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All India Coordinated Research Project on Rice (AICRPR)

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भाकृअनुप-भारतीय चावल अनुसंधान संस्थान
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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 key answer for national food security. Under the All India Coordinated Research Project on Rice (AICRPR), evaluation of varietal improvement, crop production and crop protection technologies across locations has been continuing to contribute towards strategies strengthening rice farmers' efforts towards sustainable rice production. About 400 scientists, belonging to ICAR - Indian Institute of Rice Research, 45 funded and more than hundred voluntary centres 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 2023. The scientists involved in AICRRP system conducted majority of the trials allotted 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 optimizing IPM and IRM components such as host plant resistance, ecological studies, semiochemicals, 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 weather parameters under the umbrella of AICRPR. Regular monitoring of pest occurrence at various locations across nation is undertaken to know changing pest scenario and to have timely management interventions. 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 useful and relevant information related to rice crop protection technologies across diverse ecosystem for increasing and stabilizing rice production in India.

(R. M. Sundaram)

2. ENTOMOLOGY TRIALS
Kharif 2023

Kharif 2023

Summary

All India Coordinated Entomology Programme organized and conducted during *kharif* 2023 with eight major trials encompassing various aspects of rice Entomology were conducted at 39 locations (IIRR, 29 funded & 9 voluntary centres) in 22 states and 2 Union territories. During *kharif* 2023, 326 experiments were conducted (98.2%) out of 332 experiments. 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 1685 entries which included 1420 pre-breeding lines, 97 hybrids, 2 varieties, 2 germplasm accessions and 164 check varieties. These entries were evaluated against 13 insect pests in 218 valid tests (47 greenhouse reactions and 171 field reactions). The results of these reactions identified 102 entries (6.05 % of the tested entries) as promising against various insect pests. Of these promising entries, 42 entries (41.18%) were under retesting. The trial wise summary of the results of the evaluations are given below:

Planthopper screening trial (PHS): Evaluation of 167 entries against the two planthoppers BPH and WBPH in 14 greenhouse and 8 field tests at 16 locations indicated 27 entries (including 17 breeding lines, four BPT 5204 gene pyramided lines, six BPT 5204 mutants) and 3 three checks as promising in 7 to 18 tests. Four breeding lines *viz.*, GP SS RIL-86*, BPT 3194*, BPT 3199*, KNM 14382* and two gene pyramided lines *viz.*, ISM3* and ISMA 13* of improved Samba Mahsuri from IIRR performed better in the second year of retesting.

In **Gall midge Screening Trial (GMS)** 95 entries evaluated in 9 field tests against 9 populations of gall midge helped in identification of 6 entries as most promising with nil damage in 4-5 tests of the 9 valid tests. Of these APKS 82-75, IBTWGL 21, WGL 1790, WGL 1792 were under retesting. RMS (ISM 18), RMS (ISM-B-4) were promising in the first year of testing.

Field evaluation of 25 entries replicated thrice at 18 locations in **Leaf Folder Screening Trial (LFST)** during Kharif 2023 revealed that 23 entries were promising in 4-9 tests out of 15 valid field tests. In the second year of testing, RP5564 PTB 2-4-2-1-1 was found promising in 9 of the 15 valid tests while three entries, *viz.*, RP5564 PTB 1-4-1, RP5564 PTB 2-4-1-5 and RP5564 PTB 1-1-1-2 were promising in 8 out of 15 valid field tests. Six entries were found promising in 7 tests, five entries promising in 6 tests, five entries in 5 tests and three entries in 4 tests out of 15 valid field tests.

Stem borer screening trial (SBST) Evaluation of entries in 20 valid field tests for dead hearts and white ear damage identified 8 entries as promising in 3 to 5 of the 20 tests in terms of low dead heart (≤5% DH) and white ear damage (≤5% WE). They were also promising in 1 to 4 tests of the 6 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. The mean no. of larvae in the stubbles in these entries varied from 0.29-1.10/hill). RP5564 PTB 2-4-2-1-2, RP5564 PTB 1-4-2, RP5564 PTB 1-3, RP5564 PTB 1-4-1-2 and RP5564 PTB 2-4-2-1-1 were promising in second year of testing.

Multiple resistance screening trial (MRST) was constituted with 32 entries which included breeding lines, germplasm accession and check varieties and evaluated at 27 locations against 13 insect pests. Evaluation of 32 entries in 8 greenhouse and 38 field tests against 6 insect pests helped in identification of 6 test entries and 3 checks as promising in 4-8 tests against 2-3 insect pests with a PPR of 3.6-15.9. Of these 5 entries *viz.*, RPBio4918- DB- NPK13, WGL 1062, RP Bio 4918-230, NND6 and RP 6461-248-1 were promising in second year of testing. RPGP-3000-179-3-9-1 was promising in first year of testing in 8 tests against PH and stem borer. The check lines Suraksha, RP 2068-18-3-5 and PTB 33 were promising in 4-8 tests against 3- 4 pests with a PPR of 5.4 -15.9.

National Screening Nurseries (NSN): 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 442 entries at 19 locations in 35 valid tests (7 greenhouse and 28 field tests) against 6 insect pests identified eleven entries *viz.*, IET nos 30841, 30233, 30261, 29726, 29891, 30176, 29690, 30660, 32073, 29935, 32056 as promising in 5- 8 tests of the 35 valid tests against two to four pests. RP2068-18-3-5 and PTB 33 were promising in 5 and 9 tests, respectively

IIRR-NSN2: Evaluation of 653 entries along with 24 checks in 23 valid tests (5 greenhouse and 18 field tests) against 5 insect pests identified, IET nos 31628 and 31724 in 7 tests and IET Nos 31682, 31690 and 31710 in 6 tests as promising, RP2068-18-3-5 was promising in 3 tests and PTB-33 was promising in 4 tests.

IIRR- NSN hills*:* 96 entries were evaluated at 8 locations in 16 valid tests (6 greenhouse and 10 valid field tests) against 7 insect pests. Three test entries *viz.*, 29654, 31393, 31395 along with Vikramarya, Swarnadhan, CO39 & Aganni were promising in 2 tests against 1-3 pests. PTB 33 was promising in 4 tests against planthoppers out of the 16 valid 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.

NRRI-NSN1: Evaluation of 87 entries in NSN-1 in 4 greenhouse and 17 field tests against 7 insect pests in 21 valid tests helped in identification of 3 entries namely IET 31201, IET 29308, IET 31202 as promising in 4 tests against 3 insect pest damages.

NRRI-NSN2: Evaluation of 172 entries in NSN-2 in 4 greenhouse and 9 field tests against 5 insect pests in 13 valid tests helped in identification of 4 entries namely IET nos. 32095, 32114, 32113, 32159 as promising in 2- 3 tests against 2-3 insect pest damages. Resistant checks CR Dhan 317 and CR Dhan 805 were resistant to BPH in the valid tests. Aganni were promising against gall midge.

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

Planthopper Special Screening Trial (PHSS) Among the 17 gene differentials evaluated, two differentials *viz.*, PTB 33 and RP 2068- 18-3-5 were promising in 13 and 10 locations respectively out of 13 locations. Swarnalatha performed better in 9 locations and T12 performed better in 5 locations. Babawee and Pokkali were promising at 4 locations each. ARC 10550 showed low damage at 3 locations. Three gene differentials *viz.*, Rathu Heenati, IR-65482-7-2-216-1-2-B, MUTNS 1 showed promising reaction at 2 locations each. Five gene differentials *viz.*, ASD7, Chinasaba, IR 36, IR 64 and Milyang 63 performed better at one location each. Two gene differentials OM 4498 and IR-71033-121-15 showed susceptible reaction at all test locations.

Under **Gall midge biotype trial (GMBT)** reaction of 20 differentials in five different groups along with TN1 as susceptible check was noted against different biotypes and populations of gall midge at 20 locations. Evaluation of the gene differentials in one greenhouse and 17 valid field tests at 17 locations identified Aganni (*Gm8*), INRC 3021(*Gm8*) as promising in 10 and 9 tests, respectively of the 18 valid tests. INRC17470 was promising in 7 tests. W1263 and Kavya (*Gm1*) and RP5923 (*gm3*) were promising in 7 tests each of the 18 valid tests. The results suggest that donors with *Gm8* and *Gm1* gene confer resistance to gall midge across most the test locations.

In **Planthopper population monitoring trial (PHPM),** the virulence monitoring studies of brown planthopper populations using four gene differentials *viz.*, PTB 33, RP 2068-18-3-5, RP Bio4918-230S and Salkati along with susceptible variety, TN1 conducted at six locations revealed that IIRR brown planthopper population was more virulent than the other BPH populations *viz.*, Ludhiana, Pantnagar and New Delhi in terms of highest nymphal hatching, short incubation and nymphal periods, lowest winged insects. Among the gene differentials, BPH populations were less virulent on PTB 33 in terms of low nymphal hatching, low nymphal survival, prolonged egg period and nymphal duration, more males and more winged insects.

Virulence composition of gall midge populations was monitored in **Gall midge population monitoring trial (GMPM)** at six locations across four southern states in India *viz.*, Jagtial, Gangavathi, Moncompu, Pattambi, Ragolu and Warangal through single female progeny tests. The results suggest that there is variation in the pattern of virulence. Aganni (*Gm8*) holds promise at Jagtial, and Ragolu but low virulence was observed at Warangal. Low virulence against W1263 (*Gm1*) was observed at Pattambi. Akshayadhan (with *Gm4* + *Gm8*) was promising at Jagtial and low virulence was recorded at Warangal. However, a close monitoring of the virulence pattern in endemic areas is important for deployment of effective genes.

Evaluation of granular insecticides for the management of gall midge (EIGM) In this trial, for gall midge, T12 (fipronil 0.3 GR in nursery + chlorantraniliprole 0.4 GR in the main field) was most effective with significantly lower silver shoots (9.1%) with 49.2 % reduction in silver shoots. T13 (fipronil 0.3 GR in nursery+ cartap hydrochloride 4% GR in the main field), T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole granules in main field) and T9 (seed treatment with thiamethoxam + fipronil granules in main field) were comparable to the best treatment). For dead hearts (DH); T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole 0.4 GR in the main field) was the most effective treatment with 77.9% reduction over the untreated control. In case of WE, T13 (fipronil 0.3 GR in nursery+ cartap hydrochloride 4% GR in the main field) (47.7 % reduction over control) was the best treatment followed by T12 (fipronil 0.3 GR+ chlorantraniliprole 0.4 GR in the main field) (47.4% reduction over control).

With respect to yield, T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole granules in main field) was the best treatment with significantly higher yield (4372.5 kg/ha) as compared to remaining treatments with 67.2 % increase over control. T9 (seed treatment with thiamethoxam + fipronil granules in main field) (4205.9 kg/ha) was the second best treatment with 60.8 % increase in yield over control.

Prophylactic management of rice hoppers in southern black streak virus disease affected areas (PMRH) in this trial**,** the two tested modules were effective and resulted in 36 to 49 per cent reduction in planthopper population over the untreated control. At Ludhiana, Module-2 was superior with 49 per cent reduction in the planthopper population. However, during the crop season southern black streak virus disease was not recorded in the experimental locations. Application of insecticides resulted in significant gain in grain yield. At Pantnagar, Module -1 was superior with 18.6 per cent yield increase (5375 Kg/ha) over the untreated control (4533 Kg/ha). At Ludhiana also both the modules showed similar positive effect on grain yield and Module-2 resulted in 15.8 per cent higher grain yield (6790 Kg/ha) over the untreated control (5862 Kg/ha).

Optimum Pest Control Trial (OPCT) was initiated in kharif 2022 to evaluate the performance of the identified multiple pest resistant rice cultures under protected and unprotected conditions against the pest damages in a location. In this trial, 9 resistant cultures along with TN1 were evaluated at 10 locations. Silver shoot damage by gall midge was reported from 5 locations and was significantly lower (1.43-2.71%SS) in W1263 (*Gm1*), CUL M9, Suraksha (*Gm11*), followed by Akshyadhan PYL, as compared to other varieties. These entries were possessing different gall midge resistance genes and can be utilized as donors in the breeding programs for development of gall midge resistant varieties for the endemic locations. Dead heart damage was reported from 9 locations at different dates of observations and it was significantly lower in CUL M9, W1263, and Suraksha (0.9-2.13%DH) followed by CR 3006-8- 2 and RP2068-18-3-5. White ear damage was reported from 8 locations. Cul M9 and Suraksha recorded significantly lower damage followed by W 1263 and KMR3 as compared to other test lines (F val 24.78 P val 0.0000). Leaf folder damage was significant at 6 locations. Among the test entries, damage was significantly low in Cul M9 (0.5%DL) followed by Suraksha (3.56 %DL) and W1263 (4.2%DL). Protected treatments had significantly lower damage (4.11%DL) as compared to unprotected (6.3%DL) treatments. Analysis of grain yield from 8 locations revealed that among the test entries, yields were higher in KMR 3 and RP5587-273-1-B-B-B (4.2-4.3/ha) followed by CR Dhan 317 (F val 4.94, P val 0.0). Cul M9 and Suraksha had lower damage for gall midge, stem borer and leaf folder though the yields are very low.

Influence of crop establishment methods on pest incidence (IEMP), a collaborative trial with Agronomy, was conducted at 12 locations during Kharif 2023. Across the locations, the incidence of dead hearts (12.1%) and white ears (11.4%) caused by stem borer was significantly high in aerobic rice followed by direct seeding and puddled direct seeding. Gall midge (14.1% SS) and leaf folder (14.2% LFDL) incidence was significantly high in semi-dry rice followed by direct seeding. The incidence of thrips was significantly high in puddled direct seeding (11.7% THDL) and was at par with normal transplanting (11.2% THDL). The incidence of caseworm, blue beetle, BPH and WBPH was low in all the establishment methods. Overall, the incidence of insect pests was high in aerobic rice followed by direct seeding and semi-dry rice while the incidence was low in normal transplanting and mechanical transplanting methods of crop establishment.

Cropping system influence on insect pest incidence (CSIP), a collaborative trial with Agronomy was conducted at three locations, Ghaghraghat, Karjat and Titabar during Kharif 2023. Low incidence of stem borer, leaf folder, whorl maggot, and case worm was observed in different main plots of crop establishment methods and sub-plots of straw incorporation techniques at all the locations.

