58
T2	ST + SD @ (10 g/l) Liquid Formulation)	7.88 (16.30)	12.44	4874	18.67
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	8.62 (17.07)	4.22	4649	13.19
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	7.92 (16.35)	12.00	4868	18.51
T5	T1+ Fungicide for the respective disease	7.01 (15.35)	22.11	4933	20.10
T6	T2+ Fungicide for the respective disease	6.92 (15.25)	23.11	4952	20.56
T7	Fungicide for the respective disease	6.76 (15.07)	24.89	5144	25.25
T8	Control	9.00 (17.46)		4107	
C.D.		N/A		N/A	
SE(m)		1.98		286.99	
SE(d)		2.80		405.87	
C.V.		50.58		11.97	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Karaikal centre has reported the effectivity of *T.asperellum* Strain TAIK1 either alone or in combination of the fungicide Isoprothiolane @ 1.5ml/l at panicle emergence against the neck blast disease. Accordingly, the highest percent decrease in disease severity over control (100%) when the plant were treated with bioagent as seed treatment followed by foliar spray @ 5g/l with liquid formulation (T4) followed by the treatment bioagent as seed treatment and seed dresssing followed by foliar spray @ 5g/l with solid formulation (T4). Further the application of fungicide Isoprothiolane @ 1.5ml/l at panicle emergence either alone (T7) or in combination with the bioagents (T5) were not as effective as the bioagent applications. Also, the bioagents were found to induce highest percent increase in grain yield over control T4 and T3 in that order viz., 34.86 % and 30.27% respectively (Table 12.3).

Table 12.3. Evaluation of bio control formulations against Neck blast at Karaikal

S.No	Treatments	Neck blast							
		DS (%)	% Decrease over control	No of tillers	1000 grain weight	Dry matter	Grain yield (Kg/ha)	% Increase in Grain Yield	DI (%)
T1	ST + SD @ (10 g/l) (Solid Formulation)	3.35 (10.54)	73.43	14	15.33	1450	5867	19.73	5.67 (13.78)
T2	ST + SD @ (10 g/l) Liquid Formulation)	2.70 (9.46)	78.56	14	16.33	1563	5950	21.43	4.99 (12.91)
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	0.33 (3.31)	97.35	16	20.67	1640	6383	30.27	1.15 (6.17)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	0.00 (0.00)	100.00	18	21.00	1730	6608	34.86	0.00 (0.00)
T5	T1+ Fungicide for the respective disease	0.67 (4.68)	94.71	14	16.67	1460	6050	23.47	1.37 (6.72)
T6	T2+ Fungicide for the respective disease	0.00 (0.00)	100.00	14	16.67	1530	6330	29.18	0.00 (0.00)
T7	Fungicide for the respective disease	3.61 (10.96)	71.31	11	14.67	1470	5100	4.08	5.83 (13.97)
T8	Control	12.59 (20.79)		9	13.00	1247	4900		19.96 (26.54)
C.D.		1.698		1.549	1.81	108.59	316.803		1.124
SE(m)		0.555		0.506	0.591	35.459	103.443		0.367
SE(d)		0.784		0.715	0.836	50.147	146.291		0.519
C.V.		33.044		6.354	6.095	4.064	3.038		13.04

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Sheath blight: Among the different centres that has reported sheath blight percent disease severity (DS), Pantnagar has reported the highest DS of 76.82% followed by Maruteru at 68.12% in the untreated plots (Control). The highest disease incidence (DI) was recorded at Pantnagar 95.55% followed by Maruteru 86.60% DI. Among the different formulations tested viz., the liquid formulation was found to be better than the solid formulation. Similarly, the combination of bioagent formulation and fungicides were providing higher percent disease control and increased plant yield than when compared to the fungicide treatment alone (Trial 12.4 to 12.7).

Among all the treatments and across all the locations, the treatment T6 = Seed treatment followed by seedling dip @ 10 g/l of liquid Formulation+ fungicide for the respective disease (31.29%) has shown best in controlling the disease as it produced very less disease as compared to the all the treatments tested followed by the treatment T5 (32.48%) (Table 12.8). Incase of biocontrol alone, the treatment T4 is the best in controlling the disease (38.65%). So for the control of sheath blight disease, biocontrol seed treatment along with the fungicide (Hexaconazole) spray is required to control the disease. Even at the center wise also the treatment T6 showed the better performance in reducing the disease and increasing the yield levels by promoting the plant growth characteristics like number of tillers, shoot and root length and 1000 grain weight. In this the biocontrol agent have an ability to promote the plant growth characteristics by inducing the host mechanisms. Being a soil borne pathogen, the seed treatment with biocontrol agent is very helpful to control the initial establishment of the pathogen when the plants were at very young age during tillering stage.

Among the different treatments overall for the management of the sheath blight disease, Navasari reported the highest percentage control over the disease (DC) viz., 62.48% followed by Varanasi (61.64%) when applied with the liquid formulation of the bioagent as seed treatment followed by seedling dip @ 5g/l followed by foliar spray of Hexaconazole @ 2ml/l at tillering stage (T6). Regarding the plant yield, Moncompu centre reported the highest percent increase in grain yield over control (65.37%) when the plants were applied with bioagent as seed treatment followed by seedling dip @ 5g/l with liquid formulation followed by Hexaconazole @ 2ml/l at tillering stage (T6) followed by the treatment of bioagent as seed treatment followed by seedling dip @ 5g/l with solid formulation followed by Hexaconazole @ 2ml/l at tillering stage (T5) (Table 12.9).

TABLE 12.4: Evaluation of bio control formulations against Sheath Blight at Maruteru and Moncompu

S.No	**Treatments**	**Sheath blight**								
		Moncompu				**Maruteru**				
		DS (%)	**% Decrease over control (DS)**	**Grain yield (Kg/ha)**	**% Increase in Grain Yield**	**DI (%)**	**DS (%)**	**% Decrease over control (DS)**	**Grain yield (Kg/ha)**	**% Increase in Grain Yield**
T1	ST + SD @ (10 g/l) (Solid Formulation)	33.18 (35.17)	43.12	7969	65.95	61.30 (51.54)	60.37 (51.0)	11.89	4830	17.583
T2	ST + SD @ (10 g/l) Liquid Formulation)	34.33 (35.87)	41.15	6651	38.50	54.10 (47.36)	56.85 (48.95)	17.02	4874	18.665
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	17.18 (24.49)	70.55	8528	77.59	53.20 (46.84)	59.26 (50.38)	13.51	4649	13.188
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	12.57 (20.77)	78.45	7697	60.29	52.40 (46.38)	60.19 (50.91)	12.16	4868	18.508
T5	T1+ Fungicide for the respective disease	17.55 (24.77)	69.91	6106	27.16	49.35 (44.63)	48.52 (44.15)	29.19	4933	20.104
T6	T2+ Fungicide for the respective disease	26.89 (31.24)	53.90	7941	65.37	49.24 (44.55)	46.48 (42.96)	32.16	4952	20.559
T7	Fungicide for the respective disease	25.93 (30.61)	55.55	7597	58.20	45.32 (42.26)	45.74 (42.50)	33.24	5144	25.248
T8	Control	58.33 (57.50)		4802		86.60 (70.02)	68.52 (55.98)		4107	
C.D.		8.227		N/A		10.46	8.249		N/A	
SE(m)		2.686		880.923		3.533	2.786		286.994	
SE(d)		3.799		1,245.81		4.996	3.94		405.871	
C.V.		16.473		21.306		12.52	9.996		11.971	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

TABLE 12.5: Evaluation of bio control formulations against Sheath Blight at Navasari

S.No	Treatments	Sheath blight							
		DS (%)	% Decrease over control	Root length	Shoot length	No of tillers	1000 grain weight	Grain yield (Kg/ha)	% Increase in Grain Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	31.73 (34.28)	27.27	9	19.17	15.97	84.33	4575	19.80
T2	ST + SD @ (10 g/l) Liquid Formulation)	30.10 (33.27)	31.01	10	19.67	16.23	86.67	4882	27.83
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	28.07 (31.99)	35.66	10	20.97	16.67	92.67	4902	28.36
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	26.40 (30.92)	39.49	11	21.83	18.60	96.33	5167	35.30
T5	T1+ Fungicide for the respective disease	18.22 (25.27)	58.24	12	25.60	20.33	99.00	5760	50.82
T6	T2+ Fungicide for the respective disease	16.37 (23.87)	62.48	13	26.97	22.93	101.00	6005	57.24
T7	Fungicide for the respective disease	22.67 (28.43)	48.04	11	22.27	19.07	96.67	5229	36.92
T8	T8=Control	43.63 (41.34)		8	16.20	12.60	78.00	3819	
C.D.			4.211	1.715	4.023	3.808	9.007	777.665	
SE(m)			1.375	0.56	1.314	1.243	2.941	253.925	
SE(d)			1.944	0.792	1.858	1.758	4.159	359.104	
C.V.			8.772	9.296	10.542	12.099	5.547	8.722	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

TABLE 12.6: Evaluation of bio control formulations against Sheath Blight at Pantnagar

T.No	Treatments	Sheath blight-Pantnagar									
		DI (%)	DS (%)	% Decrease over control	Root length	Shoot length	No of tillers	1000 grain weight	Dry matter	Grain yield (Kg/ha)	% Increase Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	77.10 (61.41)	52.18 (46.25)	32.08	8.15	118.50	49	25.65	435	5564	12.40
T2	ST + SD @ (10 g/l) Liquid Formulation)	74.15 (59.44)	51.39 (45.79)	33.10	8.48	118.88	52	26.22	415	5693	15.00
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	70.70 (57.23)	49.37 (44.64)	35.73	9.51	118.94	55	26.79	489	5842	18.00
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	67.15 (55.03)	47.68 (43.67)	37.93	9.68	119.00	58	26.83	505	6105	23.31
T5	T1+ Fungicide for the respective disease	64.30 (53.31)	44.81 (42.02)	41.66	9.96	121.19	58	27.10	517	6189	25.02
T6	T2+ Fungicide for the respective disease	61.12 (52.43)	40.99 (39.81)	46.64	10.09	122.16	63	27.23	577	6317	27.60
T7	Fungicide for the respective disease	69.28 (56.34)	48.21 (43.98)	37.24	9.60	119.83	57	26.96	500	6062	22.44
T8	Control	95.55 (77.82)	76.82 (61.22)		7.77	116.30	46	24.78	292	4951	
C.D.		2.594	2.601		1.088	2.655	3.89	N/A	61.45	205.04	
SE(m)		0.847	0.849		0.355	0.867	1.27	0.612	20.06	66.95	
SE(d)		1.198	1.201		0.502	1.226	1.796	0.866	28.37	94.68	
C.V.		2.026	2.86		6.722	1.258	4.015	4.009	7.456	1.98	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Table 12.7: Evaluation of bio control formulations against sheath blight at Varanasi

T.No	Treatments	Sheath blight			
		DS (%)	% Decrease over control (DS)	Grain Yield	% Increase in Grain Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	62.10 (52.00)	7.31	3557	5.61
T2	ST + SD @ (10 g/l) Liquid Formulation)	56.40 (48.68)	15.82	3883	15.29
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	54.90 (47.81)	18.06	4370	29.75
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	46.40 (42.94)	30.75	4649	38.03
T5	T1+ Fungicide for the respective disease	33.30 (35.24)	50.30	4964	47.39
T6	T2+ Fungicide for the respective disease	25.70 (30.46)	61.64	5043	49.73
T7	Fungicide for the respective disease	33.90 (35.61)	49.40	4547	35.01
T8	Control	67.00 (54.94)		3368	
C.D.		4.864		477.446	
SE(m)		1.588		155.897	
SE(d)		2.246		220.472	
C.V.		5.796		6.281	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Table 12.8: Comparison of the effect of bio formulations against Sheath Blight in different centres

T.No	Treatments	Maruteru		Moncompu		Navsari		Pantnagar		Varanasi	
		% Decrease over control (DC)	% Increase in Grain Yield	% Decrease over control (DC)	% Increase in Grain Yield	% Decrease over control (DC)	% Increase in Grain Yield	% Decrease over control (DC)	% Increase in Grain Yield	% Decrease over control (DC)	% Increase in Grain Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	11.89	17.58	43.12	65.95	27.27	19.80	32.08	12.40	7.31	5.61
T2	ST + SD @ (10 g/l) Liquid Formulation)	17.02	18.67	41.15	38.50	31.01	27.83	33.10	15.00	15.82	15.29
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	13.51	13.19	70.55	77.59	35.66	28.36	35.73	18.00	18.06	29.75
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	12.16	18.51	78.45	60.29	39.49	35.30	37.93	23.31	30.75	38.03
T5	T1+ Fungicide for the respective disease	29.19	20.10	69.91	27.16	58.24	50.82	41.66	25.02	50.30	47.39
T6	**T2+ Fungicide for the respective disease**	32.16	20.56	53.90	65.37	62.48	57.24	46.64	27.60	61.64	49.73
T7	Fungicide for the respective disease	33.24	25.25	55.55	58.20	48.04	36.92	37.24	22.44	49.40	35.01