Evaluation of pheromone blends for insect pests of rice (EPBI) trial was conducted at 13 locations during Kharif 2023. The field trial was constituted with normal and slow-release formulations of yellow stem borer and rice leaf folder. The slow-release formulations recorded maximum catches compared to the normal formulations in case of yellow stem borer and leaf folder across locations. The peak mean catches of yellow stem borer were high in slow-release pheromone formulation at Chinsurah (44.2/week) followed by Jagtial (29.6/week). Similarly, rice leaf folder catches were high at Chinsurah (45.8/week) followed by Navsari (26.4/week) compared to normal pheromone formulations.

Evaluation of entomopathogens against sucking pests of rice was conducted in eleven locations to test the effectiveness of entomopathogens *viz.*, *Lecanicillium saksenae, Beauveria bassiana* and *Metarhizium anisopliae*. Treatments with biological control agents generally demonstrated comparable or better results in reducing pest populations while maintaining crop yield compared to the chemical pesticide and the control group. *L. saksenae, B. bassiana*, and *M. anisopliae* treatments exhibited promising efficacy in controlling pests such as ear head bugs and hoppers. Natural enemies (Mirid bugs, Spiders, Coccinellids) were more abundant in plots treated with biological control agents, suggesting a potential ecosystem-friendly approach to pest management. Overall, the data suggests that biological control agents could be viable alternatives or supplements to chemical pesticides for pest management.

Integrated Pest Management special (IPMs) trial was conducted with zone-wise practices at 18 locations during Kharif 2023 and two locations during Rabi 2022-23 in 41 farmers' fields. In Zone I (Hilly areas), dead hearts caused by black beetle was predominant in both IPM (36.4%) and FP plots (20.6%) followed by leaf folder in FP plots (19.4%). Grasshopper damage was significantly high in FP plots (23.5% GHDL) as compared to IPM plots (19.6% GHDL). In Zone II (Northern areas), low incidence of stem borer, leaf folder, BPH, and WBPH was observed. However, leaf folder incidence (24.4% LFDL) was higher in FP plots at Kaul. In Zone III (Eastern areas), low incidence of stem borer, leaf folder and BPH was observed. In Zone IV (North Eastern areas), dead heart damage caused by stem borer was significantly low in IPM plot (5.0% DH) compared to FP plot (15.3% DH).

In Zone V (Central areas), a high incidence of gall midge was observed in FP plot (12.7% SS) compared to IPM plots (1.9% SS) at Jagdalpur. However, the incidence of stem borer, leaf folder, whorl maggot and thrips was low. In Zone VI (Western areas), WBPH incidence was low in IPM plots (14-17/hill) as compared to IPM plots (20-23/hill) at Nawagam. The incidence of stem borer and leaf folder was low in both IPM and FP plots across locations. In Zone VII (Southern areas), stem borer incidence was high in FP plots at Aduthurai (30.0-42.3% DH) compared to IPM plots (12.5-13.3% DH). Similarly, gall midge and leaf folder incidence were high in FP plots and low in IPM plots in all three farmers' fields at Aduthurai. BPH incidence was significantly high in IPM plots as compared to FP plots in all the farmer's fields at Gangavathi and Maruteru.

Weed population and weed dry biomass were significantly low in IPM plots as compared to FP plots across the locations. IPM implemented plots resulted in mean grain yield advantage of 49.1%, 4.4%, 25.5%, 20.7%, 18.8%, 21.0% and 14.5%, respectively in Zone-I, II, III, IV, V, VI and VII over the farmer's practices. In IPM adopted fields, the mean weed population reduction over the Zones ranged from 4.7% in Zone-I (Hills) to 80.5% in Zone-VII (Southern) at Active Tillering stage and from 9.7 % in Zone-III (Eastern) to 69.2% in Zone-VI (Western) at Panicle Initiation stage. The dry weed biomass reported from 10 locations showed that at both Active Tillering and Panicle Initiation stages, it was significantly reduced by 18.2% in Zone III (Eastern) to 80.1% in Zone-VII (Southern); 13.3% in Zone III (Eastern) to 89.7% in Zone-VII (Southern) respectively.

Adoption of IPM practices effectively reduced the disease progression of leaf blast, neck blast, bacterial blight, sheath blight, and brown spot in Zone II (Northern areas), leaf blast, neck blast, bacterial blight and false smut in Zone III (Eastern areas). There was significant reduction in the disease development of leaf blast, neck blast and sheath blight in Zone V (central areas), sheath rot, sheath blight and brown spot in Zone VI (Western areas), bacterial blight, false smut, leaf blast and neck blast in Zone VII (Southern areas) due to the adoption of IPM practices

Grain yields were significantly high in IPM-implemented plots resulting in high gross returns. Overall, BC ratios of IPM plots were superior to that of FP mainly due to better yields, lower input costs, and better returns.

Population dynamics of insect pests and natural enemies in rice ecosystem was carried out at 26 locations across the country to know the population dynamics of insect pests in relation to changes in weather parameters, crop phenology, growing season and cropping systems for designing ecologically sound and economically viable pest management strategies. Yellow stem borer, brown planthopper, leaf folder and gall midge were observed as major pests of rice across the centres during kharif, 2023. Rice hispa and whorl maggot were recorded as minor pests. Pest incidence varied across different zones, with factors like weather parameters and crop phenology exerting significant influence on pest populations. In Zone III and Zone V, gall midge and stem borer incidence displayed a pronounced correlation with maximum and minimum temperatures. Furthermore, the study revealed intriguing patterns in pest damage across various regions. In Zone IV, peak incidence of gall midge occurred 33rd SMW whereas in Zone VII it happened during the 39th SMW. The comprehensive investigation conducted across multiple regions sheds light on the complex interactions between insect pests, natural enemies, and environmental variables within rice ecosystems.

Population dynamics of insect pests through Light trap catches 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 data indicates that the key pests are reaching their peak levels in the months of October and November in the kharif season. Therefore, strategies are to be timed accordingly for the effective management of insect pests in rice.

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, evaluation of performance of breeding lines and also characterization of insect pest populations from various hot spots. 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 1685 entries were evaluated at 39 locations against 13 insect pests and 102 (6.05%) 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 are discussed trial wise:

i) Planthopper screening trial (PHS) The planthopper screening trial was constituted to find the promising entries to rice planthoppers *i.e.*, brown planthopper and whitebacked planthopper. The trial was constituted with 167 entries comprising of 15 breeding lines developed at RRU, ANGRAU, Bapatla; 18 breeding lines developed at APRRI, ANGRAU, Maruteru, 13 breeding lines developed at ARS, ANGRAU, Ragolu, 16 breeding lines developed at TNAU, Coimbatore; 6 breeding lines from RARS, PJTSAU, Jagtial; 11 breeding lines developed at Kunaram, PJTSAU; 4 breeding lines developed at ARI, PJTSAU; Rajendranagar, 21 breeding lines developed at RARS, PJTSAU, Warangal; 1 breeding line developed at ARS, UAS, Mugadh; 3 NILs in the genetic background of IR 24, 11 mutant lines derived from BPT 5204 along with BPT5204 (wild type), 2 mutant lines derived from N22, 5 recombinant inbred lines, 18 gene pyramided lines of Improved Samba Mahsuri developed at IIRR, Hyderabad along with three resistant checks PTB 33 (BPH), RP 2068-18-3-5 (BPH) and MO1 (WBPH) as well as one susceptible check TN1. Of these, eleven entries were under retesting. The entries were evaluated at 16 locations in 22 tests against brown planthopper (BPH), white-backed planthopper (WBPH) and mixed populations of planthoppers under both field and greenhouse conditions. Evaluation of entries in 11 greenhouse and 1 field test against brown planthopper, 3 greenhouse and 1 field test against white-backed planthopper and 6 field tests against mixed populations of planthoppers revealed that 27 entries including seventeen breeding lines *viz.*, GP SS RIL-86 *, BPT 3194*, BPT 3199*, CB 18586, TN TRH 99, CRCPT11, JGL 38935, KNM 14382*, PLA 100, MTU 2856-85-1-1-1, MTU 2716-28-2-1-2, MTU 2716-28-2-2-2, MTU 2720-28-2-1-1, MTU 2721-7-1-2-1, MTU 2721-7-1-2-2, Selection from RGL-11414, WGL 1792; four gene pyramided lines *viz.*, ISM-1, ISM B-8, ISMA 13* and ISM-3* in the background of Improved Samba Mahshuri, six BPT 5204 mutant lines *viz.*, RP5977-MS-112, RP6112-MS-M-23, RP6112-MS-113, RP5977-MS-41, RP6112-MS-M-140 and RP6740-SP-M-MS-70 including 3 resistant checks as promising in 7-18 tests **(Table 2.1.1)**. Four breeding lines *viz.*, GP SS RIL-86 *, BPT 3194*, BPT 3199*, KNM 14382* and two gene pyramided lines of improved Samba Mahsuri *viz.*, ISM 3* and ISMA 13*from IIRR performed better in the second year of retesting. The susceptible check, TN1 recorded damage score in the range of 8.5 to 9.0 in these valid tests. The universal checks *viz.*, PTB 33 and MO1 performed well in 18 and 9 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 13 tests. Mixed populations of brown planthopper and whitebackedplanthopper were present at Aduthurai, Gangavathi, Jagitial, Maruteru, Pantnagar, Raipur, Sakoli and Warangal. Data on BPH and WBPH populations during the field evaluation at Gangavathi (BPH: WBPH in 1.9:1.0 ratio) revealed predominance of BPH over WBPH. At Aduthurai, throughout the crop season, brown planthopper population was more compared to white-backed planthopper (17 to 59 BPH: 1WBPH). At Nawagam, only WBPH was present. BPH was predominant throughout the crop season at Pantnagar (BPH is 1.4 to 14 times more than WBPH). At Raipur, BPH was in more numbers throughout the crop season (BPH is 10 times more than WBPH). At Rajendranagar, only BPH population was present. At Sakoli, brown planthopper dominated (1.2 to 6.1 times more) white-backed planthopper throughout the crop season except at the end of season (1.0WBPH: 0.7BPH).

Evaluation of 167 entries against the two planthoppers BPH and WBPH in 14 greenhouse and 8 field tests at 16 locations indicated 27 entries (including 17 breeding lines, four BPT 5204 gene pyramided lines, six BPT 5204 mutants) and three checks as promising in 7 to 18 tests. Four breeding lines *viz.*, GP SS RIL-86*, BPT 3194*, BPT 3199*, KNM 14382* and two gene pyramided lines *viz.*, ISM3* and ISMA 13* *of improved Samba Mahsuri from IIRR performed better in the second year of testing.*

Table 2.1.1 Performance of the most promissing entries against planthoppers in PHS kharif 2023

Entry no	Designation	Brown planthopper											
		IIRR	ADT	CBT	CTC	LDN	MND	NDL	PNT	RNR	RPR	WGL	RNR
		Glasshouse reaction											FR
		Damage score											
15	BPT 3194*	0.9	7.0	5.0	3.0	3.0	1.0	2.9	3.0	9.0	0.6	5.1	9.0
16	BPT 3199*	0.3	7.0	4.2	9.0	3.5	5.0	6.6	5.0	9.0	2.3	6.0	9.0
23	GP SS RIL-86 *	5.0	9.0	7.4	9.0	NT	9.0	7.6	1.0	9.0	1.5	9.0	9.0
26	RP5977-MS-112	5.0	5.0	7.4	NT	NT	9.0	8.5	9.0	9.0	2.6	4.0	9.0
27	RP6112-MS-M-23	5.0	5.7	7.0	9.0	NT	9.0	8.4	9.0	4.0	9.0	9.0	7.0
28	RP6112-MS-113	9.0	2.3	5.0	NT	NT	9.0	8.3	9.0	4.7	4.1	4.3	7.0
29	RP5977-MS-41	5.0	2.3	5.0	NT	NT	9.0	5.0	7.0	5.6	1.0	5.0	7.0
31	RP6112-MS-M-140	0.6	7.0	4.8	9.0	8.3	5.0	6.8	7.0	4.0	9.0	8.9	7.0
37	RP6740-SP-M-MS-70	1.2	2.3	6.2	9.0	NT	3.0	7.8	7.0	3.9	1.2	2.1	7.0
39	ISM-1	5.0	4.3	7.6	9.0	3.0	5.0	4.3	7.0	4.0	0.7	8.0	9.0
51	ISM B-8	1.5	2.3	4.0	3.0	3.0	5.0	7.0	5.0	3.8	1.1	8.9	9.0
57	ISMA 13*	2.0	4.3	4.8	9.0	NT	5.0	8.4	9.0	3.7	1.0	9.0	9.0
58	ISM-3*	0.7	4.3	5.0	9.0	3.0	7.0	6.0	9.0	3.9	1.2	7.3	7.0
65	CB 18586	9.0	5.0	8.6	9.0	NT	9.0	3.4	5.0	9.0	2.8	8.7	7.0
78	TN TRH 99	4.9	8.3	8.4	1.0	NT	7.0	5.8	5.0	9.0	4.3	9.0	7.0
81	CRCPT11	2.4	3.0	5.4	9.0	NT	3.0	7.7	7.0	4.1	1.4	0.6	7.0
87	JGL 38935	8.5	4.3	6.9	9.0	3.0	3.0	7.2	5.0	9.0	1.3	9.0	7.0
92	KNM 14382*	5.0	7.7	5.2	9.0	3.0	5.0	6.8	5.0	9.0	3.1	9.0	7.0
102	PLA 100	2.5	3.7	5.7	9.0	3.0	5.0	2.6	9.0	5.8	1.0	5.7	5.0
105	MTU 2856-85-1-1-1	2.0	3.0	5.8	9.0	9.0	5.0	3.0	5.0	9.0	1.0	8.2	7.0
106	MTU 2716-28-2-1-2	3.0	2.3	5.7	5.0	3.0	5.0	1.4	9.0	8.0	2.0	5.2	7.0
107	MTU 2716-28-2-2-2	5.3	3.0	4.8	5.0	3.0	7.0	8.1	9.0	8.1	1.2	6.3	7.0
108	MTU 2720-28-2-1-1	2.4	3.0	5.0	5.0	3.0	3.0	4.5	9.0	4.0	1.6	4.1	7.0
109	MTU 2721-7-1-2-1	1.8	5.0	5.0	3.0	3.0	5.0	2.0	9.0	4.0	1.2	6.2	7.0
111	MTU 2721-7-1-2-2	5.5	9.0	5.0	3.0	3.0	5.0	3.4	9.0	3.8	1.0	4.1	7.0
122	Selection from RGL-11414	5.0	3.7	5.0	9.0	NT	3.0	7.6	7.0	6.3	9.0	8.3	7.0
147	WGL 1792	3.3	7.7	5.1	9.0	NT	5.0	8.3	9.0	9.0	2.3	9.0	5.0
40	MO1	7.0	9.0	7.0	9.0	8.2	9.0	5.0	5.0	9.0	2.7	6.8	7.0
60	PTB33	1.4	3.0	4.6	3.4	NT	5.0	5.0	5.0	4.2	1.0	4.1	5.0
70	RP2068-18-3-5	1.4	4.3	5.2	5.0	3.0	3.0	4.0	1.0	3.0	1.0	5.0	7.0
Promising Level		5.0	5.0	5.0	5.0	3.5	5.0	5.0	5.0	5.0	3.0	5.0	5.0
No. promising		50	37	23	20	26	43	30	37	23	47	20	14

* Entries under retesting

Table 2.1.1 Performance of the most promising entries against planthoppers in PHS kharif 2023

Entry no	Designation	Wwhite backed planthopper				Planthoppers						No. of promising tests					
		IIRR	CBT	LDN	NWG	ADT	GNV	JGT	MTU	PNT	SKL	BPH		WBPH		PH	Total
		Glasshouse reaction			FR	Field reaction						GH	Field	GH	Field	Field	NPT
		Damage score			No./10h	No./10h	Damage score			%HB	%DT	**11**	**1**	**3**	**1**	**6**	**22**
15	BPT 3194*	4.8	5.4	3.0	50	220	5.0	9.0	7.0	10.0	29.7	8	0	2	0	2	12
16	BPT 3199*	8.1	5.2	3.0	120	230	5.0	9.0	7.0	20.5	14.0	6	0	1	0	3	10
23	GP SS RIL-86 *	5.0	5.0	8.1	86	432	7.0	3.0	9.0	0.0	12.8	3	0	2	0	3	8
26	RP5977-MS-112	3.2	5.2	NT	80	191	5.0	3.0	NT	41.2	25.6	4	0	1	0	2	7
27	RP6112-MS-M-23	0.5	5.0	NT	80	183	5.0	3.0	9.0	21.6	28.3	2	0	2	0	3	7
28	RP6112-MS-113	1.7	5.8	NT	46	60	5.0	3.0	NT	100.0	19.4	4	0	1	0	4	9
29	RP5977-MS-41	1.4	5.8	NT	28	81	7.0	5.0	NT	27.9	44.2	6	0	1	1	2	10
31	RP6112-MS-M-140	4.9	5.0	3.0	156	228	9.0	9.0	9.0	44.8	26.0	4	0	3	0	0	7
37	RP6740-SP-M-MS-70	6.1	5.2	3.0	200	77	9.0	3.0	9.0	25.6	20.0	6	0	1	0	4	11
39	ISM-1	6.1	6.2	3.0	188	155	5.0	9.0	9.0	32.6	17.8	7	0	1	0	2	10
51	ISM B-8	1.3	9.0	3.0	226	59	9.0	9.0	9.0	18.3	20.9	9	0	2	0	2	13
57	ISMA 13*	6.6	5.3	3.0	64	140	7.0	7.0	9.0	100.0	29.2	6	0	1	0	0	7
58	ISM-3*	1.5	6.0	3.0	78	187	9.0	9.0	7.0	100.0	30.2	6	0	2	0	0	8
65	CB 18586	6.7	5.0	8.0	58	211	9.0	3.0	9.0	23.7	22.7	4	0	1	0	2	7
78	TN TRH 99	1.6	6.1	8.3	68	351	7.0	3.0	9.0	15.7	18.8	3	0	1	0	3	7
81	CRCPT11	7.1	6.8	8.3	104	144	9.0	9.0	9.0	13.3	25.5	6	0	0	0	1	7
87	JGL 38935	5.4	5.4	NT	38	180	7.0	5.0	9.0	19.6	37.3	5	0	0	1	1	7
92	KNM 14382*	0.5	5.6	3.0	54	313	9.0	5.0	9.0	21.6	20.8	4	0	2	0	1	7
102	PLA 100	1.7	5.4	NT	36	143	7.0	3.0	7.0	100.0	53.3	6	1	1	1	1	10
105	MTU 2856-85-1-1-1	5.6	5.9	NT	58	120	5.0	3.0	5.0	19.6	35.7	6	0	0	0	4	10
106	MTU 2716-28-2-1-2	2.4	5.3	NT	102	109	5.0	3.0	5.0	42.9	43.4	7	0	1	0	3	11
107	MTU 2716-28-2-2-2	3.1	5.1	3.0	54	108	3.0	5.0	5.0	34.0	35.1	5	0	2	0	2	9
108	MTU 2720-28-2-1-1	2.6	5.3	3.0	62	107	5.0	5.0	5.0	35.9	46.4	10	0	2	0	2	14
109	MTU 2721-7-1-2-1	1.8	5.3	3.0	46	183	9.0	5.0	5.0	100.0	54.2	9	0	2	0	1	12
111	MTU 2721-7-1-2-2	2.6	5.4	3.0	54	408	7.0	3.0	7.0	33.3	35.8	8	0	2	0	1	11
122	Selection from RGL-11414	1.8	4.6	4.0	198	131	7.0	5.0	9.0	29.1	20.4	4	0	3	0	1	8
147	WGL 1792	5.7	7.0	NT	48	297	5.0	5.0	7.0	100.0	12.2	3	1	1	0	2	7
40	MO1	1.9	5.0	3.0	110	388	9.0	1.0	9.0	14.9	17.5	3	0	3	0	3	9
60	PTB33	3.7	5.0	NT	NT	121	1.0	3.0	3.0	27.8	3.8	10	1	2	0	5	18
70	RP2068-18-3-5	6.0	5.1	3.0	76	170	5.0	7.0	7.0	1.9	23.8	10	0	1	0	2	13
Promising Level		5.0	5.0	5.0	40	100	5.0	3.0	5.0	30.0	20.0						
No. promising		48	30	29	14	8	44	46	10	44	49						

* Entries under retesting

ii) 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 95 entries (95 entries comprising of 82 breeding lines, 2 varieties, 2 germplasm lines and 9 insect checks). Of these 35 entries were under retesting. The nominations included breeding lines that were developed from 56 crosses bred at 11 centres, *viz.,* ICAR-IIRR; IBT PJTSAU; IGKVV Raipur, RARS Jagtial; ARS Kunaram; RARS Warangal; IRR Rajendranagar, RARS Pattambi, ARS Brahmavar, ARS Ragolu, and ARS Nellore where gall midge is an endemic pest. The entries were evaluated at 12 locations across the country against the prevailing gall midge populations. Reaction was recorded at 30 DAT, 50 DAT and 75 DAT as % DP and/or %SS. The reaction of the entries to various populations of gall midge from different locations in 9 valid tests is discussed as under:

APKS 82-75, GP 91, IBT WGL 31 and Aganni recorded nil plant damage in field reactions at **Jagdalpur and Chiplima**.

At Jagtial, field screening had identified 16 entries with nil damage along with the resistant check Aganni. At **Ranchi** only 6 entries recorded nil damage.

Akshayadhan (*Gm4+Gm8*), RP6505-32 and RMS (ISM 18) recorded nil damage at **Jagtial and Ranchi.**

APKS 82-75, JGL 41652, RP6290-22-4 (RMS-22-24), WGL 1790, RGL-7002 and recorded nil damage at both **Sakoli and Warangal** while W1263 recorded nil damage at Sakoli, Aganni was promising at Warangal.

At **Maruteru**, 17 entries had nil damage. The check variety W1263, recorded nil damage and Kavya had 5 % plant damage. None of the entries were promising in field screening at **Pattambi**.

At **Nellore** only IBTWGL 21*, WGL 1790*, WGL 1792*, WGL 1822 had nil damage. 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*:** Evaluation of 95 entries in 9 field tests against 9 populations of gall midge helped in identification of 6 entries as most promising with nil damage in 4-5 tests of the 9 valid tests **(Table 2.1.2)**. Of these APKS 82-75, IBTWGL 21, WGL 1790, WGL 1792 were under retesting. RMS (ISM 18), RMS (ISM-B-4) were promising in the first year of testing.

Table 2.1.2: Reaction of most promising cultures to gall midge populations in GMS, kharif 2023

Entry No.	Designation	Cross combination	CHP	JDP	JGT	RCI	SKL	WGL	PTB	MTU	NLR	Overall NPT
			GMB1	GMB1	GMB3	GMB3	GMB4	GMB4M	GMB5	GMB	GMB	
			50DT	75DT	75DT	50DT	50DT	75DT	50DT	75DT	75DT(RT)	9
			%DP	%SS	%SS	%SS	%DP	%DP	%SS	%DP	%DP	
3	APKS 82-75*	RP6504-75	0.0	0.0	0.0	4.4	0.0	0.0	24.8	45.0	30.0	5.0
6	IBTWGL 21*	MTUIL/RMS GM3	0.0	5.2	0.0	9.4	0.0	5.0	54.5	20.0	0.0	4.0
56	WGL 1790*	WGL 1100/JGL 19618	0.0	15.2	53.0	2.0	0.0	0.0	45.7	15.0	0.0	4.0
58	WGL 1792*	WGL 1100/JGL 19618	0.0	6.5	2.0	3.1	0.0	9.1	43.0	0.0	0.0	4.0
82	RMS(ISM 18)	*Xa21/Pi2/Gm4/Gm8*	0.0	10.0	0.0	0.0	5.0	0.0	37.3	10.0	70.0	4.0
87	RMS(ISM-B-4)	*Xa21/xa13/xa5/Gm4/Gm8*	0.0	2.8	0.0	7.0	0.0	5.0	26.4	0.0	90.0	4.0
20	Aganni		0.0	0.0	0.0	3.0	0.0	0.0	15.5	20.0	90.0	5.0
Total tested			95	94	95	95	94	92	94	92	94	
Maximum damage in the trial			80.0	83.1	93.8	16.5	100.0	100.0	100.0	90.0	100.0	
Minimum damage in the trial			0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	
Average damage in the trial			15.9	11.0	41.7	6.6	24.0	38.1	38.2	18.4	59.4	
Damage in TN1			50.0	17.1	78.4	5.5	58.3	70.0	66.4	61.7	60.0	
Promising level			0	0	0	0	0	0	0	0	0	
No. promising			45	4	16	6	38	9	0	17	4	

* entry under retesting

iii. Leaf folder screening trial (LFST)

Leaf folder screening trial (LFST) was constituted to find new sources of resistance to rice leaf folder, *Cnaphalocrocis medinalis* in the field. The trial composed of 10 nominations from Regional Agricultural Research Station (RARS) Pattambi,10 nominations from Rice Research Unit, Acharya NG Ranga Agricultural University, Bapatla, one nomination from Main Rice Research Station, Anand Agricultural University, Nawagam, two back-cross inbred lines (BILs) of Swarna/*Oryza nivara* from IIRR along with a susceptible check (TN1) and resistant check (W 1263). During *Kharif* 2023, the trial was conducted in a randomised block design with 25 entries and 3 replications at 19 locations.

In the second year of testing, the maximum damage in the test entries varied between 15.1 and 54.5% whereas the average damage in the trial ranged from 7.6 to 39.5%. Data analysis revealed that 23 entries as promising in 4-9 tests of 15 valid field tests (**Table 2.1.3**). Nominations from Pattambi were promising at many locations whose parentage includes RP Bio226/IRGC 71598/MTU 1010. Nominations from Bapatla were also found promising at many locations.

RP5564 PTB 2-4-2-1-1 was promising in 9 out of 15 valid field tests. Three entries, *viz.*, RP5564 PTB 1-4-1, RP5564 PTB 2-4-1-5 and RP5564 PTB 1-1-1-2 were promising in 8 out of 15 valid field tests. Six entries, BPT 3077, BPT 3148, RP5564 PTB 1-4-1-1, RP5564 PTB 1-4-1-2, RP5564 PTB 1-4-2 and NPK 24 were found promising in 7 tests out of 15 valid tests. Five entries, BPT 3113, BPT 3130, RP5564 PTB 2-4-2-1-2, RP5564 PTB 1-1-1-4, and NPK 46 were promising in 6 out of 15 valid field tests. Five entries, *viz.*, BPT 3135, BPT 3182, BPT 3085, NWGR 16032 and RP5564 PTB 1-3 were promising in 5 out of 15 field tests. The rest of the three entries from Bapatla, BPT 3239, BPT 3068 and BPT 3192 were promising in 4 out of 15 valid field tests. The resistant check, W 1263 was promising in 11 out of 15 valid field tests.