Table 12.9: Evaluation of bio control formulations against sheath disease severity of rice, *Kharif*, 2024

T. No	Treatment	Disease Severity (DS%)					Mean DS	Grain yield (Kg/ha)					Mean yield
		MTU	MNC	NVS	PTN	VNS		MTU	MNC	NVS	PTN	VNS	
T1	ST + SD @ (10 g/l) (Solid Formulation)	60.37	33.18	31.73	52.18	62.10	**47.91**	4830	7969	4575	5564	3557	**5299**
T2	ST + SD @ (10 g/l) Liquid Formulation)	56.85	34.33	30.1	51.39	56.40	**45.81**	4874	6651	4882	5693	3883	**5197**
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	59.26	17.18	28.07	49.37	54.90	**41.76**	4649	8528	4902	5842	4370	**5658**
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	60.19	12.57	26.4	47.68	46.40	**38.65**	4868	7697	5167	6105	4649	**5697**
T5	T1+ Fungicide for the respective disease	48.52	17.55	18.22	44.81	33.30	**32.48**	4933	6106	5760	6189	4964	**5590**
T6	T2+ Fungicide for the respective disease	46.48	26.89	16.37	40.99	25.70	31.29	4952	7941	6005	6317	5043	6052
T7	Fungicide for the respective disease	45.74	25.93	22.67	48.21	33.90	**35.29**	5144	7597	5229	6062	4547	**5716**
T8	Control	68.52	58.33	43.63	76.82	67.00	**62.86**	4107	4802	3819	4951	3368	**4209**

SHEATH ROT

The centre Karaikal reported the effectivity of *T.asperellum* Strain TAIK1 alone in combination with the foliar spray proved best in terms of controlling the sheath rot disease and improving the plant growth characteristics. The maximum control of disease reported as percent decrease in disease severity over control (92.89%) when the plant was treated with bioagent as seed treatment followed by foliar spray @ 5g/l with liquid formulation (T4) followed by the treatment bioagent as seed treatment followed by foliar spray @ 5g/l with solid formulation (T3) (84.60% decrease over control). Further the application of fungicide Hexaconazole either alone (T7) or in combination with the bioagents (T5 and T6) were not as effective as the bioagent applications. Also, the bioagents were found to induce highest percent increase in grain yield over control T4 and T3 in that order viz., 34.86 % and 30.27% respectively (Table 12.10).

Table 12.10: Evaluation of bio control formulations against Sheath rot at Karaikal

S.No	Treatments	Sheath rot							
		DS (%)	% Decrease over control	No of tillers	1000 grain weight	Dry matter	Grain yield (Kg/ha)	% Increase in Grain Yield	DI (%)
T1	ST + SD @ (10 g/l) (Solid Formulation)	10.22 (18.64)	70.85	14	15.33	1450	5867	19.73	13.13 (21.24)
T2	ST + SD @ (10 g/l) Liquid Formulation)	9.01 (17.47)	74.29	14	16.33	1563	5950	21.43	11.12 (19.48)
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	5.40 (13.44)	84.60	16	20.67	1640	6383	30.27	6.49 (14.76)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	2.49 (9.09)	92.89	18	21.00	1730	6608	34.86	3.50 (10.78)
T5	T1+ Fungicide for the respective disease	6.58 (14.86)	81.23	14	16.67	1460	6050	23.47	7.47 (15.87)
T6	T2+ Fungicide for the respective disease	4.69 (12.50)	86.63	14	16.67	1530	6330	29.18	5.63 (13.73)
T7	Fungicide for the respective disease	11.21 (19.56)	68.02	11	14.67	1470	5100	4.08	13.96 (21.94)
T8	Control	35.06 (36.31)		9	13.00	1247	4900		39.56 (38.97)
C.D.		1.206		1.549	1.81	108.596	316.803		1.258
SE(m)		0.394		0.506	0.591	35.459	103.443		0.411
SE(d)		0.557		0.715	0.836	50.147	146.291		0.581
C.V.		6.444		6.354	6.095	4.064	3.038		5.643

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

FALSE SMUT

In the study of IDM against false smut disease using the bioagent *T.asperellum* Strain TAIK1, Karaikal centre reported the highest percent decrease in disease severity over control (92.89%) when the plant were treated with bioagent as seed treatment plus foliar spray @ 5g/l with liquid formulation (T4) followed by the bioagent as seed treatment plus foliar spray @ 5g/l with solid formulation (T3) (854.60% decrease over control). Interestingly the application of fungicide Propiconazole @ 1ml/l at booting stage either alone (T7) or in combination with the bioagents (T5 and T6) were not as effective as the bioagent applications. Similarly, the bioagents were found to induce highest percent increase in grain yield over control T4 and T3 in that order viz., 34.86 % and 30.27% respectively (Table 12.11). The biocontrol treatment has some impact on plant growth characteristics as it shown the highest number of tillers (18) and the higher 1000 grain weight (21 g) in the treatment T4 (Table 12.11)

Table 12.11: Evaluation of bio control formulations against False smut at Karaikal

S.No	Treatments	False smut							
		DS (%)	% Decrease over control	No of tillers	1000 grain weight	Dry matter	Grain yield (Kg/ha)	% Increase in Grain Yield	DI (%)
T1	ST + SD @ (10 g/l) (Solid Formulation)	16.14 (23.69)	54.03	14	15.33	1450	5867	19.73	17.33 (24.60)
T2	ST + SD @ (10 g/l) Liquid Formulation)	15.20 (22.95)	56.71	14	16.33	1563	5950	21.43	16.86 (24.24)
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	3.31 (10.49)	90.56	16	20.67	1640	6383	30.27	4.13 (11.72)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	2.51 (9.12)	92.84	18	21.00	1730	6608	34.86	3.05 (10.05)
T5	T1+ Fungicide for the respective disease	4.01 (11.55)	88.59	14	16.67	1460	6050	23.47	4.86 (12.74)
T6	T2+ Fungicide for the respective disease	2.91 (9.83)	91.70	14	16.67	1530	6330	29.18	3.53 (10.82)
T7	Fungicide for the respective disease	16.90 (24.27)	51.87	11	14.67	1470	5100	4.08	18.11 (25.19)
T8	T8=Control	35.11 (36.34)		9	13.00	1247	4900		39.92 (39.80)
C.D.		1.157		1.549	1.81	108.596	316.803		0.981
SE(m)		0.378		0.506	0.591	35.459	103.443		0.32
SE(d)		0.534		0.715	0.836	50.147	146.291		0.453
C.V.		5.449		6.354	6.095	4.064	3.038		4.117

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

TRIAL No.13: INTEGRATED PEST MANAGEMENT IN DIRECT SEEDED RICE

The integrated pest management trial was formulated to validate the location-specific IPM practices to demonstrate the management of pests in a holistic way (including insects, diseases and weeds) under Direct Seeded Rice (DSR) method of cultivation. The trial was conducted against rice diseases under direct seeded rice conditions at three different zones *viz*., Zone II (Northern zone - Ludhiana, Kaul); Zone VI (Western zone – Navsari) and Zone VII (Southern zone – Aduthurai, Mandya, Gangavathi). The detailed treatments can be referred from the AICRIP Plant Pathology Technical Programme, 2024. The trial was conducted by the experts from different disciplines viz., Entomology, Pathology and Weed science. With respect to diseases, disease severity was recorded at regular intervals starting from 15 days after transplanting (DAT) onwards to till the maturity of the crop both in the IPM and Farmers practices (FP) adopted fields. Later, Area Under the Disease Progress Curve (AUDPC) was calculated based on the weekly observation on disease severity to know the influence of the various management practices on the disease development. The results of the trail conducted at various locations are presented as below.

Zone – II: (Northern zone - Kaul and Ludhiana)

Under Northern zone, the trial was conducted at Kaul and Ludhiana. At Kaul, the trial was conducted with the Basmati variety PB 1847 under DSR Conditions in the farmer's field. IPM practices and Farmers practices were adopted and compared for the management of leaf and neck blast and sheath blight, brown spot and bacterial blight. Recommended fertilizer dose of DAP@ 25.0 Kg, Urea@ 40.0 Kg and $ZnSO_4$(21%) @10kg/acre was applied in the IPM field as against DAP@50.0 Kg, Urea@ 60.0 Kg and $ZnSO_4$ (21%)@10kg/acre in the farmer practices adopted field. Similarly, combination fungicide carbendazim+mancozeb was sprayed @ 400 ml /acre for the management of leaf blast and brown spot during the period of 30 to 60 days after sowing and hexaconazole 5% EC was sprayed between 60-90 days after sowing for sheath blight disease management. The adoption of IPM practices were found to reduce the disease progression of diseases viz., leaf blast (IPM – 4.2; FP-7.0), neck blast (IPM – 1.05; FP-1.4), sheath blight (IPM – 9.45; FP-11.97) and bacterial blight (IPM – 4.2; FP-7.0). However, with respect to brown spot, the AUDPC value was high in the IPM Practices adopted field compared to Farmer Practices due to prevalence of drought condition in the IPM field (Table 13.1).

Table 13.1: AUDPC values based on disease severity (%) of rice diseases at different dates at Zone II (Kaul), *Kharif* – 2024

		AUDPC Values				
	Treatment	Kaul				
		LB	NB	SHB	BB	BS
L1	IPM	4.2	1.05	9.45	33.13	47.42
	FP	7.0	1.4	11.97	51.15	30.24

(L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices; LB- Leaf Blast; NB- Neck Blast; BB- Bacterial Blight; BS – Brown spot; SHB- Sheath Blight; DI- Disease Incidence)

Zone VI (Western zone – Navsari)

Under this zone, the trial was conducted at Navsari, the trial was conducted at one location on diseases viz., sheath blight and Sheath rot. In the IPM field, spraying of hexaconazole 5 EC (2 ml/lit) at 60 DAT effectively reduced the sheath blight disease development (AUDPC value 156) as compared to farmer practice (AUDPC value 404). Similarly, spraying of propiconazole @ 1 ml/lt reduced the disease progression in terms of AUDPC value i.e., from 422 (in Farmers Practices) to 279 (in IPM practices) (Table 13.2).

Table 13.2: AUDPC values based on disease severity (%)of sheath blight and sheath rot recorded at different dates at Navsari- *Kharif* '2024

Treatment	AUDPC Values	
	Navsari	
	Sheath blight	Sheath Rot
L1 - IPM	156	279
L1- FP	404	422

(L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices)

Zone VII (Southern zone – Aduthurai, Gangavathi, Mandya)

At Aduthurai, the trial was conducted for the management of leaf and neck blast, bacterial blight and false smut diseases in three locations. Adoption of IPM practices reduced the disease progress of all the diseases at all the three locations. The IPM practice includes viz., spraying of broad spectrum fungicide like propiconazole @ 1 ml/lt and number of sprays are restricted to once. The AUDPC values of leaf blast was significantly low as compared to farmer practices (L1 = IPM – 40.6; FP-60.9; L2 = IPM – 28; FP – 70; L3 = IPM – 31.5; FP – 50.4). Similarly, the neck blast disease severity also reduced effectively in the IPM practices adopted field compared to farmer's practices (L1 = IPM – 22.4; FP-56.7; L2 = IPM – 34.3; FP – 61.6; L3 = IPM – 35; FP – 59.5). With respect to bacterial blight, application of recommended dose of fertilizers @ N-100kg; P- 75kg and K -50 kg as against 100kg, 100kg and 70kg in the farmer's practices and spraying of copper oxychloride reduced the disease progress (Table 13.3).

Table 13.3: AUDPC values based on disease severity (%) of rice diseases recorded at different dates at Aduthurai - *Kharif* '2024

Location	Treatment	AUDPC Values			(DI %)
		LB	NB	BB	FS
L1	IPM	40.6	22.4	28	6.3
	FP	60.9	56.7	224.7	16.1
L2	IPM	38.5	23.1	47.6	8.4
	FP	62.3	56	53.9	13.3
L2	IPM	31.5	35	35.7	22.8
	FP	50.4	59.5	60.9	34.3

At Gangavathi, adoption of IPM practices reduced the disease progress of leaf blast (IPM-162, FP-122), neck blast (IPM-97, FP-216), bacterial blight (IPM – 724, FP- 819). However, with respect to sheath blight (IPM-734, FP-707) both the practices performed similar. In case of brown spot the AUDPC values are higher than the Farmer practices (IPM-1093, FP-747). At Mandya, the IPM practices were evaluated against leaf and neck blast and sheath blight. IPM practices *viz*., adoption of seed treatment with carbendazim @ 4gm/kg seed, zinc sulphate @ 8kg/acre at time of puddling operation and spraying of tricyclazole 75% WP (Beam) @ 0.6gm/lit during 5% panicle emergence stage were adopted for the disease management. In the IPM practices adopted field the disease progress was reduced significantly as compared to farmer practices in all the three diseases (L1= LB - IPM-24.5, FP-74.2; NB – 39.2; IPM-177: SHB - IPM-154, FP-462) (Table 13.4).