Table2.1.3 Performance of promising entries against leaf folder in LFST, *Kharif* 2023

Designation	Parentage	BPT 60 DAT	ADT 60 DAT	CHT 48 DAT	CHN 70 DAT	CTC 80 DAT	KJT 80 DAT	KUL 38 DAT	LDN 80 DAT	MLN 97 DAT	MSD 90 DAT	NLR 30 DAT	NVS 80 DAT	NWG 60 DAT	PTB 75 DAT	RNR 95 DAT	NPT (15)
W 1263	Resistant check	13.4	15.5	18.2	4.7	14.3	11.7	19.9	17.4	19.1	8.3	12.2	0.0	18.8	20.2	2.3	11
RP5564 PTB 2-4-2-1-1	RP Bio226 x IRGC 71598 x MTU 1010	11.5	1.9	16.2	8.3	13.9	11.6	20.6	34.4	24.3	8.3	22.3	4.4	19.7	30.8	6.5	9
RP5564 PTB 1-4-1	RP Bio226 x IRGC 71598 x MTU 1010	14.3	4.5	17.9	9.2	22.6	13.5	21.3	25.3	20.5	7.6	9.2	8.7	19.8	34.7	8.0	8
RP5564 PTB 2-4-1-5	RP Bio226 x IRGC 71598 x MTU 1010	8.4	2.7	16.1	10.5	23.7	14.6	19.8	24.7	17.0	9.4	8.5	11.0	19.7	25.5	9.8	8
RP5564 PTB 1-1-1-2	RP Bio226 x IRGC 71598 x MTU 1010	14.3	9.6	18.6	9.5	34.9	10.6	18.7	33.3	16.3	9.3	11.0	2.0	33.7	40.4	7.4	8
BPT 3077	BPT 5204/ MTU 1075	9.6	8.1	21.4	9.3	25.8	12.1	19.9	37.0	18.9	8.4	17.2	5.7	30.6	45.5	7.3	7
BPT 3148	RP Bio 226/IRGC 23385// Nidhi/MTU 1081	13.2	6.7	20.3	7.0	16.1	10.5	24.3	35.7	17.8	9.4	9.8	20.8	30.8	36.7	9.5	7
RP5564 PTB 1-4-1-1	RP Bio226 x IRGC 71598 x MTU 1010	10.5	6.1	18.1	8.2	18.0	10.5	20.8	19.7	17.5	17.7	11.0	22.6	32.6	32.4	4.8	7
RP5564 PTB 1-4-1-2	RP Bio226 x IRGC 71598 x MTU 1010	8.4	6.9	15.8	34.2	20.7	12.8	20.0	18.7	19.0	12.7	9.3	0.0	39.4	31.5	9.1	7
RP5564 PTB 1-4-2	RP Bio226 x IRGC 71598 x MTU 1010	10.0	4.3	17.8	9.7	34.2	12.5	22.4	19.4	19.2	8.5	17.6	24.7	33.4	26.5	8.5	7
NPK 24	Swarna/ O nivara BIL	17.3	15.7	16.2	9.0	15.6	10.9	18.3	27.2	19.9	8.5	16.3	14.9	40.5	35.9	8.4	7
BPT 3113	BPT 2270/ NLR 145	11.6	8.9	21.0	12.2	15.0	10.5	19.0	41.3	20.7	9.8	14.9	9.6	35.1	38.5	14.8	6
BPT 3130	BPT 5204/ MTU 1075	15.2	4.9	19.1	8.7	15.0	12.7	20.6	25.1	20.9	9.8	12.5	13.8	33.2	42.2	8.7	6
RP5564 PTB 2-4-2-1-2	RP Bio226 x IRGC 71598 x MTU 1010	12.5	6.0	15.7	10.3	33.3	13.3	20.6	37.6	13.9	7.3	16.0	16.3	19.5	31.4	8.0	6
RP5564 PTB 1-1-1-4	RP Bio226 x IRGC 71598 x MTU 1010	14.7	10.3	16.8	7.6	34.2	11.1	18.7	25.3	21.8	10.0	8.6	8.1	45.6	44.7	12.7	6
NPK 46	Swarna/ O nivara BIL	21.9	8.9	18.8	8.8	27.1	10.6	19.8	31.9	17.8	7.9	14.5	13.7	38.3	54.5	15.8	6
BPT 3135	BPT 5204/ MTU 1001	14.1	6.1	22.7	9.2	35.1	11.3	23.7	36.7	21.3	9.6	18.8	10.7	31.8	46.3	8.5	5
BPT 3182	BPT 2231/MTU 1075	12.3	5.3	21.5	9.2	25.1	12.3	22.7	19.9	19.1	9.6	10.3	16.5	33.5	41.4	8.2	5
BPT 3085	BPT 5204/MTU 1075	18.6	7.7	17.8	9.7	37.2	15.1	20.7	20.2	16.2	9.2	13.7	11.1	19.4	46.7	10.4	5
NWGR 16032	Gurjari/ NWGR 3015	12.1	15.3	20.0	9.3	33.8	12.2	21.5	33.6	18.7	8.0	26.7	8.6	35.8	44.0	9.3	5
RP5564 PTB 1-3	RP Bio226 x IRGC 71598 x MTU 1010	11.0	6.5	20.7	8.9	26.0	12.5	19.5	24.7	18.4	8.2	13.2	26.0	29.1	31.7	9.9	5
BPT 3239	BPT 5204/ MTU 1075	16.2	3.0	23.0	6.8	26.4	13.0	25.5	40.2	28.3	9.2	12.5	12.4	33.8	45.9	10.0	4
BPT 3068	NLR 34449/ Ramappa	19.4	7.5	22.8	9.4	25.5	12.0	23.2	20.5	20.4	11.2	12.7	0.0	19.7	49.8	10.7	4
BPT 3192	BPT 5204/ MTU 1075	15.4	11.9	22.3	9.6	16.0	12.5	21.2	38.9	17.7	8.7	16.1	12.4	36.5	43.8	8.4	4
GR-11	Local check												38.4	42.6			
TN 1	Susceptible check	29.2	14.3	20.0	7.0	37.4	16.1	21.4	40.4	30.7	7.8	18.0	37.9	43.3	52.4	14.4	
Minimum damage		8.4	2.7	15.7	6.8	15.0	10.5	18.3	18.7	13.9	7.3	8.5	0.0	19.4	25.5	4.8	
Maximum damage		21.9	15.7	23.0	34.2	37.2	15.1	25.5	41.3	28.3	17.7	26.7	38.4	45.6	54.5	15.8	
Average damage in trial		13.7	7.6	19.3	10.3	25.5	12.2	21.0	29.0	19.2	9.5	13.6	13.4	31.9	39.5	9.5	
Promising level		10	10	20	10	20	12	20	20	15	10	10	10	20	25	10	
Number Promising		4	19	16	21	8	10	9	5	1	21	5	10	7	1	19	
Total entries tested		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	

Data from Arundhutinagar, Jagdalpur, Karaikal and Titabar was not included in the analysis due to low pest pressure

Field evaluation of 25 entries replicated thrice at 18 locations in ***Leaf Folder Screening Trial (LFST)*** *during Kharif 2023 revealed that 23 entries were promising in 4-9 tests out of 15 valid field tests. In the second year of testing, RP5564 PTB 2-4-2-1-1 was found promising in 9 of the 15 valid tests while three entries, viz., RP5564 PTB 1-4-1, RP5564 PTB 2-4-1-5 and RP5564 PTB 1-1-1-2 were promising in 8 out of 15 valid field tests. Six entries were found promising in 7 tests, five entries promising in 6 tests, five entries in 5 tests and three entries in 4 tests out of 15 valid field tests.*

iv 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 2023 with 45 entries which included 30 nominations from IIRR (BPT mutants and its derivatives, ILs derived from *O. nivara; O. rufipogon* and *O. glaberrima*); 8 nominations from IIRR-PTB; two from Nawagam along with the checks, PB1, TN1, W 1263, Sasyasree and TKM6. Of these, 25 entries were under retesting. The entries were evaluated at 17 locations. For effective screening, two staggered sowings were taken up at NVS, PNT, CHN, and RNR-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 Ghaghraghat, pink stem borer damage was observed. Traces of pink stem borer were observed in stubbles at ARS, Rajendranagar farm. At Titabar, both yellow stem borer and white stem borer were recorded. 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 35.8% with an average damage of 15.3% DH across 11 locations in 12 valid tests. Evaluation of entries for dead heart damage at 30, 50 DAT and at 71 DAT in two staggered sowings helped in identification of two entries-RP5977-Bio-SB-5-(SM74) and RP6738-42-16-2-2 as promising in 2 of the 12 valid tests with ≤5% DH (DS-1.0).

White ear damage: The white ear damage across 7 locations in 8 valid tests varied from 0.0 to 86.0% with a mean of 16.5% WE in the trial. Evaluation of entries identified, RP5564 PTB 1-4-2 as promising in 4 of the 8 valid tests in second year of testing. RP4919-NSR40, RP5564 PTB 1-3*, RP5564 PTB 1-1-1-2*, RP5977-Bio-SB-10 (SM48), RP6738-42-16-3 were promising in 2 tests each with ≤5% WE (DS-1.0).

The larval survival per entry across 9 locations in 11 tests varied from 0.8 to 1.3 larvae/hill in the stubbles with a mean of 0.3 larvae/hill.

Grain yield: RP5564 PTB 2-4-2-1-1*, NWGR-19007 and RP5977-Bio-SB-4 (SM72) were promising in 4 of the 6 valid tests with grain yield of ≥15g/hill despite white ear damage. RP4919-NSR40, RP-6112-SM-92-R-293-1-1-3-3*, RP-6112-SM-92-R-

293-2-2-4-4(a)*, RP2068-18-3-5, RP5564 PTB 2-4-2-1-2*, RP6420-C10-21-8, BK 49-76* were promising in 3 of the 6 valid tests with grain yield of ≥15g/hill.

Overall reaction: *Evaluation of entries in 20 valid field tests for dead hearts and white ear damage identified 8 entries as promising in 3 to 5 of the 20 tests in terms of low dead heart (≤5% DH) and white ear damage (≤5% WE). They were also promising in 1 to 4 tests of the 6 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 mechanisms in these entries as they have good grain yield despite damage. The mean no. of larvae in the stubbles in these entries varied from 0.29-1.10/hill). RP5564 PTB 2-4-2-1-2*, RP5564 PTB 1-4-2*, RP5564 PTB 1-3*, RP5564 PTB 1-4-1-2* and RP5564 PTB 2-4-2-1-1* were under retesting* ***(Table 2.1.4).***

Table 2.1.4 Reaction of most promising cultures to stem borer in SBST, *kharif*2023.

SBST No	Designation	SBDH	SBWE	SB NPT	GY	Overall NPT	larvae/hill
		12	8	12+8=20	6	DH+WE+GY 26	
42	RP6738-42-16-2-2	2	3	5	1	6	0.61
25	RP5564 PTB 2-4-2-1-2*	1	3	4	3	7	0.29
27	RP5564 PTB 1-4-2*	0	4	4	2	6	0.62
21	RP5564 PTB 1-3*	1	2	3	1	4	0.48
24	RP5564 PTB 1-4-1-2*	0	3	3	1	4	0.55
28	RP5564 PTB 2-4-2-1-1*	0	3	3	4	7	0.58
37	RP5977-Bio-SB-10 (SM48)	1	2	3	2	5	0.43
39	RP5977-Bio-SB-5-(SM74)	2	1	3	2	5	1.10

*Entry under retesting. Data on dead heart damage from ABP, CHN, LDN, RNR, TTB; white ear damage from ADT, PTB, ABK, ARN, NVS ,RNR, CHN, MND and NLR was not considered for analysis due to low pest pressure.

Valid data considered for analysis

Parameters	Locations/Tests											Total Tests
Dead heart damage	IIRR*	ADT	MNC	MND	NLR	NVS2	PNT 1	PNT 2	PTB	PSA	**GGT**	NLR	12
White head damage	IIRR*	PNT-1	PNT-2	MNC	PSA	LDN	RPR	GGT					8
Grain yield (g/hill)	IIRR	PNT-1	PNT-2	MNC	RPR	LDN							6

- Infestation augmented; 1 & 2 suggest different sowing dates.

V 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 32 entries consisting of one line promoted from SBST trial, three entries each promoted from PHS and GMS trials, 2 nominations from IIRR Rajendranagar; one from MRRS, Nawagam; two N22 EMS mutants tolerant to heat, 7 wild rice introgression lines, 2 lines derived from BPT 5204 EMS mutants, four germplasm lines from IIRR; along with five resistant and two susceptible checks. Of these, 15 entries were under retesting. The entries were evaluated against 13 insect pests at 27 locations. Some of the introgression lines possessing disease resistance have been included in this trial to evaluate 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 one field test against BPH. Field screening was augmented by releasing insects periodically to ensure population build – up at RNR. RP Bio 4918-230*, RP 5587-B-B-B-267*, RNR 37964 was RP 2068-18-3-5 and IBT-BPHM23 were promising in one of the 6 valid tests. The resistant check, PTB33 recorded a DS of ≤3.0 in 3 valid tests.

WBPH: RP Bio 5477-NH363 was the only entry which recorded a DS of 1.5 in greenhouse reaction at IIRR in the second year of testing but at CBT it had recorded a DS of 5.2. RNR 37971 was promising only at Ludhiana with a DS of ≤3.0. At other locations, it was moderately susceptible.

Planthoppers: Only RP 2068-18-3-5 recorded a DS of ≤3.0 in 2 tests of the 3 valid tests.

Gall midge: Entries were evaluated in 5 field tests which identified one entry *viz*., RP 6614-102-11-3-3-1-1-1(FBL 19101) as promising in 2 of the 5 valid tests with nil damage. The resistant check, W1263 recorded nil damage in one test.

Stem borer: Entries were evaluated against stem borer at vegetative phase for dead heart damage in 9 valid tests. RPBio4918- DB- NPK13, WGL 1062, Suraksha, RPGP-3000-179-3-9-1, RP-6112-SM-92-MS-M-R-279-3-6-2-10-5-8 recorded nil damage in one of the 9 valid tests. At reproductive phase, of the 9 valid tests with ≤5 % WE damage, RPBio4918- DB- NPK13, WGL 1062, RPGP-3000-179-3-9-1 were promising in 6 tests. RP 6461-248-1*, NND 2 and NND5 were promising in 2 tests each.

Foliage feeders: Incidence of leaf folder, and whorl maggot, were observed at various locations. None of the test entries were promising.

Overall reaction: *Evaluation of 32 entries in 8 greenhouse and 38 field tests against 6 insect pests helped in identification of 6 test entries and 3 checks as promising in 4-8 tests against 2-3 insect pests with a PPR of 3.6-15.9* ***(Table 2.1.5)****. Of these 5 entries viz., RPBio4918- DB- NPK13, WGL 1062, RP Bio 4918-230*, NND6 and RP 6461-248-1 were promising in second year of testing. RPGP-3000-179-3-9-1 was promising in first year of testing in 8 tests against PH and stem borer. The check lines Suraksha, RP 2068-18-3-5 and PTB 33 were promising in 4-8 tests against 3-4 pests with a PPR of 5.4 -15.9.*

Table 2.1.5 Performance of most promising cultures against major insect pests in MRST kharif 2023

MRST No.	Designation	Cross combination	Number of Promising tests (NPT)								MRI			
			BPH	WBPH	BPH + WBPH	GM	SBDH	SBWE	LF	WM	Tests (T)	Pests (P)	PXT	PPR
			6	**3**	**3**	**5**	**9**	**13**	**5**	**2**	**46**	**6**	**276**	
19	RPGP-3000-179-3-9-1	MTU1121x Vijetha	0	0	1	0	1	6	0	0	8	3	24	**8.7**
4	RPBio4918- DB- NPK13*	Swarna / *O. nivara*	0	0	0	0	1	6	0	0	7	2	14	**5.1**
9	WGL 1062*	Gedongibetan/Kavya	0	0	0	0	1	6	0	0	7	2	14	**5.1**
1	RP Bio 4918-230*	(Swarna/*O. nivara)*	1	0	1	0	0	2	0	0	4	3	12	**4.3**
31	NND6*	Land race	0	0	1	0	1	4	0	0	6	3	18	**6.5**
2	RP 6461-248-1*	(Swarna/*O. nivara)*	0	0	1	0	0	4	0	0	5	2	10	**3.6**
	Checks													
25	PTB 33	R. check	3	2	0	0	1	5	0	0	11	4	44	**15.9**
15	RP 2068-18-3-5	R. check	1	0	2	0	0	2	0	0	5	3	15	**5.4**
10	Suraksha	Sasyasree/MR 1523	2	0	0	0	1	2	0	0	5	3	15	**5.4**

* entry under retesting; Per cent promising reaction (PPR) = (MRI of the test entryX100)/Total MRI.