Table 13.4: AUDPC values based on disease severity (%) of rice diseases recorded at different dates at Gangavathi and Mandya -*Kharif* '2024

Location	Treatment	AUDPC Values							
		Gangavathi					Mandya		
		LB	NB	BB	SHB	BS	LB	NB	SHB
L1	IPM	162	97	724	734	1093	24.5	39.2	154
	FP	122	216	819	707	747	74.2	177	462

(L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices; LB- Leaf Blast; NB- Neck Blast; BB- Bacterial blight; SHB- Sheath Blight; BS- Brown spot; FS- False smut; DI- Disease Incidence)

TRIAL No.14: SPECIAL TRIAL ON YIELD LOSS ASSESSMENT DUE TO BROWN SPOT DISEASE OF RICE

A special trial on yield loss was designed to assess the impact of brown spot disease on the grain yield of rice during *Kharif* 2024. The trial included three different treatments to create graded levels of disease infection, along with a control treatment where no infection occurred (un-inoculated + fungicide-treated control plot). The three treatments were as follows: T1 - inoculum sprayed thrice at intervals of 2 days (disease intensity >50%); T2 - inoculum sprayed twice at intervals of 2 days (disease intensity 30–50%); T3 - inoculum sprayed once (disease intensity <30%). Each treatment was replicated three times in a randomized block design (RBD). The pathogen *Bipolaris oryzae* was artificially inoculated using a standard inoculation method, and disease observations were recorded as percent disease index following the IRRI, SES scale. The trial was conducted at four hotspot locations, Gangavathi, Jagdalpur, Moncompu, and Pusa, with data collected from all four locations. Trial details for each location are provided in Table 14.1. Brown spot-susceptible varieties, *viz*., GNV-10-89 (at Gangavathi), Swarna (at Jagdalpur), Uma (at Moncompu), and Sugandha (at Pusa), were used for yield loss assessment at different locations.

The highest percent disease index (PDI) of brown spot was recorded at Jagdalpur (70.37%), followed by Pusa (57.40%), Moncompu (34.17%), and Gangavathi (19.75%) when the pathogen was inoculated thrice at intervals of two days (T1 treatment). This resulted in a yield reduction of 62.0% at Jagdalpur, followed by 31.8% at Pusa, 21.7% at Moncompu, and 11.5% at Gangavathi. Among the four locations, at Gangavathi, there was minimal variation in disease severity among treatments compared to other locations. The percent disease index (PDI) ranged between 9.77% (T4) and 19.75% (T1), showing a relatively lower disease pressure overall. At Jagdalpur, when the inoculum was sprayed twice at two-day intervals (T2 treatment), the PDI was 51.11%, leading to a yield reduction of 43.3%. When the inoculum was sprayed only once (T3 treatment), the PDI was 37.03%, with a yield reduction of 25.6% (Table 14.2).

At Moncompu, the T2 and T3 treatments recorded PDIs of 26.54% and 21.06%, respectively, with corresponding yield reductions of 17.7% and 8.0%. Similarly, at Pusa, the PDI values for T2 and T3 were 38.00% and 23.20%, causing yield reductions of 19.6% and 9.9%, respectively. The control treatment (T4) consistently showed the lowest disease severity across all locations, with a mean PDI of 13.5% (Table 14.2).

The mean values across all locations revealed that:

- A PDI of 53.98% resulted in a 31.7% yield reduction (T1).
- A PDI of 38.55% caused a 23.7% yield reduction (T2).
- A PDI of 27.10% led to a 15.0% yield reduction (T3).

These results indicate the strong correlation between increasing disease severity and declining rice yield.

Table 14.1: Experimental details of Yield loss trial, *Kharif*-2024

S. No	Location	Test Variety	Screening	Date of activities					
				Sowing/ Transplanting	Inoculation	Initial symptom	Fungicide Spraying Date	Observation	Harvesting
1	**Gangavathi**	GNV-10-89	Artificial	8.8.2024 9.4.2024	25-09-2024, 27-09-2024, 29-09-2024	10.08.24	08.10.24 18.10.24	11.08.24	20.12.24
2	**Jagdalpur**	Swarna	Artificial	25.06.2024 17.07.2024	-	10.10.24	-	15.10.24	20.12.25
3	**Moncompu**	Uma	Artificial	21.05.2024 6.11.2024	22-07-2024, 26-07-2024 30-07-2024	08.03.24	07.08.24	05.10.24	18.10.24
5	**Pusa**	Sugandha	Artificial	15.06.2024 10.07.2024	12.09.2024, 21.09.2024 & 04.10.2024	17-09-24	21.09.2024 04.10.2024	05.11.24	29.11.24

Table 14.2: Effect of gradients of brown spot disease severity on rice grain yield, *Kharif*-2024

Treat. No	GNV			JDP			MNC			PSA			Mean	
	PDI (%)	**Yield (Kg/ha)**	**% yield reduction over control**	**PDI (%)**	**Yield (Kg/ha)**	**% yield reduction over control**	**PDI (%)**	**Yield (Kg/ha)**	**% yield reduction over control**	**PDI (%)**	**Yield (Kg/ha)**	**% yield reduction over control**	**PDI (%)**	**% yield reduction over control**
T1	19.75 (26.36)	5,226	11.5	70.37 (57.02)	2194	62.0	34.17 (35.73)	5822	21.7	57.40 (49.24)	2860	31.8	53.98	**31.7**
T2	19.00 (25.83)	5,300	10.3	51.11 (45.61)	3276	43.3	26.54 (30.90)	6121	17.7	38.00 (37.97)	3370	19.6	38.55	**23.7**
T3	19.00 (25.80)	5,223	11.6	37.03 (37.46)	4296	25.6	21.06 (27.12)	6846	8.0	23.20 (28.66)	3776	9.9	27.10	**15.0**
T4	9.77 (17.98)	5,906	-	15.92 (23.50)	5774	-	9.53 (17.62)	7439	-	15.00 (22.62)	4192	-	13.5	-
C.V (%)	7.8	3.3		3.2	12.3		12.5	18.1		9.1	14.5			
LSD @ 5% *(P= 0.05)*	2.62	250		1.879	752		4.853	N/A		4.43	714			
Transformation	AT			AT			AT			AT				

(PDI- Percent disease index; Figures in the parenthesis indicates Arc sine transformed means)

Treatment details:

T1- Inoculum sprayed thrice at an interval of 2 days (disease intensity is more than 50%)
T2- Inoculum sprayed twice at an interval of 2 days (disease intensity is 30-50%)
T3- Inoculum sprayed once (disease intensity is below 30%)
T4- Un-inoculated + fungicide-treated control plot

TRIAL No.15: SPECIAL SCREENING TRIAL ON FALSE SMUT – *Kharif* 2024

Rice false smut, an important grain disease of rice, affects both the economic yield and quality of the rice grains. Identification of promising donors against false smut disease is very important to develop disease tolerant genotypes. Hence the trial was formulated to screen the selected rice entries either artificially at IIRR and artificially/naturally at disease hotspot locations. The detailed methodology of artificial screening technique standardised at IIRR, Hyderabad was given in the Technical Programme 2024. The trial was proposed at five Plant Pathology AICRPR locations *viz*., Gangavathi (GNV), Gudalur (GDL), IIRR, Ludhiana (LDN) and Masodha (MSD). During 2023, a severe incidence of false smut was recorded at Radhanagari (RDN), a voluntary centre for the conduct of Breeding trails and hence this centre was also selected to screen the selected entries under natural incidence.

In *Kharif* 2023, one hundred and twelve (112) entries belongs of AVT 1 & AVT 2 with Early and Mid-early duration were selected and screened under National Screening Nursery 1. The entries were artificially screened at IIRR and naturally at Gangavathi, Gudalur, IIRR, Masodha. Among the 112 entries screened, 89 entries were recorded 4 to 64 smut balls per panicle. Based on the number of smut balls/panicle and number of smut balls/Hill, twenty-two entries (22) were selected for further screening in *Kharif* 2024. In addition to that, entries which are showed tolerance to false smut disease after repeated screening either artificially/ naturally were also nominated by AICRPR Plant Pathology co-operators were also included and a total of 85 entries were screened artificially at IIRR and naturally screened at Gangavathi, Gudalur, Ludhiana, Masodha and Radhanagari (RDN) during 2024. At Gudalur, the disease incidence was very low and the data was not considered for the selection of promising entries. The data was recorded in terms of number of infected panicles/Hill and number of smut balls/panicle. Date of sowing, transplanting and other details are mentioned in the Table 15.1.

Gangavathi: The entries were sown on two different dates *viz*., 01.08.2024, 12.08.2024 and transplanted on 30.08.2024, 09.09.2024. Disease incidence is high in the first date of sowing (01.08.2024) compared to the second sowing. The natural occurrence of disease was noticed on 22.11.2024. Eighty-five entries were screened and among them 41 entries recorded the maximum smut ball of up to 2. Maximum of fourteen smut balls/panicle was recorded.

Ludhiana: The entries were sown on 29.05.2024 and transplanted on 03.07.2024 and the natural occurrence of disease was noticed on 05.09.2024. The level of disease infection was very good and rainfall received in the month of August (239 mm) with nine rainy days might have coincided with booting stage and favoured the natural disease infection. The susceptible genotype recorded a maximum of 16 smut balls/ panicle. Among the 85 entries, 47 entries recorded zero to three smut balls per panicle.

Masodha: The entries screened naturally and the disease was augmented artificially by spraying the chlamydospore suspension during panicle emergence. The entries were sown on 12.07.2024 and transplanted on 08.08.2024. Symptoms were observed on 14.11.2024. Maximum of 25 smut balls per Panicle was recorded. Among the 85 entries, 72 entries recorded zero to three smut balls per panicle.

Radhanagari: Thirty-Nine selected entries were sown on 18.06.2024 and transplanted on 11.07.2024. Maximum of 25 smut balls were recorded per panicle. Twenty-nine entries showed zero to two smut balls per panicle and eleven entries recorded 4 to 25 smut balls per panicle.

IIRR, Hyderabad: The entries were sown on 15th June, 2024 and transplanted on 16th July, 2024. The *Ustilaginoidea virens* conidial suspension was prepared and injection method of inoculation was adopted to screen the entries. For each entry, minimum of four panicles were inoculated and observations were recorded during maturity stage. Observation was recorded as number of smut balls per panicle. The field was provided with green shade and sprinkler system to create conducive conditions for false smut disease. The artificial inoculation was initiated on 30.08.2024 and ended on 11.10.2024. The same entries were screened during Rabi 2024-25 and the number of smut balls were recorded per panicle. For each entry, both the Kharif and Rabi data was pooled and maximum number of smut balls was considered. Number of smut balls varied from 0 to 60 per panicle. Among the 85 entries screened, twenty-seven (27) entries recorded 0 to 3 smut balls per panicle.

With respect to the entries designated as DL, it includes the selected entries of *Kharif* 2023, Land races and wild introgressed lines. Among the 41 entries screened across the five location either artificially (IIRR) or naturally (GNV, LDN, MSD, RDN), the eleven entries *viz*., IET29536 R, IET29549, Rasi, RL-348, RL-479, PAU 1044, NPS -13, IET29939, RL 4, RL-1516 and RL-4609 recorded as moderately tolerant with the smut ball ranged from 3 to 4 per panicle with the disease score of 5. None of the entries recorded as 0 across the locations (Table 15.2).

The entries designated as GGV (44 in number), it includes the IRRI germplasms and selected varieties. These entries were screened artificially at IIRR and naturally at Gangavathi, Ludhiana and Masodha. Among the 44 entries screened, 31 entries recorded 0 to 3 smut balls per panicle (Table 15.3). From the results, forty-four entries are selected for further confirmation for one more season across the locations.

Table 15.1: Details about the false smut trial taken up at the different locations – *Kharif* 2024

Location	IIRR	GGV	LDN	MSD	RDN
Nature of screening	Artificial	Natural	Natural	Natural/ Artificial	Natural
Date of Sowing	15.06.2024	01.08.2024	29.05.2024	12.07.2024	18.06.2024
Date of Transplanting	16.07.2024	30.08.2024	03.07.2024	08.08.2024	11.07.2024
Natural occurrence of the Disease	-	22.11.2024	05.09.2024	14.11.2024	-
Maximum number of smut balls observed Panicle	60	14	15	25	25
Number of entries with zero smut balls	28	48	39	12	7
Number of entries with 1 to 3 smut balls/Panicle	18	33	9	38	13
Number of entries >4 smut balls/Panicle	37	6	13	14	12
Number of entries screened	85	85	85	85	39
Number of infected Entries	54	38	14	75	24
Maximum number of smut balls in the local susceptible entry	60	15	16		
No. of Entries not Flowered/Late flowered	-	-	13	-	-
Number of entries not germinated / Missing	-	-	2	-	2

Table 15.2: False smut Disease Reaction of Selected genotypes screened at Multi-locations – *Kharif* 2024

Genotype Details			Maximum No.of smut ball/Panicle					Maximum No. of Smut Balls / Panicle (Across the locations)	Score
S. No.	Designation	IET No/ Entry	MSD	LDN	GNV	RDN	IIRR*		
DL-7	P. No. 37	IET29536 R	2	-	1	0	3	3	5
DL-13	P. No. 57	IET29549	3	-	0	0	-	3	5
DL-14	P. No. 61	Rasi	3	0	2	0	3	3	5
DL-26	L3- 78	RL-348	0	LF	1	1	3	3	5
DL-27	L3-98	RL-479	3	LF	0	0	2	3	5
DL-32	IIRR - 4	PAU 1044	3	0	0	0	0	3	5
DL-33	IIRR - 10	NPS -13	2	0	0	0	3	3	5
DL-5	P. No. 14	IET29939	2	0	0	0	4	4	5
DL-24	L2-20	RL 4	3	0	0	0	4	4	5
DL-28	L3-204	RL-1516	4	0	1	1	2	4	5
DL-31	L3-401	RL-4609	0	LF	0	0	4	4	5
DL-4	P. No. 9	IET30827	5	0	1	1	4	5	5
DL-16	P. No. 65	IET30240	3	0	2	1	5	5	5
DL-30	L3-367	RL-4213	3	5	5	2	1	5	5
DL-8	P. No. 39	IET30032	1	6	2	1	1	6	5
DL-23	L2-17	RL 41	2	4	2	0	6	6	5
DL-1	P. No. 2	IET 30178	4	0	0	7	6	7	7
DL-6	P. No. 31	IET30078	2	6	8	2	6	8	7
DL-9	P. No. 41	IET30028	0	8	0	1	6	8	7
DL-11	P. No. 52	IET30020	1	8	0		5	8	7
DL-12	P. No. 53	IET29405 R	2	8	0	0	6	8	7
DL-17	P. No. 67	IET30270	3	0	5	6	8	8	7
DL-22	P. No. 214	ADT 39	9	0	0	0	5	9	7
DL-35	IIRR - 13	NPS -9	2	LF	0	1	9	9	7
DL-10	P. No. 42	IET30029	2	0	0	10	6	10	7
DL-20	P. No. 184	IET29284 R	0	0	1	11	6	11	9
DL-15	P. No. 63	Vandana	4	0	0	0	12	12	9
DL-29	L3-277	RL-2453	1	12	0	2	6	12	9
DL-19	P. No. 183	IET29257 R	3	4	3	13	6	13	9
DL-34	IIRR - 11	NPK - 77-3	3	LF	0	2	13	13	9
DL-3	P. No. 6	IET30176	2	6	14	0	5	14	9
DL-2	P. No. 3	CSR 36	3	15	0	11	2	15	9
DL-25	L3 - 67	RL-263	2	LF	0	0	15	15	9
DL-36	IIRR -16	NPS- 25	4	LF	1	8	15	15	9
DL-37	IIRR -17	NPS- 35	3	LF	1	16	6	16	9
DL-18	P. No. 69	Swarna	3	0	0		18	18	9
DL-21	P. No. 188	IET29290 R	3	0	0	25	3	25	9
DL-38	IIRR - 21	NPS-61	2	LF	0	1	25	25	9
DL-40	IIRR - 23	NPS -64	4	4	0	1	27	27	9
DL-39	IIRR - 22	NPS-62	3	3	0	7	30	30	9
DL-41	IIRR - 24	NPS-65	3	11	6	4	30	30	9

(Note: P. No.: Pathology Serial Number; * Screening done artificially)

Table 15.3: False smut Disease Reaction of selected genotypes screened at Multi-locations – *Kharif* 2024

Genotype Details			Maximum No.of smut ball/Panicle –				Maximum No. of Smut Ball/Panicle across the locations	Score
S. No.	Pathology S.No.	IET No.	GNV	LDN	MSD	IIRR		
GGV-5	IRRI-G-104	CHI GU::IRGC 71988-1	0	0	0	0	0	0
GGV-20	RPL-6	Aanandi 614	0	0	0	0	0	0
GGV-26	RPL-12	Barma Black 625	1	NF	0	-	0	1
GGV-39	RPL-38	Madras Sanna 635	1	NF	0	0	0	1
GGV-8	IRRI-G-117	E 4197::IRGC 68004-1	0	0	2	0	2	3
GGV-15	IRRI-G-219	DUDHSAR::IRGC26609-2	2	NF	2	0	2	3
GGV-17	IRRI-G-254	KHAO' SIM:: IRGC 24094-1	0	0	2	0	2	3
GGV-24	RPL-10	Bangara Sanna 604	0	0	2	0	2	3
GGV-25	RPL-11	Udda jyothi	0	1	2	1	2	3
GGV-28	RPL-25	Hasara 658	1	NF	2	0	2	3
GGV-31	RPL-30	Jugal Batta 611	2	NF	0	0	0	3
GGV-32	RPL-31	Joolige 654	2	NF	2	0	2	3
GGV-34	RPL-33	Kaagi Saale 626	1	NF	2	0	2	3
GGV-41	RPL-49	Raama Dari 641	0	1	2	0	2	3
GGV-43	RPL-56	Selam Sanna 627	0	NF	1	0	1	3
GGV-4	IRRI-G-98	BU ZHI MING ::IRGC 71971-1	2	0	3	3	3	5
GGV-6	IRRI-G-115	DONGREM::IRGC 6688-1	1	0	3	0	3	5
GGV-9	IRRI-G-120	E ZI110::IRGC 70201-1	0	0	3	0	3	5
GGV-14	IRRI-G-200	AI NAN TSAO 39:: IRGC 28461-2	1	0	3	0	3	5
GGV-16	IRRI-G-247	DILVAKSH::IRGC 74738-1	0	2	3	1	3	5
GGV-18	IRRI-G-270	ARC 15505:: IRGC 42066-1	0	0	4	0	4	5
GGV-19	RPL-5	Andanuru Sanna 620	2	0	4	0	4	5
GGV-21	RPL-7	Aasanaliya 610	2	3	3	0	3	5
GGV-23	RPL-9	Baasamati 640	0	0	3	1	3	5
GGV-27	RPL-20	Gowri Sanna 605	0	NF	3	0	3	5
GGV-29	RPL-28	Jasmin Black 629	2	0	3	0	3	5
GGV-30	RPL-29	Jeerige Samba	1	-	3	0	3	5
GGV-33	RPL-32	Jeerige Sanna 609	2	NF	4	0	4	5
GGV-35	RPL-34	Kari Gajali 603	1	NF	4	0	4	5

Genotype Details			Maximum No.of smut ball/Panicle –				Maximum No. of Smut Ball/Panicle across the locations	Score
S. No.	Pathology S.No.	IET No.	GNV	LDN	MSD	IIRR		
GGV-36	RPL-35	Kempu Batta 608	0	NF	3	0	3	5
GGV-37	RPL-36	Karigallu 660	0	3	2	-	2	5
GGV-38	RPL-37	Kagga Selection 655	2	3	2	0	2	5
GGV-42	RPL-54	Saandara Saali 657	0	0	3	0	3	5
GGV-44	RPL-58	Selam Sanna 656	0	NF	3	0	3	5
GGV-10	IRRI-G-127	IH PEN SHIM MING::IRGC 26067-1	0	0	0	9	9	7
GGV-13	IRRI-G-158	NCS 331::IRGC 62247-1	1	0	0	10	10	7
GGV-1	IRRI-G-30	FACAGRO64::IRGC 82059-1	0	1	1	20	20	9
GGV-2	IRRI-G-32	GUIHUAZAO::IRGC 68060-1	0	0	3	18	18	9
GGV-3	IRRI-G-84	AN FU ZHAN ::IRGC 72576-1	0	0	2	11	11	9
GGV-7	IRRI-G-116	DU GEN CHUAN::IRGC 70083-1	0	0	3	60	60	9
GGV-11	IRRI-G-128	IR19058-107-1::IRGC 72997-1	1	2	3	12	12	9
GGV-12	IRRI-G-143	LIU HE XI HE::IRGC 76661-1	1	0	4	14	14	9
GGV-22	RPL-8	Antara Saali 659	0	0	2	50	50	9
GGV-40	RPL-42	Mulagudi Sanna 616	0	0	25	0	25	9

TRIAL 16: EVALUATION OF DRONES FOR SPRAYING OF AGROCHEMICALS (HERBICIDES, INSECTICIDES, AND FUNGICIDES) IN RICE PEST MANAGEMENT (EDAPM)

(Collaborative trial –Agronomy, Entomology and Pathology)

The trial is proposed to find out the efficiency of DRONE spraying in rice cultivation

Objectives:

- ❖ To evaluate the efficacy of drone based spraying of herbicides, insecticides and fungicides for the management of weeds, major insect pests and diseases of rice.

- ❖ To compute the labour saving, economics and feasibility of drone application in rice cultivation

The trial was conducted for the management of leaf blast, sheath blight disease and grain discolouration and details of treatments are given in the AICRPR Plant Pathology Technical Program 2024. In brief the treatments details are: T1 treatment - drone is used to spray the tank mix of both fungicide and insecticide at maximum tillering stage (tebuconazole 50% + trifloxystrobin 25% WG (Nativo) @ 80 g/acre + isocycloseram 18.1% W/W SC (Insipio) @ 120 ml/acre) and at booting stage (Picoxystrobin 7.05% + propiconazole 11.7% SC (Galilieo way) + chlorantraniliprole 18.50 % SC @60ml/acre@400 ml/acre: T2 treatment - the same chemicals are sprayed with Battery operated Knapsack sprayer at maximum tillering, booting stage and T3 is the control treatment. Data was recorded at maximum tillering stage and booting stage as Per cent Disease Index (PDI). The trial was proposed at 11 locations. However, Pathology data was received from three locations *viz*., Gangavathi, Nawagam and Rajendranagar.

Leaf Blast: The trial was conducted at Gangavathi and Nawagam. At Gangavathi, leaf blast disease severity was recorded as 12.73% (PDI) at booting stage. In T2 treatment, spraying of chemicals using battery operated knapsack sprayer at maximum tillering and booting stage reduced the PDI from 12.73% to 4.94%. In T1 treatment, same chemicals were sprayed using drones and the recorded PDI was 3.61%. Use of drones for spraying the chemicals reduced the PDI up to 71.65% as against 61.17% in case of battery operated knapsack sprayer. Similarly, at Nawagam 46.02% of PDI was recorded in the control treatment at booting stage. Application of chemicals using battery operated knapsack sprayer at two stages, recorded the PDI of 32.25%. With respect to drone spraying (T1 treatment) the recorded PDI was 29.68% as against 46.02% at booting stage in the control (T3 treatment). The results revealed that, the percentage of reduction of PDI with battery operated knapsack sprayer was 45.55% (T2 treatment) and it was 53.58% in T1 treatment with drone spraying as compared to control (Table 16.1).

Sheath blight: The trial was conducted at Gangavathi. The PDI of sheath blight was 32.24% in the control treatment at booting stage. In the T1 and T2 treatments, the chemicals were sprayed at maximum tillering and booting stage. At booting stage, the treatment T1 recorded 16.55% PDI (use of drone for spraying chemicals) and the treatment T2 recorded 17.49% PDI (use of knapsack sprayer for spraying the chemicals) as against 32.24% in T3 treatment. The percentage of reduction of PDI was 48.65% in T1 treatment and 45.73% in T2 treatment (Table 16.1).

Grain discolouration: At Rajendranagar, the trial was conducted for the management of grain discolouration. The chemicals were sprayed only at booting stage in both the treatments (T1 & T2). The Per cent Disease Index of grain discolouration was 36.21% in the control treatment.

The treatment T1 recorded 20.31% of PDI and the treatment T2 recorded the PDI of 21.90% as against 36.21% in control. The percentage of reduction of PDI was 43.91% in the treatment where chemicals were sprayed with drone and 39.42% reduction of PDI was recorded in the treatment, in which chemicals were sprayed with battery operated knapsack sprayer (Table 16.1).