Valid reaction to insect pests considered for analysis in MRST, kharif 2023

Insect pests	Reaction	Locations/ Tests									Total tests
BPH	GH	IIRR	CBT	MND	PNT	LDN					**5**
BPH	FR	RNR*									**1**
WBPH	GH	IIRR	CBT	LDN							**3**
BPH+ WBPH	FR	MTU	GNV	PNT							**3**
GM	FR	GNV	PTB	WGL	JDP	SKL					**5**
SBDH	FR	MLN	ADT	MTU	CHN	CHP	PSA	PNT	RPR	NVS	**9**
SBWE	FR	IIRR *	SKL	CHN	CHP	LDN	MSD	NVS	NWG	PNT	**13**
		PSA	RPR	WGL	MTU						
LF	FR	CHT	MLN	NWG	NLR	PTB					**5**
WM	FR	CHN	JDP								**2**

*Augmented Insect infestation

Data on BPH from PNT(FR), ADT: WGL; WBPH from PNR; GLH from JDP & RPR; GM from, ABP, CHP, NLR,RCI, TTB; SBDH from ABP, CHP, JDP, LDN, MSD ,MTU,NLR, NWG, PTB, RNR; SBWE from PTB, ADT, RCI, NLR, RNR, TTB, CHT; LF from ADT, GNV, JDP, RNR, RPR, TTB, WGL, MSD, NVS, CHN , BRH, ADT, LDN, NVS, GNV, PNT, PSA, RCI, WM from ADT, JDP, NLR, PTB & RNR & CW from BRH were not included due to low pest pressure.

vi. IIRR-National Screening Nurseries

IIRR-National Screening Nurseries (NSN) comprised of 4 trials -National Screening Nursery1 (NSN1), National Screening Nursery 2 (NSN2), National Screening Nursery–Hills (NSN hills) and National Hybrid Screening Nursery (NHSN). **IIRR-NSN1** was constituted with 442 entries (418 AVT entries along with 10 insect checks and 14 disease checks) and was evaluated at 21 locations. **IIRR-NSN 2** trial comprising of 653 entries (629 entries from IVT trials, 10 insect and 14 disease checks) was evaluated at 18 locations against 7 insect pests. **IIRR NSN-Hills** trial consisting of 96 entries (72hill entries + 10 insect check lines and 14 disease checks) was evaluated at 8 locations against 9 insect pests. **IIRR**-**NHSN** trial constituted with 130 entries (97 hybrids + 10 insect checks +23 disease checks) was evaluated at 14 locations against 8 insect pests. The valid reactions from the evaluations in each trial are discussed pest wise:

Brown planthopper:

IIRR-NSN1: IET Nos. 30233, 30261 and 29726 recorded a Damage Score (DS) of ≤3.0 in 3 of the 5 tests in greenhouse evaluations. IET nos. 30240, 28523, 29738 and 30620 were promising at 2 locations. PTB-33 and RP 2068-18-3-5 were resistant at seedling stage in 2 and 3 tests respectively of the 5 tests with a DS of ≤3.0.

IIRR-NSN2: Greenhouse evaluations were carried out at 5 locations. IET Nos 31552, 31665 recorded a DS of ≤3.0 in 2 (IIRR & MND) of the 3 valid tests. At Coimbatore, both the entries recorded a DS of 5.0. IET 31505 was promising at both Ludhiana and Pantnagar (Zone 3).

IIRR-NSN hills: Entries were evaluated at seedling stage against BPH under greenhouse conditions at IIRR, CBT, LDN and PNT. The resistant check, PTB33 had a DS ≤ 3.0 at IIRR, Ludhiana and Coimbatore. Vikramarya recorded a DS ≤ 3.0 at Ludhiana and Coimbatore. IET Nos 31389, 31393, 31395, 31396, 31397, 31403, 31406, 31412 and RML -22 recorded a DS ≤ 3.0 in greenhouse reaction only at IIRR. All the test entries were susceptible at Pantnagar when evaluated against brown planthopper under greenhouse conditions.

IIRR-NHSN: IET Nos 31444, 31495 were promising in two of the five valid tests at seedling stage with a DS of ≤ 3.0. PTB 33 and RP 2068-18-3-5 were promising in 3 and 4 tests, respectively of the 5 valid tests against BPH in greenhouse reaction.

Whitebacked planthopper:

IIRR-NSN1: Entries were evaluated in greenhouse conditions against WBPH at both IIRR and Coimbatore. None of the test entries were observed to be promising for WBPH except MO1 at IIRR. At Coimbatore IET No 31128 was found promising with a DS≤ 3.0 but MO1 recorded DS of 5.0.

IIRR_NSN2: Entries were evaluated in greenhouse conditions at IIRR and CBT. All the entries were susceptible to WBPH except MO1 at IIRR. IET Nos. 31661, 31715 recorded DS of ≤ 3.0 at Coimbatore where MO1 recorded a DS of 5.0. At IIRR MO1 recorded DS of 1.5.

*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. None of the entries were promising.

IIRR-NHSN: Entries were evaluated in greenhouse conditions against WBPH at both IIRR and Coimbatore. None of the test entries were observed to be promising for WBPH except MO1 at IIRR (DS 1.4) and CBT (DS 3.2).

Mixed population of Planthoppers:

*IIRR-NSN1***:** CR Dhan 202 and PTB 33 were identified as promising in 2 tests at Gangavathi and Maruteru (DS ≤ 3.0) to mixed populations of planthoppers in the field at Maruteru and Gangavathi. The average infestation was 474 planthoppers/10 hills at 113 DAT at Gangavati. The ratio of BPH to WBPH was 1.5:1.0 at Gangavati and 9.0:1.0 at Maruteru.

IIRR-NSN2: All the entries were evaluated in field against a mixed population of BPH and WBPH at Gangavathi and Maruteru. The ratio of BPH to WBPH at Gangavati was 1.5: 1.0 at 103 DAT and 9.0:1.0 at Maruteru at 95 DAT. The average planthopper population was 494.7/10 hills at Gangavati. Evaluation of the entries at both the locations identified IET Nos 31515, 31619, 31682, 31710, 31742, 31946, 31872 as promising at both the locations with a DS ≤ 3.0 and low populations (100nos/ 10 hills).

IIRR-NSN hills: Entries were evaluated at Pantnagar and Maruteru against the mixed populations of planthoppers under field conditions. The ratio of BPH to WBPH was 9.0:1.0 at Maruteru and 5.0:1.0 at Pantnagar. All the test entries were susceptible at Maruteru when evaluated against mixed population of BPH and WBPH under field conditions except for PTB which recorded a DS of 3.0.

IIRR-NHSN: None of the test entries were promising in field reaction at Maruteru against planthoppers except PTB33 (DS 3.0.)

GLH:

IIRR-NSN hills: Greenhouse reaction against GLH was reported from Coimbatore. IET 31393 had recorded a DS 3.0 in the evaluation.

Gall midge:

*IIRR-NSN1***:**

Valid data pertaining to reaction of entries to rice gall midge was recorded from three locations in zone 5 (Ambikapur, Jagdalpur and Sakoli), one from zone 1 (Chiplima) and 2 from zone 7 (Warangal and Gangavati). IET No 31105 recorded nil damage at Ambikapur, Jagdalpur and Sakoli of Zone 5. But IET 30685 and Naveen (RP) were promising only at Ambikapur and Jagdalpur only. At Chiplima (zone 1), 26 entries were promising. IET Nos 30660, 30841, 32057 recorded nil damage at Warangal in Zone 7 of the two locations tested. The resistant checks Kavya and Aganni were promising in 2 of 6 valid tests.

IIRR-NSN2: Valid reactions for gall midge damage were recorded from Chiplima, Jagdalpur and Gangavati. In field reaction at GNV, all the entries were susceptible. The average damage was 22.7% SS. IET Nos 31684, 32018 and Aganni recorded nil damage in 2 of the 3 valid tests.

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

Stem borer (SB):

IIRR NSN1: Valid data for stem borer dead heart damage was recorded from 4 tests in 3 zones *viz.,* Zone 2 (Pantnagar), zone 3 (Chiplima and Pusa) and zone 5 (Raipur). IET Nos 31135 and 29690 were promising in Zone 2 with <10% dead heart damage. At Chiplima in zone 3, 20 entries had <5 % damage. IET nos 29741, 29822, 30622 and 30705 had nil damage at Raipur in zone 5. White ear damage was reported from Zone 2, 3, 5 and 7. IET Nos 29690, 30078, 32038, 30942, 29935, 29891, 30860, Pusa 44, 30831, 32065 recorded ≤5 % white ear damage in 3-4 valid tests of the 11 valid tests. However, the infestation levels should be corroborated with flowering data and pest incidence to ensure that there are no escapes.

IIRR NSN2: Valid data were reported from Pusa, Chiplima (zone 3) and Pantnagar (zone 2). IET Nos 31517, 31798, 31809, 31810 and 31811 recorded ≤ 10% dead heart damage at Pantnagar. IET Nos, 31593, 31546, 31724, 31749, DRR Dhan 54, 31765, 31852, 31855, 31861, 31968, 31969 and 32014 recorded <5 % DH at Chiplima, but all these entries had < 20% at Pusa. IET Nos. 31509, 31628, 31677, 31690 were found promising for white ear damage (≤5% WE) in four out of the 6 valid tests.

*IIRR NSN hills***:**

Dead heart damage: IET 31423 and Bhrigudhan had recorded <10% dead heart damage (DS <1.0) in field reaction at Pantnagar.

White ear damage: Valid data was obtained from 2 locations, MLN & PNT for stem borer white ear damage. IET 29654 and Swarnadhan had recorded <5% white ear damage (DS 1.0) in field reaction at both Pantnagar and Malan.

IIRR NHSN: IET Nos 31453, 31474, 31500 were promising in 2 of the 5 valid tests but all these recorded 18.5-22.4% DH damage at Pantnagar. In the field evaluation against SB white ear damage,19 entries were promising in 2 of the 8 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 5 locations in zone 3, 6 and 7. IET nos 30577 and 32041 recorded < 5 % DL in 2 of the 5 valid tests.

IIRR NSN2: Sixteen entries *viz.,* IET Nos 31663, 31701, 31820, Swarna (Positive Check), 31994, 31995, 32000, 32003, 31928, 30159 (R), 31936, 31941, 31964, 31872, 31876, Chittimuthyalu had < 5 % DL in one valid test at Kaul at 40 DAT. Average leaf folder damage was only 25.7% DL.

*IIRR NHSN***:** Field evaluation of entries in 3 valid tests identified 14 entries with <5 % DL. But none of the entries were promising across the locations.

*IIRR NSN Hills***:** Field evaluation against leaf folder damage was reported from Malan with an average damage of 15.03% DL and from Chatha with an average damage of 22.01 %DL. None of the entries had <10% DL.

Other pests
Gundhi bug
IIRR-NSN Hills: Incidence of Gundhi bug at Chatha was recorded with an average of 20.5% DG.

IIRR-NHSN: Two entries *viz.*, HR12 and IET No 31439 were promising at Ghaghraghat with <7 % DG.

Grass hopper
*IIRR NSN Hills***:** Grass hoppers (*Oxya nitidula, Hieroglyphus* spp. *Attractomorpha pscittacina* & Long-horned grasshopper) caused an average of 11.2 % leaf damage. Incidence of Rice skipper (*Paranara guttata*) at Khudwani was observed.

Case worm
IIRR-NSN 1: At Brahmavar, case worm damage was recorded at 45 DAT. The average damage in the trial was 14.1% DL. US 314 (Hybrid Check), IET nos. 29579 (R), 30653, 30771, 30933, 32063, 30180 (R) recorded <5 % DL.

Overall reaction
IIRR-NSN1: Evaluation of 442 entries at 19 locations in 35 valid tests (7 greenhouse and 28 field tests) against 6 insect pests identified eleven entries viz., IET nos 30841, 30233, 30261, 29726, 29891, 30176, 29690, 30660, 32073, 29935, 32056 as promising in 5- 8 tests of the 35 valid tests against two to four pests. RP2068-18-3-5 and PTB 33 were promising in 5 and 9 tests, respectively (Table 2.1.6).

IIRR-NSN2: Evaluation of 653 entries along with 24 checks in 23 valid tests (5 greenhouse and 18 field tests) against 5 insect pests identified, IET nos. 31628 and 31724 in 7 tests and IET Nos 31682, 31690 and 31710 in 6 tests as promising.

RP2068-18-3-5 was promising in 3 tests and PTB-33 as promising in 4 tests (Table 2.1.7).

***IIRR- NSN hills**:* Entries were evaluated at 8 locations in 16 valid tests (6 greenhouse and 10 valid field tests) against 7 insect pests (Table 2.1.8). Three test entries *viz.*, IET 29654, 31393, 31395 along with Vikramarya, Swarnadhan, CO39 & ganni were promising in 2 tests against 1-3 pests. PTB 33 was promising in 4 tests against planthoppers out of the 16 valid tests (Table 2.1.8).

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 (Table 2.1.9).