Table 16.1: Evaluation of Drone spraying of chemicals for the management of leaf blast, sheath blight and grain discolouration

Treatment Details/Disease/ Location	Leaf Blast							Sheath Blight			Grain Discoloration	
	GNV			NWG			Mean	GNV			RNR	
	PDI (%)			PDI (%)				PDI (%)			PDI (%)	
	MTS	BS	% of disease reduction	MTS	BS	% of disease reduction		MTS	BS	% of disease reduction	Booting Stage	% of disease reduction
T1- Drone	2.82 (1.92)	3.61 (2.11)	71.65	27.48	29.68	35.5	53.58	6.15 (2.62)	16.55 (23.87)	48.65	20.31 (26.76)	43.91
T2- Battery operated Knapsack sprayer	3.94 (2.18)	4.94 (2.4)	61.17	29.48	32.25	29.92	45.55	7.39 (2.86)	17.49 (24.61)	45.73	21.9 (27.87)	39.52
T3 - Untreated Control	10.78	12.73		40.71	46.02			12.22	32.24		36.21	
C. V.	14.56	13.34		12.91	11.43			9.6	6.88		12.21	
LSD @ 5% *(P= 0.05)*	0.35	0.35		3.98	3.9			0.28	1.8		3.53	
Transformation	ST	ST						ST	AT		AT	

(MTS- Maximum Tillering Stage; BS- Booting Stage; PDI – Percent Disease Index)

V. AICRPR - RAINFED TRIALS – HOST PLANT RESISTANCE - *Kharif* 2024

Seeds for Rainfed ecology trials were sent to 17 different co-operative centres out of which two centres namely Mugad and Raipur could not conduct the trials. The data from other centres were received but ironically only few centres conducted all the trials. The trials regarding NSN-1 is manageable but the NSN-2 trials are too poor.

In case of NSN-1 which consisted of rainfed shallow low land (RSL), semi deep water (SDW) and early direct seeded (EDS):

In case of bacterial blight data were received from Chinsurah, Maruteru, Masodha, Bankura, Titabar, Sabour centres with a range of LSI 1.52 to 8.57. But the data from Chinsurah showing LSI more than 8 (8.57) and Bankura (LSI-2.7) and Sabour (LSI= 1.52) showed LSI less than 3 were not considered. Only 3 entries namely 32122, 32193, 32198 showed less than 5. Other entries showed more than 5 SES score. In case of Sheath Blight data received from Chinsurah, Maruteru, Masodha, Bankura and Titabar with LSI 3.02 to 6.9 Conducted trials. Four entries namely 32147, 32150, 29026, 29031 showed severity index less than/equal to 5.0. Rest all were more than 5.0. Data received from four centres for sheath rot namely Pusa, Chinsurah, Bankura and Titabar with LSI 2.24 to 6.49. Data from Pusa and Bankura centres were not considered due to low LSI. The lines 30330 (R) 32100, 32077, 32085, 33259, 31237, 31204, 32175, 32146,32147, 32123, 32122, 32131,33264, 29026, 29031 showed SI 5.0 or less. It was interesting that sensitive check IR64 showed SI 5.0 which needs to be rechecked. We received the data from Hazaribag, Ponnampet, Cuttack, Bankura, Ranchi, Jagdalpur, Coimbatore (Range of LSI 1.91 to 5.67). Bankura centre showed less LSI (LSI=1.91) so was not considered. Interestingly none was promising. Pusa, Chinsurah, Ponnampet, Bankura, Sabour sent the data for brown spot disease with the range of LSI 1.4 to 6.96. Data from Ponampet, Bankura and Sabour not considered due to very low LSI. 30330 (R), 31170, 33264 were promising if Si is considered to be 5.0 or less.

NSN-2 trials consisted of EDS–Early Direct Seeded, RSL–Rainfed Shallow Lowland, SDW-Semi Deep Water, RSL- Rain fed Shallow Lowland, DW-Deep Water.

Data were received from 6 centres namely Hazaribag, Ponnampet, Cuttack, Jagdalpur, Coimbatore and Ranchi with LSI range 3.94 to 5.90 for blast disease. Only 33087 showed SI 3.0 out of 190 lines checked. In case of brown spot data received from Pusa, Ponnampet and Sabour but the data from Sabour and Ponnampet and were not considered due to very low LSI (1.3 to 1.5 respectively). None of the line showed promising. Data received from Pusa, Maruteru, Masodha, Titabar and Sabour with LSI range of 1.27 to 7.62. The data of Sabour was not considered as it was having very less LSI (1.27). Considering the data from rest of the centres lines namely 33123, 33129, 33145, 33147, 33149, 33153, 33154, 33155, 33156, 33159, 33164, 33167, 33170, 33171, 33180, 33181, 33183, 33196, 33198, 33202, 33204, 33208, 32223, 33253, 33254, 33257 showed 5 or less than 5 SI. Data of sheath blight screening were received from Maruteru, Masodha and Titabar with LSI of 5.36 to 6.99. Lines namely 33093, 33099, 33123, 33137, 33150, 33160, 33164, 33172, 33174, 33179, 33182, 33183, 33196, 33198, 33201, 33211, 33237, 33251, 33253, 33254, 33255 showed 5 or less SI. For sheath rot data were received only from to centres namely Pusa and Titabar. Data from Pusa was not considered as it is having low LSI (2.98). Only Titabar data was considerable with LSI of 3.75.

VI. AICRPR Basmati programme: Host Plant Resistance trials - *Kharif* 2024

The All India Coordinated Rice Pathology Program on Basmati rice initiated with more focused programme on Basmati cultivars. During the year 2024, a total of 50 entries excluding local check were evaluated for host plant resistance in 2 trials i. e. IVT-BT and AVT-BT at 4 locations. For sheath blight and bakanae all the trials were conducted under artificial inoculation conditions. The details on different disease screening nurseries are given in Table 1 and Table 2. For blast, bacterial blight and sheath blight standard evaluation scale as mentioned for all the non-basmati trials were followed. Bakanae was evaluated using 0-9 scale (Fiyaz et al., 2015) where, 0 = highly resistant (HR), 1 = Resistant (R), 3 = moderately resistant (MR), 5 = moderately susceptible (MS), 7 = susceptible (S), and 9 = highly susceptible (HS) was used.

Table 1. Table: Diseases evaluation on IVT-BT trials

S.No.	Code	Blast		Bacterial blight					Bakanae		Sheath blight		
		IARI	KUL	PNT	IARI	PAU			IARI	PAU	IARI	PAU	PNT
						VII	950	902					
1	IVT-BT-1801	7	9	9	5	5-7	7	5	5	7	9	9	5
2	IVT-BT-1802	3	7	7	3	3	5	7	5	7	9	9	7
3	IVT-BT-1803	5	9	9	5	7	7	7	5	3	9	7	7
4	IVT-BT-1804	5	7	9	5	7	7	7	5	5	9	7	9
5	IVT-BT-1805	5	7	9	7	9	7	7	7	5	9	9	7
6	IVT-BT-1806	3	9	9	1	3	3	7	7	3	9	9	5
7	IVT-BT-1807	3	9	9	3	7	7	7	7	5	7	5	5
8	IVT-BT-1808	3	7	9	5	7	7	7	9	5	9	5	7
9	IVT-BT-1809	5	7	9	7	7	7	7	5	7	7	7	7
10	IVT-BT-1810	3	7	9	5	7	7	7	9	5	7	7	7
11	IVT-BT-1811	3	9	9	7	7	7	7	1	5	9	7	7
12	IVT-BT-1812	5	9	9	7	7	7	7	1	5	9	7	7
13	IVT-BT-1813	5	9	9	9	9	7	9	5	5	9	7	7
14	IVT-BT-1814	5	7	9	5	9	7	7	9	5	9	7	9
15	IVT-BT-1815	7	9	7	7	7	7	7	5	5	9	7	7
16	IVT-BT-1816	7	9	9	5	7	7	7	7	5	9	7	7
17	IVT-BT-1817	7	7	9	5	7	7	7	9	3	9	9	7
18	IVT-BT-1818	5	7	9	7	7	7	7	5	5	9	9	7
19	IVT-BT-1819	3	9	9	7	7	7	7	9	5	7	5	7
20	IVT-BT-1820	3	9	9	5	7	7	7	7	5	9	7	7
21	IVT-BT-1821	3	7	9	3	7	7	7	5	5	7	5	7
22	IVT-BT-1822	5	9	9	7	7	7	7	7	5	7	7	7
23	IVT-BT-1823	5	9	9	5	9	7	7	5	3	9	9	5
24	Pusa Basmati 1 (Local Check)	7	9 (CSR 30)		9	7	7	7	9				

Table 2. Table: Disease's evaluation in AVT-BT trials

S.NO.	Code	Blast		Bacterial blight					Bakanae		Sheath blight		
		IARI	KUL	PNT	IARI	PAU			IARI	PAU	IARI	PAU	PNT
						VII	950	902					
1	AVT-BT-1901	5	9	9	5	7	9	7	9	7	7	7	7
2	AVT-BT-1902	1	9	5	3	3	3	5	7	7	9	7	7
3	AVT-BT-1903	3	9	9	5	7	7	7	7	5	9	7	7
4	AVT-BT-1904	5	9	9	7	7	7	7	7	3	9	7	9
5	AVT-BT-1905	5	7	9	7	7	7	7	7	3	9	7	7
6	AVT-BT-1906	7	9	9	5	7	7	7	7	5	7	7	9
7	AVT-BT-1907	1	9	9	3	5	7	3-5	7	5	7	7	7
8	AVT-BT-1908	5	9	9	5	7	7	7	7	5	7	7	7
9	AVT-BT-1909	5	9	9	5	7	7	7	7	5	9	7	7
10	AVT-BT-1910	3	7	9	5	7	7	7	5	5	9	7	7
11	AVT-BT-1911	3	7	9	7	7	7	7	7	5	7	7	7
12	AVT-BT-1912	3	9	9	7	7	7	7	7	5	9	7	7
13	AVT-BT-1913	5	9	7	5	7	7	5-7	9	5	9	7	5
14	AVT-BT-1914	5	9	9	5	7	7	7	9	5	9	7	7
15	AVT-BT-1915	3	9	9	3	3	3	7	9	5	9	9	7
16	AVT-BT-1916	7	9	9	7	7	7	7	7	5	9	9	7
17	AVT-BT-1917	5	9	9	7	7	7	7	9	5	7	7	7
18	AVT-BT-1918	5	5	9	5	7	7	7	9	5	7	7	9
19	AVT-BT-1919	5	9	7	5	7	7	5-7	5	5	7	7	7
20	AVT-BT-1920	3	9	9	1	3	3	5	9	5	7	7	7
21	AVT-BT-1921	3	9	9	1	1	3	5	9	7	9	7	7
22	AVT-BT-1922	3	9	9	5	7	7	7	7	5	9	7	7
23	AVT-BT-1923	3	9	9	5	7	7	7	9	7	9	7	7
24	AVT-BT-1924	5	9	9	5	7	7	7	7	5	9	7	9
25	AVT-BT-1925	5	7	9	7	7	7	7	7	5	9	7	7
26	AVT-BT-1926	5	9	9	5	7	3	7	9	7	9	7	7
27	AVT-BT-1927	5	9	9	5	7	7	7	7	7	9	7	7
28	Local Check	7	9	9	9	7	7	7	9	7	9	7	9

Annexure I

Weather conditions at test locations where Plant Pathology Coordinated Trials were conducted, *Kharif*-2024

S. No	Location/ Details		Weather data from May-2024 to January-2025								
1	**Aduthurai**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		4	4	1	5	0	9	14	8	2
	Rainfall (mm)		96.6	40.5	12.2	50.8	0.0	251.4	249.5	350.8	57.2
	Temp. (ºC)	Maximum	35.8	35.0	35.4	35.2	36.1	33.4	30.1	29.4	29.9
		Minimum	26.2	24.9	25.6	25.0	27.5	24.4	22.8	21.8	22.0
	RH (%)	Morning	87.7	84.4	78.4	86.0	78.4	90.2	93.4	92.0	92.3
		Evening	67.4	62.0	53.9	58.0	50.9	68.2	70.7	74.5	71.3
2	**Almora**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		4	7	17	14	9	1	0	-	-
	Rainfall (mm)		29.5	25	382.5	148	173.5	2	0	-	-
	Temp. (ºC)	Maximum	33.25	35.2	30	27.8	30.6	30.4	26.1	-	-
		Minimum	14.96	17.86	20.5	19.5	18	11.7	4	-	-
	RH (%)	Morning	79.27	74.73	91.6	91.7	92.4	91.6	96.7	-	-
		Evening	37.72	43.4	72	72.2	73.5	52.1	50.4	-	-
3	**Arundhutinagar**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Weather data not available										
4	**Bankura**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		5	1	9	7	7	5	-	-	-
	Rainfall (mm)		13.32	10.4	19.62	28.77	27.18	22.58	-	-	-
	Temp. (ºC)	Maximum	36.22	37.5	33.27	34.45	32.22	32.41	-	-	-
		Minimum	21.51	25.9	25.82	25.41	24.22	25.33	-	-	-
	RH (%)		70.51	72.23	81.3	78.06	78.22	79.86	-	-	-
5	**Chatha**		May	June	July	August	Sep	Oct	Nov	Dec	Jan
	Rainy days (No.)		2	3	12	12	6	1	0	1	-
	Rainfall (mm)		8.2	45	459.6	412.2	261.4	22.4	0	31.6	-
	Temp. (ºC)	Maximum	39	40.6	35.6	33.4	34.4	32.7	27.3	21.2	-
		Minimum	20.6	24.6	26.2	25.7	24.3	18.1	11.5	4.3	-
	RH (%)	Morning	62	61	85	89	88	90	92	93	-
		Evening	28	40	64	71	62	55	52	45	-
6	**Chinsurah**		May	June	July	August	Sep	Oct	Nov	Dec	Jan
	Rainy days (No.)		-	9	26	25	20	14	1	4	-
	Rainfall (mm)		-	45.4	185.3	465.8	349.4	243.8	1.5	13.7	-