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 use 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 Performance of most promising cultures against insect pests in NSN 1 Kharif 2023

Entry No.	IET No.	Designation	Number of promising tests (NPT)										Promising against	No. of insects
			BPH	WBPH	BPH+ WBPH	GM	SBDH	SBWE	LF	CW	Overall			
			5	2	2	6	4	11	4	1	35			
312	30841	R 2404-346-1-164-1	1	0	1	3	0	2	1	0	8		BPH+PH+GM+ SBWE+LF	4
56	30233	WGL 1495	3	0	0	0	1	1	1	0	7		BPH + SBDH+ SBWE+LF	3
70	30261	RP 6317-RMS-S35-BC2F4-49-25-12-18	3	0	1	0	0	2	0	0	6		BPH +PH+ WE	2
209	29726	*PHI-21103*	3	0	0	1	0	1	1	0	6		BPH +PH+ WE +LF	3
309	29891	MTU 1376	1	0	1	0	0	3	1	0	6		BPH+PH+SBWE + LF	3
6	30176	*IIRRH 156 (Hybrid)*	1	0	0	2	0	2	0	0	5		BPH+PH+ GM +SBWE	3
26	29690	*UPLRH-180842*	0	0	0	0	1	3	0	0	5		SBDH+SBWE	1
135	30660	KNM 13557	1	0	0	3	0	1	0	0	5		PH+GM+ WE	3
272	32073	RP 6765-RAF 999-41	1	0	1	0	0	2	1	0	5		PH + SBWE	2
307	29935	MTU 1377	0	0	1	1	0	3	0	0	5		PH+GM+ WE	3
340	32056	RP 6751-RMS-1-13-34-42	0	0	1	1	0	2	1	0	5		BPH+GM +SBWE+LF	4
	Checks													
437	PTB 33		2	0	2	2	0	3	0	0	9		PH+LF+GM	2
436	MO 1		0	1	0	2	0	1	1	0	5		WBPH+GM +SBWE + LF	4
439	RP 2068-18-03-05		3	0	0	0	0	1	1	0	5		PH+LF	2

Data from WGL, NVS, PNT (FR), WGL for BPH; PNT, WGL for WBPH; MNC for GM; ABP,WGL, RNR, JDP, SKL, MSD, MNC, LDN , NVS, NWG , LDN,for SBDH; RNR, NVS, TTB, for SBWE; WGL, GVT, MSD, JDP, BRH, TTB for LF; RNR & JDP for WM - not considered for analysis due to low pest pressure.

Valid NSN1 data considered for analysis, *kharif* 2023

Insect pests	Reaction	Locations/Tests											Total tests
BPH	GH	IIRR	LDN	CBT	MND	PNT							5
WBPH	GH	IIRR	CBT										2
PH	FR	MTU	GNV										2
GM		ABP	JDP	SKL	CHP	WGL	GNV						6
SBDH	FR	PNT	CHP	PSA	RPR								4
SBWE	FR	ABP	RPR	SKL	NWG	PSA	MSD	CHP	PNT	GNV	WGL	MNC	11
LF	FR	PSA	NVS	NWG	BRH								4
CW	FR	BRH											1
											Total		35

Table 2.1.7 Performance of most promising cultures against insect pests in IIRR- NSN2, kharif 2023

Entry No.	IET No	No. of promising tests						
		BPH	WBPH	PH	GM	SBDH	SBWE	Overall
		5	2	3	3	3	6	23
140	31628	1	0	2	0	0	4	7
243	31724	1	0	2	0	1	3	7
197	31682	1	0	3	1	0	1	6
205	31690	1	0	0	1	0	4	6
226	31710	1	0	3	0	0	2	6
	Checks							
648	PTB 33	2	1	1	0	0	1	4
650	RP 2068-18-3-5	2	1	0	0	0	0	3

PH- Mixed population of BPH & WBPH; Data from JDP, NVS, PNT(FR) for BPH; PNT (FR for WBPH; MNC & ADT for GM; NVS, GNV for SBDH; GNV for SBWE; NVS, GNV, CHP, JDP for LF; CHN, ADT, JDP for WM; GB from GGT - not considered for analysis due to low pest pressure.

Valid NSN 2 data considered for analysis , kharif 2023

Insect pests	Reaction	Locations					Total
BPH	GH	IIRR	CBT	MND	LDN	PNT	5
WBPH	GH	IIRR	CBT				2
PH	FR	MTU	GNV	GNV			3
GM	FR	CHP	JDP	GNV			3
SBDH	FR	PSA	CHP	PNT			3
SBWE	FR	PSA	CHN	CHP	GGT	MNC	6
LF	FR	KUL					1
						Total	23

Ratio of BPH: WBPH

GNV	at 60 to 90 DAT In Field	1.5 BPH:1.0 WBPH
MTU	Field	9.0 BPH: 1.0 WBPH

Table 2.1.8 Performance of most promising cultures to insect pests in NSN Hills, Kharif 2023

Entry No.	IET No.	Designation	IIRR	CBT	LDN	PNT	BPH	IIRR	CBT	WBPH	MTU	PNT	PH	CBT	GLH	PNT	SBDH	MLN	PNT	SBWE	MLN	CHT	LF	CHT	GB	KDW	Gr. H	Total
			BPH	BPH	BPH	BPH	NPT	WBPH	WBPH	NPT	PH	PH	NPT	GLH	NPT	SBDH	NPT	SBDH/SBWE	SBWE	NPT	LF	LF	NPT	GB	NPT	Gr.h	NPT	NPT
			GH	GH	GH	GH	4	GH	GH	2	93DT	74DT	2	GH	1	50DT	1	85DT	116DT	2	85DT	79DT	2	57DT	1	45DT	1	16
1	29654	VL 32605	8.1	5.6	8.4	9.0	0	9.0	6.2	0	GF	213	0	5.6	0	35.6	0	0.0	2.8	2	31.1	16.4	0	DNF	0	12.1	0	2
27	31393	VL 32942	7.3	3.0	8.4	9.0	1	9.0	4.4	0	GF	264	0	3.0	1	21.8	0	25.0	23.5	0	11.7	14.7	0	10.0	0	12.5	0	2
29	31395	RCPL 1-448	2.7	9.0	8.7	9.0	1	9.0	6.0	0	9.00	211	0	9.0	0	36.6	0	0.0	18.5	1	26.7	14.7	0	50.0	0	13.7	0	2
77	Vikramarya		6.8	3.0	3.0	6.8	2	9.0	5.6	0	GF	200	0	4.0	0	19.3	0	7.7	23.7	0	13.8	13.8	0	NF	0	9.3	0	2
82	Swarnadhan		7.2	5.6	8.4	7.0	0	9.0	5.0	0	9.00	259	0	5.2	0	28.2	0	0.0	0.0	2	18.2	16.2	0	10.0	0	8.1	0	2
85	CO-39		8.6	9.0	7.6	6.9	0	9.0	7.0	0	9.00	95	1	8.8	0	26.1	0	0.0	25.0	1	24.0	18.5	0	10.0	0	8.8	0	2
	Checks																											
88	Aganni		6.8	2.7	8.4	8.8	1	8.1	5.2	0	9.00	210	0	5.6	0	15.8	0	20.0	0.0	1	20.0	16.2	0	NF	0	10.3	0	2
91	PTB 33		1.7	2.6	3.0	9.0	3	4.9	5.3	0	3.00	221	1	5.2	0	17.7	0	18.2	35.8	0	14.5	14.7	0	NF	0	9.6	0	4
Total Tested			95	94	94	96		95	94		74	96		94		96		92	96		92	96		66		94		
Max.damage in the trial			9.0	9.0	8.7	9.0		9.0	9.0		9.0	354.0		9.0		41.7		28.6	87.8		32.5	22.9		60.0		15.2		
Min.damage in the trial			1.7	2.6	3.0	4.8		1.8	4.0		3.0	35.0		3.0		8.8		0.0	0.0		11.7	10.5		8.0		7.8		
Ave. Damage in the trial			7.2	7.0	7.6	7.5		8.4	6.7		8.9	182.5		7.1		23.4		14.2	19.0		22.0	15.0		20.5		11.2		
Promising level			3	3	3	3		3	3		3	100		3		10		5	5		10	10		7		5		
No . promising entries			9	4	3	0		1	0		1	5		1		2		12	6		0	0		0		0		

Valid data considered for analysis, NSN Hills, kharif 2023

Insect Pests	Reaction	Promising tests				
BPH	GH	IIRR	LDN	CBT	PNT	4
WBPH	GH	IIRR	CBT			2
Mixed population of BPH +WBPH	FR	MTU	PNT			2
GLH	GH	CBT				1
SBDH	FR	PNT				1
SBWE	FR	PNT	MLN			2
LF	FR	CHT	MLN			2
GB	FR	CHT				1
GrH	FR	KDW				1
Total tests	FR					**16**

Valid insect pest reaction considered for analysis in NHSN, *kharif* 2023

Insect pest	Reaction	Locations								Total
BPH	GH	IIRR	CBT	MND	LDN	PNT				**5**
WBPH	GH	IIRR	CBT							**2**
GM	FR	PTB								**1**
PH	FR	MTU								**1**
SBDH	FR	PNT	CHN	GGT	NWG	RPR				**5**
SBWE	FR	PTB	MNC	RPR	CHN	GGT	LDN	PNT	NWG	**8**
LF	FR	NWG	PTB	GGT						**3**
GB	FR	GGT								**1**
										26

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.

Table 2.1.9: Performance of the most promising cultures against insect pests in NHSN, kharif 2023

E No.	IET No.	Zone VII	Zone VII	Zone VII	Zone II	Zone II		Zone VII	Zone VII		Zone VII		Zone VII		Zone II	Zone-III	Zone-III	Zone V1	Zone V	
		IIRR	CBT	MND	LDN	PNT	BPH	IIRR	CBT	WBPH	MTU	PH	PTB	GM	PNT	CHN	GGT	NWG	RPR	SBDH
		GH	GH	GH	GH	GH	NPT	GH	GH	NPT	bph+ wbph	NPT	GMB5	NPT	53DT	50DT	74DS	45DT	58DT	NPT
		BPH	BPH	BPH	BPH	BPH	5	WBPH	WBPH	2	1	1	30DT	1	SBDH	SBDH	SBDH	SBDH	SBDH	5
		DS	DS	DS	DS	DS		DS	DS				% DP		%DH	%DH	%DH	%DH	%DH	
16	31444	3.0	3.0	5.0	NG	8.8	**2**	9.0	6.4	**0**	9	**0**	33.3	**0**	26.9	10.3	13.8	6.1	6.2	**0**
39	31453	4.1	5.2	5.0	NG	8.9	**0**	6.1	6.0	**0**	9	**0**	47.6	**0**	18.5	1.7	0.0	13.5	0.0	**2**
71	31474	7.5	9.0	5.0	NG	8.9	**0**	8.5	6.8	**0**	9	**0**	38.1	**0**	20.4	0.0	7.8	0.0	28.8	**2**
	Checks																			
29	HR-12	9.0	5.2	5.0	3.0	9.0	**1**	7.4	5.6	**0**	9	**0**	33.3	**0**	20.4	18.8	12.1	0.0	7.5	**1**
125	PTB 33	1.4	4.0	3.0	3.0	9.0	**3**	4.2	6.0	**0**	3	**1**	9.3	**0**	25.2	NT	12.5	NT	13.6	**0**
127	RP 2068-18-03-05	1.9	3.0	3.0	3.0	9.0	**4**	6.1	5.4	**0**	9	**0**	14.3	**0**	33.9	NT	22.6	NT	33.9	**0**
Total Tested		129	129	130	51	127		129	127		125		130		127	122	130	121	129	
Max. damage in the trial		9.0	9.0	9.0	9.0	9.0		9.0	9.0		9.0		47.6		53.2	24.2	22.6	47.8	257.1	
Min. damage in the trial		1.4	3.0	3.0	3.0	4.9		1.4	3.2		3.0		4.8		12.9	0.0	0.0	0.0	0.0	
Average damage in the trial		7.0	7.3	6.7	7.3	8.1		8.2	7.0		8.8		35.0		25.1	10.2	10.9	12.2	13.9	
Damage in TN1		6.14	6.2	5.3	NT	5.5		6.6	6.4		6.8		26.1		24.5	19.7	10.0	17.9	15.7	
Promising level		3	3	3	3	3		3	3		3		0		10	0	0	0	0	
No. of promiisng entries		5	3	9	8	0		1	0		1		0		0	4	4	21	16	

Table 2.1.9: Performance of the most promising cultures against insect pests in NHSN, kharif 2023

E No.	IET No.	Zone VII	Zone VII	Zone V	Zone-III	Zone-III	Zone II	Zone II	Zone IV		Zone IV	Zone VII	Zone-III		Zone-III		OVERALL
		PTB	MNC	RPR	CHN	GGT	LDN	PNT	NWG	SBWE	NWG	PTB	GGT	LF	GGT	GB	
		SBWE	110DT	78DT	Pr.h	109DS	100DT	Pr. H	Pr.h	NPT	45DT	75DT	74DT	NPT	109DT	NPT	NPT
		75DT	SBWE	SBWE	SBWE	SBWE	SBWE	SBWE	SBWE	8	LF	LF	LF	3	GB	1	26
		%WE	%WE	%WE	%WE	%WE	%WE	%WE	%WE		%DL	%DL	%DL		%DG		
16	31444	32.6	0.0	17.3	15.9	12.7	10.9	33.9	4.2	**2**	6.0	34.2	6.0	**0**	11.3	**0**	**4**
39	31453	WBD	19.7	13.2	0.0	0.0	8.7	26.8	22.0	**2**	25.7	28.1	10.6	**0**	16.1	**0**	**4**
71	31474	WBD	0.0	35.1	15.7	16.1	8.3	17.6	21.7	**1**	4.3	13.7	9.8	**1**	10.1	**0**	**4**
	Checks																
29	HR-12	0.0	5.6	30.9	0.0	18.5	3.8	3.3	23.1	**3**	3.6	18.9	8.3	**1**	7.0	**1**	**7**
125	PTB 33	4.4	18.4	0.0	0.0	18.5	5.2	34.1	NT	**2**	NT	10.8	12.4	**0**	10.1	**0**	**6**
127	RP 2068-18-03-05	WBD	4.8	2.1	9.5	20.0	5.0	15.0	NT	**1**	NT	18.4	10.7	**0**	7.8	**0**	**5**
Total Tested		37	130	129	130	130	107	127	121		121	130	130		130		
Max. damage in the trial		33.3	30.4	83.9	19.3	26.9	16.3	100.0	37.0		38.5	45.6	14.2		17.0		
Min. damage in the trial		0.0	0.0	0.0	0.0	0.0	1.8	3.3	2.0		1.3	4.4	4.8		6.9		
Average damage in the trial		7.8	9.7	22.3	8.5	15.5	7.4	40.0	23.5		18.0	20.4	10.0		11.0		
Damage in TN1		6.9	19.4	31.4	10.6	15.6	7.5	43.5	27.2		17.0	19.7	9.5		12.5		
Promising level		0	0	5	5	5	0	5	5		5	5	5		7		
No. of promiisng entries		12	29	8	24	9	0	1	3		12	1	1		2		

WBD- wild boar damage; area, - Dead heart damage at Pantnagar

b. NRRI-National Screening Nurseries

AT NRRI 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, Deepwater. NSN1 trial constituted with 87 entries (75 AVT entries along with 12 insect checks) was evaluated at 23 locations. NSN2 trial comprised of 172 entries (160 IVT entries plus 12 insect checks) was evaluated at 175 locations. The valid data of the reaction of entries in the above said trials are presented insect pest wise:

Brown Planthopper:

NRRI-NSN1: The following IET lines *viz.,* 31201, 31215, 31192, 312074, 32130, 32131, 31279, 31203 were found promising in 1 test in greenhouse reaction of the 3 valid tests against PTB-33 and CR Dhan 317 exhibited resistant reaction (damage score ≤3 on SES scale) in 3 tests.