S. No	Location/ Details		Weather data from May-2024 to January-2025								
	Temp. (ºC)	Maximum	-	36.5	34.4	32.4	33.6	32	29.2	25.7	-
		Minimum	-	28.1	27.1	26.5	26.5	25	20.7	12.2	-
7	**Chiplima**		May	June	July	August	Sep	Oct	Nov	Dec	Jan
	Rainy days (No.)		-	9	13	19	10	1	0	0	-
	Rainfall (mm)		-	168.4	225.6	468.6	115	15.2	3	1.4	-
	Temp. (ºC)	Maximum	-	37.4	30.3	31.1	32.6	32.9	30.1	28.2	-
		Minimum	-	25.7	25.2	25.3	18.8	23.5	16.4	14.9	-
	RH (%)	Morning	-	81.6	92.7	93.5	90.5	90.7	92.2	89.9	-
		Evening	-	61.3	89.3	84.6	80.8	71.3	55.9	58.9	-
8	**Coimbatore**		May	June	July	August	Sep	Oct	Nov	Dec	Jan
	Rainy days (No.)		9	2	8	3	1	14	5	5	-
	Rainfall (mm)		175.8	27	89.3	31.8	11.2	369.4	43.4	39.1	-
	Temp. (ºC)	Maximum	34.4	32.1	30.6	31.8	32.9	30.8	29.8	29.8	-
		Minimum	24.6	24.3	23.6	23.9	23.7	22.7	22	21	-
	RH (%)	Morning	84	82	84	87	85	92	91	92	-
		Evening	54	60	63	57	55	68	60.3	60	-
9	**Cuttack**		May	June	July	August	Sep	Oct	Nov	Dec	Jan
	Rainy days (No.)		-	7	21	13	17	7	-	-	-
	Rainfall (mm)		-	215	269.1	276.9	277	84	-	-	-
	Temp. (ºC)	Maximum	-	36.6	31.7	31.95	31.3	32.57	-	-	-
		Minimum	-	26.94	27.15	26.76	26.59	25.68	-	-	-
	RH (%)	Morning	-	90.4	94.16	93.51	92.6	92.35	-	-	-
		Evening	-	58.9	78.16	73.9	72	66.41	-	-	-
10	**Faizabad (Masodha)**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	3	11	10	12	0	0	-	-
	Rainfall (mm)		-	96	189.4	283.2	252.6	0	0	-	-
	Temp. (ºC)	Maximum	-	40	34.1	32.5	32.4	32.6	27.8	-	-
		Minimum	-	26.7	26.6	25.1	24.7	21.4	13.1	-	-
	RH (%)	Morning	-	77.1	92.2	92.5	89.2	86	84.6	-	-
		Evening	-	41.4	65.4	64.4	64.9	59.5	47.8	-	-
11	**Gangavathi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		2	7	3	10	4	8	3	1	-
	Rainfall (mm)		25	202	34	242.2	55.5	125.5	14.5	6	-
	Temp. (ºC)	Maximum	41.11	35.1	31.51	28.85	31.15	30.98	29.92	29.97	-
		Minimum	26.37	25.47	24.76	24.09	23.63	23.45	18.96	20.63	-

S. No	Location/ Details		Weather data from May-2024 to January-2025								
	RH (%)	Morning	69.44	79.33	77.13	81.97	78.83	92.77	87.47	91	-
		Evening	41	58.04	67.26	71.32	68.21	76.52	61.83	58.94	-
12	**Ghaghraghat**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Weather data not available										
13	**Gudalur**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		10	14	21	13	18	10	3	8	-
	Rainfall (mm)		174	371	438	257	508	142	56	66	-
	Temp. (ºC)	Maximum	26.1	23.2	21.9	22.6	25.7	25.7	25.6	23.8	-
		Minimum	19.6	16.8	17	16.9	16.5	16.5	15.1	14.5	-
	RH (%)	Morning	92.7	96.7	98.7	98.5	95.3	93.6	91.2	88.3	-
		Evening	75.1	88	93.6	91.7	90.6	86.4	75.2	68	-
14	**Hazaribag**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		06	10	22	27	17	08	0	2	0
	Rainfall (mm)		84.8	88 .0	190 .4	584.9	297.6	50.8	0.0	5.4	0 .0
	Temp. (ºC)	Maximum	36.2	37.7	30.8	29.7	30.0	29.5	26.4	23.5	22.8
		Minimum	20.0	22.0	20.8	19.5	19.4	17.1	8.4	6.8	7.6
	RH (%)	Morning	60.9	64.7	86	88	85.5	83.6	82.8	81.4	82
		Evening	45.4	46	77.4	81.3	78.4	65.5	46.1	44.2	39.8
15	**IIRR, Hyderabad**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	7	13	10	12	5	0	2	-
	Rainfall (mm)		-	60.2	143	209.5	390.6	40.6	0	13	-
	Temp. (ºC)	Maximum	-	34.5	23.3	23.3	22.4	21.9	17.1	16.9	-
		Minimum	-	24.4	30	31.1	29.8	31.6	30.2	28.6	-
	RH (%)	Morning	-	84.8	87.5	86.9	88.9	88.4	80.7	86.3	-
		Evening	-	53.7	67.6	66.8	68.3	57.1	43	50.8	-
16	**Imphal**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		15	16	26	23	16	16	7	0	-
	Rainfall (mm)		354.7	121.8	412.9	288.9	180.4	134.1	51.9	0	-
	Temp. (ºC)	Maximum	29.2	30	29.8	29.3	30.5	27.9	26.2	23.5	-
		Minimum	19.8	23	23.1	22.6	22.3	19.7	14	9.2	-
	RH (%)	Morning	93.5	94.4	94.9	90.7	92	95.1	94.8	92.5	-
		Evening	64.5	70	72.3	73	70.1	68.9	56.5	51.6	-
17	**Jagdalpur**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		9	10	20	16	15	5	0	5	-
	Rainfall (mm)		117.2	273.6	434.1	331.7	284.1	32.2	0.2	50.6	-
	Temp. (ºC)	Maximum	35.6	33.6	28.4	29.9	30.5	32	29.7	28.3	-
		Minimum	22.5	23.1	22.4	22.2	22.4	21	13.9	15	-
	RH (%)	Morning	80.4	84.7	92	92.1	91.9	90.2	89.8	89.6	-
		Evening	46	60.7	80.3	74	74.5	57.7	42	49.2	-
18	**Jagtial**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Weather data not available										
19	**Karaikal**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**

S. No	Location/ Details		Weather data from May-2024 to January-2025								
	Rainy days (No.)		4	5	2	11	3	7	18	8	2
	Rainfall (mm)		111.4	36.9	20.5	188.4	27.4	203.2	794	403.9	86.4
	Temp. (ºC)	Maximum	36.6	37.1	37.7	36.1	38.2	34.5	30.8	31	30.8
		Minimum	27.4	26.6	26.9	25.9	26.7	25.5	24.1	24.1	22.6
	RH (%)	Morning	88	84	80	85	79	90	92	93	90
		Evening	65	57	53	58	49	73	82	79	71
20	**Karjat**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		2	14	30	24	22	12	0	-	-
	Rainfall (mm)		52	507.1	2227.8	995.2	682.5	217.7	0	-	-
	Temp. (ºC)	Maximum	39.3	34.1	29.1	31.3	31.1	33.86	34.83	-	-
		Minimum	25.7	25.7	23.9	25.1	24.4	22.89	18.45	-	-
	RH (%)	Morning	-	-	-	-	-	-	-	-	-
		Evening	-	-	-	-	-	-	-	-	-
21	**Kaul**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		1	2	7	8	7	1	0	4	-
	Rainfall (mm)		2.5	19.1	344.7	173.7	211.4	9.7	0	61.3	-
	Temp. (ºC)	Maximum	40.7	40.9	35.3	33.7	33	33.6	27.6	21	-
		Minimum	23.1	26.5	27.2	26.2	24.5	19.3	12.8	7.5	-
	RH (%)	Morning	66	90	91	94	95	94	94	90	-
		Evening	30	59	72	79	76	48	48	54	-
22	**Khudwani**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		5	9	3	14	3	2	2	4	-
	Rainfall (mm)		32.2	33.8	11.2	159.2	7.5	4	7	79	-
	Temp. (ºC)	Maximum	26.9	28.5	32.8	28.9	29.4	26.6	17.35	8.31	-
		Minimum	9	11.8	16.9	16.6	12.2	5.8	-0.4	-4.7	-
	RH (%)	Morning	78.35	76.6	72.03	82.58	84.36	88.03	89.76	91.61	-
		Evening	47.54	52.53	46.77	62.96	58.2	48.96	70.23	76.12	-
23	**Lonavala**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		2	24	30	31	25	10	0	0	0
	Rainfall (mm)		26.4	597.1	2933.4	1639.2	784.2	178.4	0	0	0
	Temp. (ºC)	Maximum	36.3	34.3	29.7	30.3	29.9	30.4	30	30.5	30.3
		Minimum	17.3	17.7	16.9	18.6	19.6	16.7	14.4	10.6	13.4
	RH (%)	Morning	86.7	87.3	84.6	82.9	89	89	81.7	75.7	74
		Evening	56.6	59	50.9	46.1	58.1	55.7	50.1	54.5	73
24	**Ludhiana**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	5	13	9	9	1	-	-	-
	Rainfall (mm)		0	48.6	137.2	239.9	98.4	0.4	-	-	-
	Temp. (ºC)	Maximum	40.2	40.2	35.3	33.4	33.3	33.3	-	-	-
		Minimum	24.4	27.7	28.3	26.9	25.7	20	-	-	-
	RH (%)	Morning	46	57	77	84	87	86	-	-	-
		Evening	21	31	61	67	65	40	-	-	-
25	**Malan**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**

S. No	Location/ Details		Weather data from May-2024 to January-2025								
	Rainy days (No.)		3	6	17	15	13	Nil	Nil	-	-
	Rainfall (mm)		27.3	121.5	888.7	683.8	223	Nil	Nil	-	-
	Temp. (ºC)	Maximum	32.8	35.8	30.4	25.0	26.1	26.8	24.0	-	-
		Minimum	18.6	18.3	16.8	16.7	16.8	14.5	14.0	-	-
	RH (%)	Morning	85.9	85.5	84.6	83.6	83.8	77.0	75.0	-	-
		Evening	81.8	80.8	80.6	79.8	79.7	72.8	71.0	-	-
26	**Mandya**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		10	6	9	7	4	8	4	3	-
	Rainfall (mm)		230.2	140.6	75.2	62	101	116	37	59	-
	Temp. (ºC)	Maximum	34.4	30.1	27.9	29.5	30.6	29.6	29	28.6	-
		Minimum	22.6	21.5	19.8	19.4	20.3	20.6	18.9	18.5	-
	RH (%)	Morning	81.9	84.3	88.3	83.2	84.1	83.8	83.7	83	-
		Evening	57.9	57	63.3	58.3	59	59	55	57.6	-
27	**Maruteru**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		8	10	19	12	10	13	2	1	-
	Rainfall (mm)		89.6	129	328.4	215.2	240.6	197.4	11	17.4	-
	Temp. (ºC)	Maximum	36.71	34.77	30.1	31.42	31.2	30.89	30.8	28.58	-
		Minimum	26.1	25.4	26	26.55	26.32	25.05	22.97	22.35	-
	RH (%)	Morning	87.97	86.13	87.33	87.94	88.1	85.39	88.87	87.58	-
		Evening	62.13	63.1	68.13	77.45	75.3	74.58	77.43	77.19	-
28	**Moncompu**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		15	20	23	11	15	10	8	4	-
	Rainfall (mm)		818	410.5	477.6	327.5	158.1	314.4	262.5	94.8	-
	Temp. (ºC)	Maximum	32.8	31.3	30.2	31.1	31.9	31.8	32.2	32.8	-
		Minimum	25.8	25.5	24.1	25	25.1	24.8	24.8	24.6	-
	RH (%)	Morning	85.4	89.2	88.1	84.7	83.4	82.45	83.1	84.9	-
		Evening	71.3	77.5	76.3	66.6	64.3	75.15	69	79.8	-
29	**Mugad**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		6	15	31	12	2	10	1	2	-
	Rainfall (mm)		80.4	273.2	527.2	133.2	38.1	257.6	7	22.9	-
30	**Navsari**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	10	21	21	13	6	0	0	-
	Rainfall (mm)		0	238	1281	387	368	120	0	0	-
	Temp. (ºC)	Maximum	36.4	34.2	30.5	30	31.2	34.4	33.7	29.7	-
		Minimum	25.6	26	25.1	24.8	24.1	23.2	17.8	14.7	-
	RH (%)	Morning	83.8	88.8	91.8	94.1	97.2	95.7	81.8	77.8	-
		Evening	52.2	69.2	87.8	86.8	80.1	61.4	37.6	39.8	-
31	**Nawagam**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		1	6	14	15	11	2	0	0	-
	Rainfall (mm)		1.00	113.60	199.00	538.80	276.20	5.60	0.00	0.00	-
	Temp. (ºC)	Maximum	42.70	39.10	33.20	31.00	31.60	34.80	33.00	28.80	-
		Minimum	26.90	27.30	26.00	25.80	25.10	23.50	16.70	12.90	-