NRRI-NSN2: IET32113 were promising in 2 locations out of the 3 tests. CR Dhan 317 and CR Dhan 805 exhibited resistant reactions in 3 and 2 tests, respectively.

White-backed Planthopper:

NRRI-NSN1: None of the entries were found promising at CBT except the resistant check PTB-33 and CR Dhan 317.

NRRI-NSN2: None of the entries were found promising at CBT. CR Dhan 317 exhibited resistant reaction.

Mixed population of Planthoppers:

NRRI-NSN2: None of the entries were found promising in field evaluation including the resistant check PTB-33 and RP2068-18-3-5 when tested in the field reaction at Pantnagar. The average population in the trial was 67 No/10 hills at Pant Nagar.

Gall Midge:

NRRI-NSN1: IET32101 recorded nil damage against gall midge at Titabar and Warangal locations. IET29038 and IET31202 recorded nil damage at Sakoli and Titabar. The resistant check Aganni showed nil damage in three locations out of 4 valid tests.

NRRI-NSN2: IET32134 recorded nil damage against gall midge at Chiplima. Following IET Nos. *viz.*,32232, 32190, 32192, 32194, 32195, 32083, 32087, 32095, 32099, 32101, 32107, 32114, 32119, 32143, 32157 recorded nil damage against gall midge at Moncompu. Aganni recorded nil damage at both the test locations.

Stem borer:

NRRI-NSN1: IET31202 was promising against stem borer during vegetative and reproductive phases in 3 out of the 8 tests.

NRRI-NSN2: IET32159 had nil white ear damage at Chiplima during reproductive phase; however, it requires a glass house study for confirmation.

Leaf folder:

NRRI-NSN1: Anjali was promising against leaf folder in Warangal and Rajendranagar locations. The Check W1263 showed resistant reaction in both locations.

NRRI-NSN2: None of the entries were found promising in field evaluation including the resistant check W1263 at Kaul, where the average leaf folder damage was at 65%.

Gundhi Bug:

NRRI-NSN1: In the field evaluation at Masodha, GB incidence at 70 DAT was recorded and the average damage in the trial was 13.0% DL.

Whorl Maggot:

NRRI-NSN2: In the filed evaluation at Chinsura and Aduthurai, WM incidence at 30 and 50 DAT, respectively was recorded and the average damage in the trial was 7.0 and 8.0% DL, respectively.

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 pest in specific screening program under suitable pest pressure for further use in the resistant breeding program.

Overall reaction:

NRRI-NSN1: Evaluation of 87 entries in NSN-1 in 4 greenhouse and 17 field tests against 7 insect pests in 21 valid tests helped in identification of 3 entries as promising in 4 tests against 3 insect pest damages **(Table 2.6.2.1)**. Resistant checks PTB 33 and RP 2068-18-3-5 were resistant to BPH in the valid tests. Aganni and W1263 were promising against gall midge and leaf folder, respectively.

NRRI- NSN2: Evaluation of 172 entries in NSN-2 in 4 greenhouse and 9 field tests against 5 insect pests in 13 valid tests helped in identification of 4 entries as promising in 2- 3 tests against 2-3 insect pest damages **(Table 2.6.2.2)**. Resistant checks CR Dhan 317 and CR Dhan 805 were resistant to BPH in the valid tests. Aganni were promising against gall midge.

Table 2.6.2.1 Performance of most promising culture against insect pests in NRRI-NSN1, *Kharif* 2023

Sl. No.	IET No.	Number of promising tests (NPT)							
		BPH	WBPH	GM	LF	SBDH	SBWE	GB	Overall NPT
		3	1	4	4	3	5	1	21
1	31201	1	0	2	1	0	0	0	4
2	29038	0	0	1	1	0	2	0	4
3	31202	0	0	1	0	2	1	0	4
Resistant checks									
PTB-33		3	1	1	1	0	1	0	7
CR Dhan 317		3	1	0	0	0	0	0	4
RP2068-18-3-5		2	1	0	0	0	0	0	3
Aganni		0	0	3	0	0	0	0	3
W-1263		0	0	0	2	1	0	0	3

*PNT, WGL for BPH&WBPH; AMB, MNC for GM; NAV, TBR, RPR, MSD, JDL for LF; JDL for GLH; NVA, CHP, TBR, WNGL, RNR, PUSA, MSD, JDL 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	-	-
WBPH	CBT	-	-	-	-
Gall midge	CHP	TTB	WGL	SKL	-
Leaf folder	NWG	PSA	WGL	RNR	
SBDH	RPR	MNC	PNT	-	-
SBWE	RPR	NWG	PNT	SKL	MNC
Gundhi Bug	MSD	-	-	-	-

Table 2.6.2.2 Performance of most promising culture against insect pests in NRRI-NSN2, *Kharif* 2023

Sl. No	IET No.	Number of promising tests (NPT)						
		BPH	WBPH	GM	SBDH	SBWE	WM	Overall NPT
		3	1	2	2	4	1	13
1	32095	1	0	1	0	1	0	3
2	32114	1	0	1	0	1	0	3
3	32113	2	0	0	0	0	0	2
4	32159	1	0	0	0	1	0	2
Resistant checks								
CR Dhan 317		3	1	0	0	0	0	4
CR Dhan 805		2	0	0	0	0	0	2
RP2068-18-3-5		1	0	0	0	0	0	1
Aganni		0	0	2	0	0	0	2
W-1263		0	0	1	1	0	0	2

*JDL, PNT for BPH; PNT for WBPH; JDP for GM; ADT, JDP, NVS, GGT, CHN, MNC for SBDH; ADT, JDL, GGT, NVS for SBWE; ADT, JDP, NVS, GGT for LF 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	-	-	-
Gall midge	CHP	MNC	-	-
SBDH	CHP	-	PNT	
SBWE	CHP	MNC	PNT	CNH
WM	ADT			

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 a) Planthopper Special Screening trial (PHSS) b) Gall midge biotype monitoring trial (GMBT) c) Planthopper population Monitoring trial (PHPM) and d). Gall midge population monitoring trial (GMPM). The results of the observed virulence pattern of trials are discussed below:

a) Planthopper Special Screening Trial (PHSS): A set of 17 primary sources of BPH resistance with some sources having known resistance gene(s) was evaluated at 13 locations *viz.*, IIRR, Aduthurai, Coimbatore, Cuttack, Gangavathi, Ludhiana, Mandya, Maruteru, New Delhi, Pantnagar, Raipur, Rajendranagar and Warangal in 15 tests in the greenhouse in Standard Seedbox Screening Test (SSST) with 1 to 4 replications. At IIRR and Coimbatore, the sources were screened for both brown planthopper and whitebacked planthopper reaction. The special screening tests such as days to wilt to know the tolerance mechanism, feeding preference test by measuring honeydew excretion and nymphal survival were conducted at Maruteru and Pantnagar. Based on SSST results presented in (Table 2.2.1), it is observed that two gene differentials *viz.*, PTB 33 (with *bph2*+*Bph3*+*Bph32*+unknown factors) and RP 2068-18-3-5 (with Bph33(t) gene) were promising in 13 and 10 tests respectively out of 15 tests at 13 locations. Swarnalatha with Bph6 gene performed better at 9 locations while T12 (with bph7 gene) performed better in 5 locations. Babawee with bph 4 gene and Pokkali with bph9 gene performed better at 4 locations each. ARC 10550 with bph5 gene showed low damage at 3 locations. Three gene differentials *viz.*, Rathu Heenati (with Bph3+Bph17 genes), IR-65482-7-2-216-1-2-B with Bph18(t)) gene, MUTNS 1 with unknown genetics showed promising reaction at 2 locations each. Five gene differentials *viz.*, ASD7 with bph2, Chinasaba with bph8 gene, IR 36 (with *bph2* gene), IR 64 (with *Bph1*+ gene) and Milyang 63 with unknown genetics performed better at one location each. Two gene differentials *viz.*, OM 4498 with unknown genetics and IR-71033-121-15 with Bph20/21 genes showed susceptible reaction at all test locations.

At Pantnagar, lowest nymphal survival was observed in PTB33 (32.0%) followed by ASD7, ARC10554 and IR 64 and highest nymphal survival was observed in TN1 (74.0%) followed by MUTNS 1 and Milyang 63. IR36 took more days to wilt (16.0) followed by MUTNS 1 and ASD7. Honeydew excretion was the lowest in PTB33 (105.0 mm^2) followed by ASD 7 and Babawee whereas it was highest in Milyang 63 (369.4 mm^2) followed by TN1 and IR-65482-7-2-216-1-2-B. At Maruteru, highest nymphal survival was observed in TN1 (83.3%) followed by ASD7 and MUTNS1 while lowest nymphal survival was observed in PTB33 (33.3 %) followed by ASD7 and RP 2068-18-3-5. Honeydew excretion was the lowest in RP2068-18-3-5 (36.7 mm^2) followed by PTB33 (40 mm^2) and RatuHeenati whereas it was highest in IR-71033-121-15 (146.0 mm^2) followed by TN1 and ASD7.

Among the 17 gene differentials evaluated, two differentials viz., PTB 33 and RP 2068-18-3-5 were promising in 13 and 10 tests respectively out of 13 locations. Swarnalatha performed better in 9 locations and T12 performed better in 5 locations. Babawee and Pokkali were promising at 4 locations each. ARC 10550 showed low damage at 3 locations. Three gene differentials viz., Rathu Heenati, IR-65482-7-2-216-1-2-B, MUTNS 1 showed promising reaction at 2 locations each. Five gene differentials viz., ASD7, Chinasaba, IR 36, IR 64 and Milyang 63 performed better at one location each. Two gene differentials OM 4498 and IR-71033-121-15 showed susceptible reaction at all test locations.

b) Gall midge biotype monitoring trial (GMBT) Gall midge biotype trial was constituted with a set of 19 gene differentials categorized into 4 groups, along with the susceptible check TN1 in the fifth group and three lines with *Gm4*, *Gm8* and *gm3* genes in the background of Improved Samba Mahsuri and INRC17470 in the 6th group. The trial was conducted at 20 locations in 10 States of India. The reaction of the differentials was observed at both 30 DAT and /or 50 DAT in terms of percent plant damage and silver shoots (%). Data with >50 % plant damage/ ≥15% SS in TN1 at a location was considered as valid. Though gall midge incidence was recorded at Raipur and Aduthurai, the severity was low. The results of the evaluation from the valid data from research stations at 17 locations in 18 tests are summarized in **(Table 2.2.2)** and discussed as under.

Assam

Titabar: All the differentials were susceptible

Odisha

Cuttack: The evaluation was carried out in summer 2023. ARC5984 and Aganni recorded nil damage. All the other differentials were susceptible.

*Chiplima***:** Except Kavya, W1263 (*Gm1*) and RP5923 (*gm3*) recorded nil damage. Aganni, INRC 3021, and RP5925-24 (*Gm8*), Madhuri L9 (*Gm9*), ARC5984 and INRC17470 had <10 % plant damage. Variation in the reaction of the other donors was observed within the groups.

Jharkhand

Ranchi: Differentials from Group 1 (Kavya, W1263, ARC6605), Group 3 (CR-MR 1523), Group 4 (Abhaya, Aganni and INRC3021) recorded nil damage

Chhattisgarh

Ambikapur: Kavya W1263 and RP5922-21 (*Gm1*)**;** Aganni, INRC 3021, INRC 15888 and RP 5925-24 *(Gm8)* recorded <10% DP 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 ARC 6605 in Group 1 being susceptible. RP 2068-18-3-5 and INRC15888 recorded low damage of 20% DP.

Maharashtra

Sakoli: This year only Aganni and INRC 3021(both with *Gm8*), RP 5923, INRC 17470 and W1263 (*Gm1*) recorded nil damage at this location.

Telangana state

IIRR: The populations at IIRR was collected from farmers' fields at Medchal and were maintained in greenhouse on TN1. All the differentials were promising with nil damage except for Madhuri L9 and BG380-2.

Jagtial: Earlier the populations at Jagtial conformed to the typical pattern of R-S-R-R-S for biotype 3. This year, only Aganni and INRC 3021 (with *Gm8* gene) from Group 4 differentials were promising with nil damage.

Warangal: Aganni and INRC 3021(with *Gm8*), W1263 (*Gm1*), RP5923 (*gm3*) and the new donor INRC17470 exhibited nil damage at Warangal research station. W1263 recorded 15% DP and RP5925-24 (nil damage) in the evaluation in the farmer's field at Kothapally which is 30 km away from research farm. It is interesting to note that the virulence on *Gm11* and *gm3* is less in farmers' field as compared to the reaction in the research station.

Andhra Pradesh

Maruteru: All the gene differentials tested exhibited susceptibility to this population at 50 DAT except for Aganni and RP5925-24, INRC 15888 and Kavya which recoded low damage (≥15% DP)

Nellore: All the gene differentials were susceptible to this population.

Ragolu: Differentials of Group 3 and 4 conferred resistance to gall midge at this location which exhibits typical reaction pattern (S-S-R-R-S) of biotype 4. Even RP5925-24, RP5923 and INRC 17470 recorded nil damage.

Karnataka

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

Brahmavar: Except for group 2 differentials (except Dukong1) all other differentials recorded nil damage which is typical of biotype 3 (RSRRS).

Kerala

Moncompu; Only Kavya (Gm1) and INRC 17470 recorded nil damage.