S. No	Location/ Details		Weather data from May-2024 to January-2025								
	RH (%)	Morning	65	72	85	89	88	84	69	76	-
		Evening	32	48	77	80	77	56	36	42	-
32	**Nellore**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		1	2	8	6	2	9	12	7	0
	Rainfall (mm)		20.1	24.6	193.8	32.2	58.8	347.2	290.2	161.4	0
	Temp. (ºC)	Maximum	36.07	34.78	32.32	34.85	34.7	32.8	29.6	27.58	29.77
		Minimum	24.96	23.82	24.32	24.74	24.3	23.5	21.8	20.98	19.46
	RH (%)	Morning	62.45	67.13	74.7	68.96	70.3	80.6	90.1	89.16	83.48
		Evening	54.38	49.26	57.48	65.48	54.1	66.9	78.5	76.9	70.22
33	**New Delhi (IARI)**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Weather data not available										
34	**Pantnagar**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	3	17	15	8	0	0	1	-
	Rainfall (mm)		0.80	20.60	623.60	433.00	323.20	0.00	0.00	6.00	-
	Temp. (ºC)	Maximum	38.50	39.20	33.00	31.90	32.10	32.10	27.80	23.20	-
		Minimum	23.80	26.50	26.20	25.80	25.00	20.20	13.40	7.20	-
	RH (%)	Morning	55.00	62.70	87.90	89.10	90.00	86.40	91.40	91.70	-
		Evening	30.00	39.30	74.00	75.30	72.00	54.40	50.10	44.60	-
35	**Patna**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		5	18	22	14	15	11	16	5	-
	Rainfall (mm)		94.4	108.8	104	333.2	184.2	98.8	70	20.4	-
	Temp. (ºC)	Maximum	42.11	43.3	35.54	32.28	32.16	30.85	29.57	24.26	-
		Minimum	29.09	31.43	28.85	26.33	25.83	23.32	18.31	12.8	-
	RH (%)	Morning	87.67	89.27	89.67	94.93	94.67	94.43	92.27	91.86	-
		Evening	60.32	66.47	71.81	79.35	76.27	72.77	63.2	61.37	-
36	**Pattambi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		16	25	29	15	13	13	3	5	-
	Rainfall (mm)		543.2	483.8	787.7	253.2	260	194	44.1	34	-
	Temp. (ºC)	Maximum	33.7	31.1	29.6	30.7	31.6	31.9	32.7	32.4	-
		Minimum	22.9	22	21.1	21.8	21.2	21.5	20.8	19.5	-
	RH (%)	Morning	92	93	95	94.2	93	92	87	91	-
		Evening	68	78	82	79	71	75	67	65	-
37	**Ponnampet**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		13	19	30	18	8	11	4	2	0
	Rainfall (mm)		339.8	593.5	1300.3	454.8	129.8	137.2	93.7	49.3	0
	Temp. (ºC)	Maximum	33.5	32.1	28.2	33.8	33.2	35.3	33.4	33.1	32.8
		Minimum	20.4	19.3	17.6	19.4	16	19	15.8	11.8	11.4
38	**Pusa**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	3	17	15	8	0	0	1	-
	Rainfall (mm)		0.80	20.60	623.60	433.00	323.20	0.00	0.00	6.00	-
	Temp. (ºC)	Maximum	38.50	39.20	33.00	31.90	32.10	32.10	27.80	23.20	-
		Minimum	23.80	26.50	26.20	25.80	25.00	20.20	13.40	7.20	-

S. No	Location/ Details		Weather data from May-2024 to January-2025								
	RH (%)	Morning	55.00	62.70	87.90	89.10	90.00	86.40	91.40	91.70	-
		Evening	30.00	39.30	74.00	75.30	72.00	54.40	50.10	44.60	-
39	**Raipur**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	7	18	16	8	2	0	-	-
	Rainfall (mm)		-	131	342.5	356.8	248.4	12.1	0	-	-
	Temp. (ºC)	Maximum	-	39	31.2	30.5	31.9	33	30.3	-	-
		Minimum	-	27.7	25.8	25.4	25.4	24.5	16	-	-
	RH (%)	Morning	-	71	88	87	88	87	86	-	-
		Evening	-	47	75	76	70	55	35	-	-
40	**Rajendranagar**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	7	13	10	12	5	0	2	-
	Rainfall (mm)		-	60.2	143	209.5	390.6	40.6	0	13	-
	Temp. (ºC)	Maximum	-	34.5	23.3	23.3	22.4	21.9	17.1	16.9	-
		Minimum	-	24.4	30	31.1	29.8	31.6	30.2	28.6	-
	RH (%)	Morning	-	84.8	87.5	86.9	88.9	88.4	80.7	86.3	-
		Evening	-	53.7	67.6	66.8	68.3	57.1	43	50.8	-
41	**Ranchi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		2	6	18	21	13	4	0	0	-
	Rainfall (mm)		32.2	81.2	473	657	407	63	0	2	-
	Temp. (ºC)	Maximum	36.6	36.8	33.4	32.6	31.9	30.8	27	24.7	-
		Minimum	25.1	25.8	23.9	23.8	22.3	19.7	13.2	8.4	-
	RH (%)	Morning	86	86	86	87	87	87	86	86	-
		Evening	70	69	69	70	70	70	70	70	-
42	**Rewa**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	-	12	20	13	1	-	-	-
	Rainfall (mm)		-	24.6	195.4	458	238.7	5.6	-	-	-
	Temp. (ºC)	Maximum	-	40.8	35.5	24.5	25.5	33.36129	-	-	-
		Minimum	-	28.4	26.5	30.2	31.5	20.9	-	-	-
	RH (%)	Morning	-	58.27	75.71	82.55	83.63	84.06	-	-	-
		Evening	-	35.13	55.81	66.94	71.3	57.58	-	-	-
43	**Sabour**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		4	1	10	10	13	5	0	0	-
	Rainfall (mm)		81.9	4.1	230.0	241.4	242.0	47.1	0.0	0.0	-
	Temp. (ºC)	Maximum	35.6	37.1	33.7	33.1	32.7	30.5	28.9	24.4	-
		Minimum	24.6	27.3	27.2	26.4	26.1	23.6	16.9	9.6	-
	RH (%)	Morning	68.0	75.2	83.9	83.9	84.7	85.5	86.6	87.3	-
		Evening	57.7	68.1	77.4	77.9	77.6	78.7	80.2	80.9	-
44	**Titabar**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		9	11	16	12	9	8	0	0	-
	Rainfall (mm)		4.2	8.2	12.4	6.4	2.6	2.7	0	0	-
	Temp. (ºC)	Maximum	32.5	32.8	34	34	34.8	30	29.2	26	-
		Minimum	20.6	22.4	22.7	21.6	20.9	17.8	13.6	9.6	-

S. No	Location/ Details		Weather data from May-2024 to January-2025								
	RH (%)	Morning	90.6	92.5	91.1	93.5	92.8	95.3	93.7	68.5	-
		Evening	71	73.4	71.8	73.7	65.1	76.6	62.5	66.5	-
45	**Umiam (Barapani)**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	-	16	18	12	-	-	-	-
	Rainfall (mm)		-	-	255.2	335.2	133.6	-	-	-	-
	Temp. (ºC)	Maximum	-	-	28.7	28.1	29.3	-	-	-	-
		Minimum	-	-	21.6	20.8	20.4	-	-	-	-
	RH (%)	Morning	-	-	91.7	92.7	89.6	-	-	-	-
		Evening	-	-	83.2	85.4	84.4	-	-	-	-
46	**Upper Shillong**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		25	26	21	27	15	-	-	-	-
	Rainfall (mm)		547.6	563	309	396.6	89.2	-	-	-	-
	Temp. (ºC)	Maximum	26.17	26.38	27.01	26.48	28.5	-	-	-	-
		Minimum	11.49	7.24	16.98	16.14	16.08	-	-	-	-
	RH (%)	Morning	97.67	97.65	97.85	97.9	97.9	-	-	-	-
		Evening	26.06	56.59	68.35	62.67	49.97	-	-	-	-
47	**Varanasi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	-	-	-	-	-	-	-	-
	Rainfall (mm)		0	29.5	105	208.3	120.8	3.6	0	-	-
	Temp. (ºC)	Maximum	43.5	44.8	36.4	35.8	34.9	34.4	30.7	-	-
		Minimum	20.3	25.3	26.5	25.8	24.1	22.1	12.4	-	-
	RH (%)	Morning	72	86	91	93	91	90	94	-	-
		Evening	49	72	77	83	81	65	55	-	-
48	**Wangbal**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Weather data not available										

Annexure - II

Details on the locations where Coordinated Pathology Screening trials were conducted during, *Kharif* 2024-2025

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2024)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
1	**Aduthurai**	11º N	79º E	19.5 m	Irrigated	13-09-2024	37.5:50:25	112.5:0:25 (NPK)
2	**Almora**	29º36'N	79º40'E	1250 m	Upland	15-07-2024 LB	60:60:40	20 + 20 N (30 DAT & 60 DAT)
3	**Arundhutinagar**	-	-	-	-	08-08-2024	100:80:80	-
4	**Bankura**	23º24' N	87º05'E	84 m	Upland (Rainfed) Rainfed Shallow lowland Upland (Irrigated – Boro only)	19-06-2024	60:30:30	30.00.00
5	**Chatha**	32º40'N	74º18'E	293 m	Irrigated	05-07-2024	120:60:30	40+40 N (1st and 2nd top dressing)
6	**Chinsurah**	22º52'N	88º24'E	8.62 m	Irrigated	12-07-2024	60:50:30	60
7	**Chiplima**	20º21'N	80º55'E	178.8 m	Irrigated	16-07-2024	100:40:40 50:40:20	25:0:20 NPK (tillering stage) 25:0:0 NPK (PI stage)
8	**Coimbatore**	11º N	77ºE	409 m	Irrigated and Potted plants	For leaf blast: 14.11.2024; For brown spot: 28.07.2024 and 29.07.2024 For RTD: 11.06.2024, 15.06.2024, 25.06.2024, 08.07.2024, 18.07.2024, 05.08. 2024 and 13.08.2024		Urea 25 kg for entire uniform blast nursery bed; 10g/pot (RTD)
9	**Cuttack**	20º23'N	85º 17'E	36 m	Irrigated Shallow lowland	23-09-2024(BL, BLB) 31-5-2024(SHR)	FOR SHR: 100:40:40 50KG FOR BL & BLB:120Kg	SHR: Twice @25 Kg Nitrogen 20N
10	**Gangavathi**	15º43'N	76º53'E	1332 ft	Irrigated	15-10-2024 (For Leaf Blast), 23-10-2024 (For Brown Spot), 31-07-2024 (For BLB & Sheath blight)		-
11	**Ghaghraghat**	27°50'N	81°20'E	112m	Irrigated	-	-	-
12	**Gudalur**	11°30'N	76°30'E	950 m	Irrigated	Blast :08.08.2024; Brown spot : 16.10.2024; False smut: 12.09.2024	100:50:50 kg/ha	Urea 15 kg for entire uniform blast nursery bed; for false smut 50 kg N/ha
13	**Hazaribag**	23° 95'91'' N	85° 37'20'' E	614 m	Upland	16.08.2024	75:60:30 (NPK)/ha for Leaf Blast and 50:60:30 (NPK)/ha for brown leaf spot	75:0:0 (NPK)/ha for leaf blast
14	**IIRR**	17°19'N	78°23'E	542m	Irrigated	15-06-2024	45:60:40	135N

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2024)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
15	**Imphal**	24°45' N	93°54' E	774 m	Rainfed lowland	25-06-2024 (direct sowing)	80:60:40	40N
16	**Jagdalpur**	19°05' N	81°57'E	556 m	Upland / Rainfed	12.08.2024	60:60:60	30:30 (N: N)
17	**Jagtial**	18°831’N	78°96’E	264m	Irrigated	-	120 Nitrogen 40	40+40
18	**Karaikal**	10°55’ N	79°52’E	4	Irrigated	05.09.24	75:50:50:25	75N
19	**Karjat**	18°55’ N	73°15’E	51.7 m	Rainfed lowland	05-08-2024	50%-	50%
20	**Kaul**	29°51’N	76^{0}39’E	230.7 m	Irrigated	01-07-2024	50:0:60	100 N
21	**Khudwani**	33.73°N	75.15°E	1601 m	Irrigated	11-07-2024	60:60:30	60 N
22	**Lonavala**	18.9°N	73.5°E	622m	Rainfed lowland	Sowing in UBN - 16-17 August 2024, and Field Sowing -8-10 July 2024	60:50:50	60 N
23	**Ludhiana**	30°90’N	75° 85’E	262 m	Irrigated	05-07-2024	Urea 37kg / Acre	Urea 74kg / Acre
24	**Malan**	32°1’N	76°2’E	950 m	Upland	20.7.2024 (for leaf blast screening under UBN)	120:40:40 60:40:40	60 N
25	**Mandya**	12°36’N	76°15’E	694.65 m	Irrigated	Blast :24-10-2024 ; Sheath blight:20-08-2024 ; Neck blast :20-08-2024	200:50:50 100:50:50	50:0:0 (15 DAT) 50:0:0 (30 DAT)
26	**Maruteru**	16°38’N	81°44’E	5m	Irrigated	4.7.2024	150:40:40 50:40:20	50:0:0 (NPK) 50:0:20
27	**Faizabad (Masodha)**	26°47’N	82°12’E	113 m	Irrigated	12.07.2024	SHB- 60:60:60 BLB-75:60:60	ShB-60, BLB-75 N & 25 ZnSo$_4$
28	**Moncompu**	9^{0}51’N	76 °5’E	Below MSL	Irrigated	24.06.2024	120:45:45 Kg/ha 1/2N,1/3P&K	15DAP-1/4N, 1/3P&K, 40DAP-1/4N, 1/3P&K
29	**Mugad**	50°26’N	74°54’E	697m	Rainfed drill sown lowland	26.06.2024	100:50:50 33:50:50	33 kg N/ha at 30 days after sowing and 33 kg N/ha at 60 days after sowing.
30	**Navsari**	20 °57’N	72°90’E	10 m	Irrigated	16-07-2024	150:50:0 75:50:0	Remaining 75 N given in two splits at 30 days intervals.
31	**Nawagam**	22°48’N	71°38’E	32.4 m	Irrigated	23-07-2024	120:30:0 60 N + 30 P_2O_5.	60 N + 20 $ZnSO_4$
32	**Nellore**	14°27’N	79°59’E	20 m	Upland	04-10-2024	150:60:40 75:60:20 20 kg/acre-Zn	37.5+ 37.5 0 20 (30DAT & 60DAT)
33	**New Delhi (IARI)**	28 ° 08’N	77°12’E	216 m	Irrigated	Bacterial Blight: 08.07.2024; Sheath blight: 13.07.2024; Blast: 03.08.2024	Full dose of P, K and 1/3rd dose of N (i.e @20 kg N per ha)	-N at two splits @ 20 Kg N per ha at early tillering stage (30 DAT) and at panicle initiation (60 DAT)
34	**Pantnagar**	29°N	79^{0}30’E	343.84 m	Irrigated	09.07.2024	60:60:40-25Kg (ZnSO4)	N-60kg, P2O5-0.00kg, K2O-0.00kg, ZnSO4-0.00kg
35	**Patna**	25°13N	84°14E	77m	Irrigated	23-07-2024	120:60:40 NPK kg/ha	-
36	**Pattambi**	10°48’N	76°12’E	25.35 m	Upland Rainfed lowland	Blast -22.7.2024 (NSNI, NSN II),23.7.2024 (NHSN and DSN): BLB and SB	120:30:30 80:30:15	40:0:15

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2024)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
						14.06.2024 (NSN 2, NHSN, DSN), 06.07.2024 (NSN 1)		
37	**Ponnampet**	12º29'N	75º56'E	856 m	Rainfed lowland	29/08/2024 in UBN Pattern Nursery and 09/08/2024 in Field Nursery	75:75:90 37.5:75:45	37.5:0:45
38	**Pusa**	25º98'N	85 º67'E	51.8 m	Irrigated	09.07.2024	N-60kg,P2O5-60kg, K2O-40kg,ZnSO4-25kg	N-60kg,P2O5-0.00kg, K2O-0.00kg,ZnSO4-0.00kg
39	**Raipur**	21º 16'N	81º36'E	681 m	Irrigated	07-08-2024	120 60	60N as a spray in two split doses
40	**Rajendranagar**	17º 19'N	78º23'E	542 m	Irrigated	Leaf Blast: 15.12.2024; Neck Blast: 27.06.2024; Bacterial Leaf Blight: 03.07.2024	180-60 NP (Kg/ha)	125% RDN was applied in 3-4 split doses
41	**Ranchi**	23º 17'N	85º 19'E	625m	Upland	23.07.2024 (Direct sown))	60:30:20 30:30:20	15+15 N
42	**Rewa**	24º30'N	81º15'E	360 m	Upland Irrigated	25/07/24	N40 Kg/Ha	N40 Kg/Ha
43	**Sabour**	25º23'N	87º07'E	37.19 m	Rainfed lowland	09.07.2024	40:40:20	20+20 N
44	**Titabar**	26º60'N	94º20' E	99 m	Irrigated	15.07.2024 to 16.07.2024	60:20:40 30:20:40	15+15 N
45	**Umiam (Barapani)**	25°30' N	91°51' E	1000m	Upland	19-07-2024	60:60	60
46	**Upper Shillong**	25º 54'24" N	91º 83' 96" E	1814 m	Rainfed	16.07.2024	50:40:40 25:40:40	25
47	**Varanasi**	25º20' N	23º03'Eº	75.7 m	Irrigated	16-07-2024	180:60:60 120:60:60	15+15 N
48	**Wangbal**	24º8'N	94'E	781 m	Rainfed lowland	11-07-2024	-	-

Note: (-) data not received

Annexure – III (Abbreviations)

Name of the centre	Code	Details	Code
Aduthurai	ADT	(-)	Data not available
Almora	ALM	A	Artificial Inoculation
Arundhatinagar	ARD	AVTs	Advanced variety trails
Bankura	BAN	BB	Bacterial blight
Chatha	CHT	BS	Brown spot
Chinsurah	CHN	CV	Co-efficient of variation
Chiplima	CHP	DSN	Donor Screening Nursery
Coimbatore	CBT	FS	False Smut
Cuttack (NRRI)	CTK	GD	Glume discoloration
Gangavathi	GNV	IET No.	Initial Evaluation Trail Number
Ghaghraghat	GGT	IVTs	Initial variety trails
Gudalur	GDL	LB	Leaf blast
Hazaribagh	HZB	LSD	Least significant difference
Imphal	IMP	LSI	Location Severity Index
Indian Institute of Rice Research	IIRR	MSL	Mean sea level
Jagadalpur	JDP	N	Natural Infection
Karjat	KJT	NB	Neck blast
Kaul	KUL	NHSN	National Hybrid Screening Nursery
Kudhwani	KHD	NSN-1	National Screening Nursery 1
Lonavala	LNV	NSN -2	National Screening Nursery 2
Ludhiana	LDN	NSN-H	National Screening Nursery- Hills
Malan	MLN	PI	Promising index
Mandya	MND	RTD	Rice Tungro Disease
Maruteru	MTU	RTV	Rice Tungro Virus
Masodha (Faizabad)	MSD	SE	Standard error
Moncompu	MNC	ShB	Sheath blight
Mugad	MGD	ShR	Sheath rot
Navsari	NVS	SI	Susceptibility Index
Nawagam	NWG		
Nellore	NLR		
New Delhi (IARI)	NDL		
Pantnagar	PNT		
Patna	PTN		
Pattambi	PTB		
Ponnampet	PNP		
Pusa	PSA		
Raipur	RPR		
Rajendranagar	RNR		
Ranchi	RCI		
Rewa	REW		
Sabour	SBR		
Titabar	TTB		
Umiam (Barapani)	UMM		
Upper Shillong	USG		
Varanasi	VRN		
Wangbal	WBL		

Progress Report-2024 report was compiled by the following scientists of Department of Plant Pathology, ICAR-IIRR, Hyderabad.

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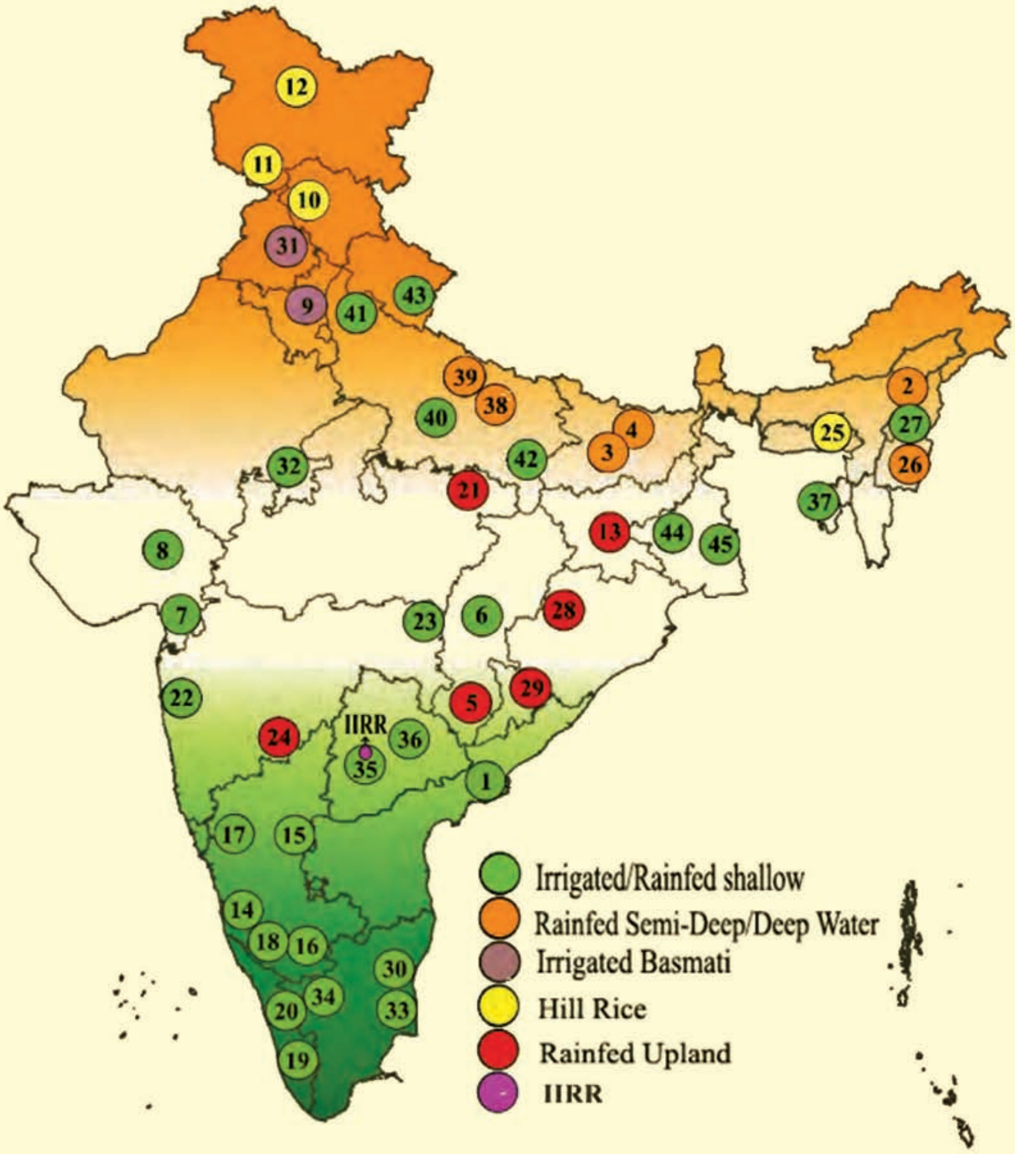

भाकृअनुप-भारतीय चावल अनुसंधान संस्थान

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