Pattambi: All the differentials were susceptible

Overall reaction: *Evaluation of the gene differentials in one greenhouse and 17 field tests at 17 locations identified Aganni (Gm8), INRC 3021 (Gm8) as promising in 10 and 9 tests, respectively of the 18 valid tests. INRC 17470 was promising in 7 tests. W1263 and Kavya (Gm1) and RP 5923 (gm3) were promising in 7 tests each of the 18 valid tests. At Cuttack, ARC 5984 and at Gangavathi ARC 6605 were promising. The results suggest that donors with Gm8 and Gm1 gene confer resistance to gall midge across most the test locations.*

Table:2.2.1 Performance of promising gene differentials in Planthopper Special Screening Trial (PHSS) -kharif 2023

Entry No.	Designation	Cross combination	Gene	Brown planthopper													WBPH		Total NPT (15)
				IIRR	ADT	CBT	CTC	GNV	LDN	MND	MTU	NDL	PNT	RNR	RPR	WGL	IIRR	CBT	
1	ASD7 (Acc 6303)	pure line selection from Karsamba Red	*bph2*	4.5	9.0	7.0	9.0	5.7	8.8	9.0	7.7	8.6	5.3	8.7	9.0	9.0	8.8	6.1	1
2	Babawee	Land race	*bph4*	3.0	9.0	6.0	7.0	4.3	6.5	7.0	4.3	8.0	5.2	8.7	4.2	8.8	8.3	5.4	4
3	Chinasaba (Acc33016)	Land race	*bph8*	5.0	7.0	8.0	9.0	8.3	8.8	9.0	5.7	8.6	6.6	8.7	9.0	8.7	8.5	6.0	1
4	IR 36	IR 1561-228//4*IR661-1-140-3-117/*O.nivara*//CR 94-13	*bph2*	7.3	7.7	8.4	9.0	7.7	7.8	9.0	5.0	8.2	6.7	8.7	6.4	9.0	9.0	8.2	1
5	ARC 10550	Assam Rice Culture	*bph5*	2.8	6.3	8.6	9.0	3.7	8.8	7.0	5.7	8.5	7.0	8.5	3.5	9.0	7.0	5.2	3
6	IR64	IR 5657-33-2-1/IR 2061-465-1-5-5	*Bph1+*	8.0	7.7	9.0	9.0	6.3	6.8	9.0	4.3	8.3	8.7	8.7	7.3	8.9	9.3	6.2	1
7	IR-65482-7-2-216-1-2-B	IR 31917-45-3-2-2*3/*O.australiensis*	*Bph18(t)*	6.4	7.7	7.0	9.0	9.0	7.2	5.0	4.3	7.9	6.9	8.8	9.0	9.0	5.5	6.8	2
9	Milyang 63	TONGIL/IR946-33-2-2-2//YR675-131-2	?	7.3	9.0	7.0	9.0	8.3	8.3	7.0	5.0	8.7	7.1	8.7	6.7	9.0	6.4	8.8	1
11	MUTNS 1	Nizersail Mutant	?	7.2	6.3	5.4	9.0	7.7	8.6	5.0	5.7	8.3	8.7	8.9	4.8	9.0	7.0	7.6	2
13	Pokkali	saline tolerant rice variety	*bph9*	6.2	9.0	5.4	9.0	1.0	8.1	5.0	5.7	7.6	8.7	8.8	9.0	8.9	2.0	4.4	4
14	PTB 33	Resistant Check	*bph2+Bph3+*	2.4	4.3	4.8	3.0	2.3	2.2	3.0	7.0	3.6	8.7	4.7	2.1	4.6	3.4	5.0	13
16	RatuHeenati	Land race	*Bph3+Bph17*	8.7	6.3	6.0	9.0	2.3	6.3	5.0	5.7	7.2	8.8	8.7	9.0	6.7	6.1	5.8	2
17	RP 2068-18-3-5	Swarnadhan/Velluthacheera	*Bph33(t)*	1.1	3.0	3.2	2.0	5.7	2.6	3.0	5.7	5.3	8.9	3.7	3.1	4.4	6.9	3.8	10
18	Swarnalatha (Acc33964	Land race	*Bph6*	2.3	4.3	4.2	9.0	3.0	7.6	5.0	5.0	3.1	7.1	8.3	6.9	6.4	3.4	4.6	9
Promising level				5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
No of promising entries				8	3	4	2	7	2	8	7	2	0	2	5	2	3	4	

Table 2.2.2 Reaction of gene differentials against gall midge populations in GMBT, *kharif* 2023

Entry no.	Differential	Gene	IIRR	ABP	CHP	JDP	CTC	JGT	BRH	RNC	RGL	SKL	WGL	WGL$	MNC	PTB	GNV	MTU	NLR	TTB	Overall NPT
			GMB1	GMB1	GMB1	GMB1	GMB2	GMB3	GMB3	GMB3	GMB4	GMB4	GMB4M	GMB4M	GMB5	GMB5	GMB	GMB	GMB	GMB	
			GH	50DT	50DT	50DT		50DT	30DT	50DT	50DT	50DT	50DT	50DT	50DT	50DT	50DT	50DT	70DT(Rt)	50DT	18
			% DP	%DP	%DP	%DP	%SS	%DP	%SS	%SS	%DP	%DP	%DP	%DP	%DP	%DP	%DP	%DP	%DP	%SS	
1	KAVYA	***Gm 1***	0.0	0.0	0.0	0.0	20.0	100.0	0.0	0.0	90.0	5.6	35.0	30.0	0.0	61.9	65.0	10.0	20.0	8.3	**7**
2	W 1263	***Gm 1***	0.0	10.0	0.0	0.0	26.1	100.0	0.0	0.0	70.0	0.0	0.0	15.0	13.3	85.7	90.0	30.0	40.0	18.2	**7**
3	ARC 6605	***(?)***	0.0	30.0	30.0	70.0	9.5	100.0	0.0	0.0	70.0	60.0	45.0	25.0	40.0	100.0	0.0	35.0	20.0	9.1	**4**
4	PHALGUNA	***Gm 2***	0.0	30.0	30.0	40.0	8.3	100.0	14.3	8.0	70.0	50.0	65.0	40.0	26.7	100.0	80.0	75.0	60.0	18.2	**1**
5	ARC 5984	***Gm 5***	0.0	30.0	10.0	10.0	0.0	100.0	25.0	13.9	80.0	50.0	31.6	20.0	33.3	52.4	70.0	40.0	80.0	7.7	**2**
6	DUKONG 1	***Gm 6t***	0.0	10.0	40.0	20.0	13.6	100.0	0.0	0.0	80.0	52.6	40.0	55.0	26.7	100.0	70.0	30.0	20.0	5.0	**3**
7	RP 2233-156-8	***Gm 7***	0.0	20.0	30.0	70.0	26.1	100.0	25.0	10.2	90.0	70.0	65.0	15.0	26.7	95.2	100.0	45.0	90.0	4.5	**1**
8	MADHURI L 9	***Gm 9***	NT	50.0	10.0	50.0	42.9	100.0	25.0	0.0	90.0	25.0	45.0	50.0	20.0	100.0	70.0	NG	80.0	9.5	**1**
9	BG 380-2	***Gm 10***	NT	30.0	20.0	60.0	73.9	100.0	25.0	0.0	70.0	65.0	40.0	30.0	53.3	100.0	100.0	50.0	90.0	5.3	**1**
10	MR 1523	***Gm 11***	0.0	20.0	40.0	40.0	42.9	95.0	0.0	0.0	0.0	90.0	25.0	20.0	33.3	18.8	70.0	20.0	80.0	6.7	**4**
11	RP 2068-18-3-5	***gm 3***	0.0	20.0	20.0	20.0	28.6	95.0	0.0	12.6	0.0	30.0	25.0	5.0	46.7	95.2	95.0	30.0	100.0	7.7	**3**
12	ABHAYA	***Gm 4***	0.0	30.0	30.0	0.0	12.5	60.0	0.0	0.0	0.0	63.2	10.0	20.0	53.3	100.0	95.0	25.0	30.0	7.1	**5**
13	INRC 3021	***Gm 8***	0.0	10.0	10.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	100.0	25.0	25.0	30.0	16.7	**9**
14	AGANNI	***Gm 8***	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	100.0	20.0	15.0	30.0	5.9	**10**
15	INRC 15888	***Gm 8***	0.0	10.0	20.0	20.0	95.8	100.0	0.0	15.2	0.0	15.0	45.0	30.0	26.7	85.7	80.0	5.6	90.0	7.7	**3**
16	RP 5925-24	***Gm 8***	0.0	0.0	10.0	60.0	36.8	60.0	0.0	6.6	0.0	20.0	5.0	0.0	66.7	66.7	95.0	10.0	100.0	13.3	**5**
17	RP 5922-21	***Gm 1***	0.0	0.0	30.0	30.0	4.5	100.0	0.0	0.0	0.0	50.0	35.0	36.8	73.3	85.7	100.0	40.0	30.0	8.3	**5**
18	RP 5923	***gm 3***	0.0	20.0	0.0	10.0	13.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0	40.0	90.5	75.0	35.0	30.0	8.3	**7**
19	INRC 17470	***Gm 8***	0.0	10.0	10.0	90.0	8.3	20.0	0.0	7.9	0.0	0.0	0.0	0.0	0.0	90.5	30.0	20.0	60.0	6.7	**7**
20	TN 1	***none***	100.0	50.0	50.0	80.0	100.0	100.0	17.6	15.5	100.0	100.0	75.0	70.6	100.0	81.0	100.0	42.1	100.0	35.3	**0**
	TN1																	95.0			
Total tested			18	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	
Maximum damage in the trial			100.0	50.0	50.0	90.0	100.0	100.0	25.0	15.5	100.0	100.0	75.0	70.6	100.0	100.0	100.0	75.0	100.0	35.3	
Minimum damage in the trial			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.8	0.0	5.6	20.0	4.5	
Average damage in the trial			5.6	19.5	20.0	33.5	28.6	77.0	6.6	4.5	40.5	37.3	29.3	23.6	37.0	85.5	71.5	30.7	59.0	10.5	
Damage in TN1			100.0	50.0	50.0	80.0	100.0	100.0	17.6	15.5	100.0	100.0	75.0	70.6	100.0	81.0	100.0	42.1	100.0	35.3	
Promising level			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
No. promising			17	3	3	5	2	2	14	12	10	5	5	4	2	0	1	0	0	0	

c) Planthopper population monitoring trial (PHPM)

The planthopper population monitoring trial (PHPM) was conducted to monitor the virulence pattern of brown planthopper populations against selected donors by releasing a single brown planthopper female and testing its progeny. This trial was conducted at six locations *viz.*, IIRR Rajendranagar, Coimbatore, Gangavathi, Ludhiana, New Delhi and Pantnagar. Four gene differentials *viz.*, PTB 33 (Bph2, 3 and 32 genes), RP 2068-18-3-5 (bph 33t gene), RP Bio4918-230S (bph39 and 40 genes) and Salkati (two QTLs qBph4.3 and qBph4.4) were tested along with susceptible variety, TN1. The four gene differentials along with TN1 were planted in a single earthen/plastic pot with 6-7 seedlings per each differential in two sets. When the plants in the first set were 45 days old, they were covered with a mylar tube and one gravid BPH female was released into the mylar tube and the open end of the tube was covered with muslin cloth. The female was allowed to oviposit for three days and removed afterwards and each gene differential was covered with separate mylar tubes. The number of nymphs hatched from each gene differential and TN1 were counted and recorded. In the second set of pots, each gene differential was caged separately with mylar tubes and known number of nymphs from the first set were released into the second set of pots. The number of adults, nymphal duration, their sex and macroptery were recorded on each gene differential and the results are presented here in Table 2.2.3 and figures 1 and 2.

IIRR, Rajendranagar: The females laid eggs on all the gene differentials and the number of nymphs hatched were more on TN1 (92.0) and were lowest on PTB33 (15.0) and the total nymphs hatched were 182/female, the egg period was 9 days. The nymphal duration was shortest on TN1 and Salkathi (12.7 days) and longest in PTB33 (16.9 days). The sex ratio was in favour of males in RP Bio4918-230S, RP 2068-18-3-5 and Salkathi. The winged insects outnumbered the wingless insects in all the gene differentials. The macropterous adults were 60.0% and they were less in Salkathi (53.5%) and more in PTB33 (71.2%).

Coimbatore: All the females laid eggs on all the gene differentials and the nymphs hatched were highest on TN1 (43.2) and lowest on RP 2068-18-3-5 (4.3). The total number of nymphs hatched /female were 62.6. The incubation period was 13.0 days.

Ludhiana: All the females laid eggs on all the gene differentials and nymphs hatched were highest on TN1 (76.5) and lowest on PTB33 (21.2). The total number of nymphs hatched /female were 174.0. The egg period ranged from 10.3 days (TN1) to 11.0 days (RPBio4918-230S). The nymphal survival was highest in TN1 (86.7%). Nymphal duration was shortest on TN1 (17.1) and highest in PTB33 (20.6). Males were highest in Salkathi (64.8%) and sex ratio was in favour of males except in TN1 (1.42F:1.0M). The macropterous adults were more (68.0%) than wingless adults (32.0%) and were more in PTB33 (73.4%). The wingless adults were more in TN1 (43.5%).

Pantnagar: All the females laid eggs on all the gene differentials and nymphs hatched were highest on TN1 (44.8) and lowest on PTB33 (18.5). The total number of nymphs hatched/female were 139.0. The egg period was 12.0 days. The nymphal survival was highest on TN1 (82.0%) and lowest in PTB33 (42.8%) and nymphal duration was 15.6 to 16.1 days. Males were lowest in TN1 (31.2%) and sex ratio was in favour of females. The macropterous adults were more (98.6%) than wingless adults (1.4%) and were more on PTB33 and RPBio4918-230S (100%). The wingless adults were more in Salkathi (4.6%).

Gangavathi: All the females laid eggs on all the gene differentials and the nymphs hatched were highest on TN1 (70.48) and lowest on PTB33 (29.12) and the fecundity per female was 219.5 eggs. The incubation period was 19 days.

New Delhi: All the females laid eggs on all the gene differentials and nymphs hatched were highest on TN1 (57.25) and lowest on RPBIO4918-230S (24.5). The total number of nymphs hatched/female were 174.0. The egg period ranged from 16.0 days (TN1) to 17.5 days (PTB33). The nymphal survival was highest in TN1 (81.25%) and lowest on PTB33 (48.33%). Nymphal duration was shortest on TN1 (14.5 days) and longest in RP2068-18-3-5 (15.1). Males were highest in Salkathi (49.3%) and sex ratio was in favour of females in others. The macropterous adults were more (92.2%) than wingless adults (7.8%) and were more in PTB33 and salkathi (100.0%). The wingless adults were more in TN1 (17.3%).

The virulence monitoring studies of brown planthopper populations conducted using four gene differentials viz., PTB 33, RP 2068-18-3-5, RP Bio4918-230S and Salkati along with susceptible variety, TN1 *revealed that IIRR brown planthopper population was more virulent than the other BPH populations viz., Ludhiana, Pantnagar and New Delhi in terms of highest nymphal hatching, short incubation and nymphal periods, lowest winged insects. Among the gene differentials, BPH populations were less virulent on PTB 33 in terms of low nymphal hatching, low nymphal survival, long egg period, long nymphal duration, more males and more winged insects.*

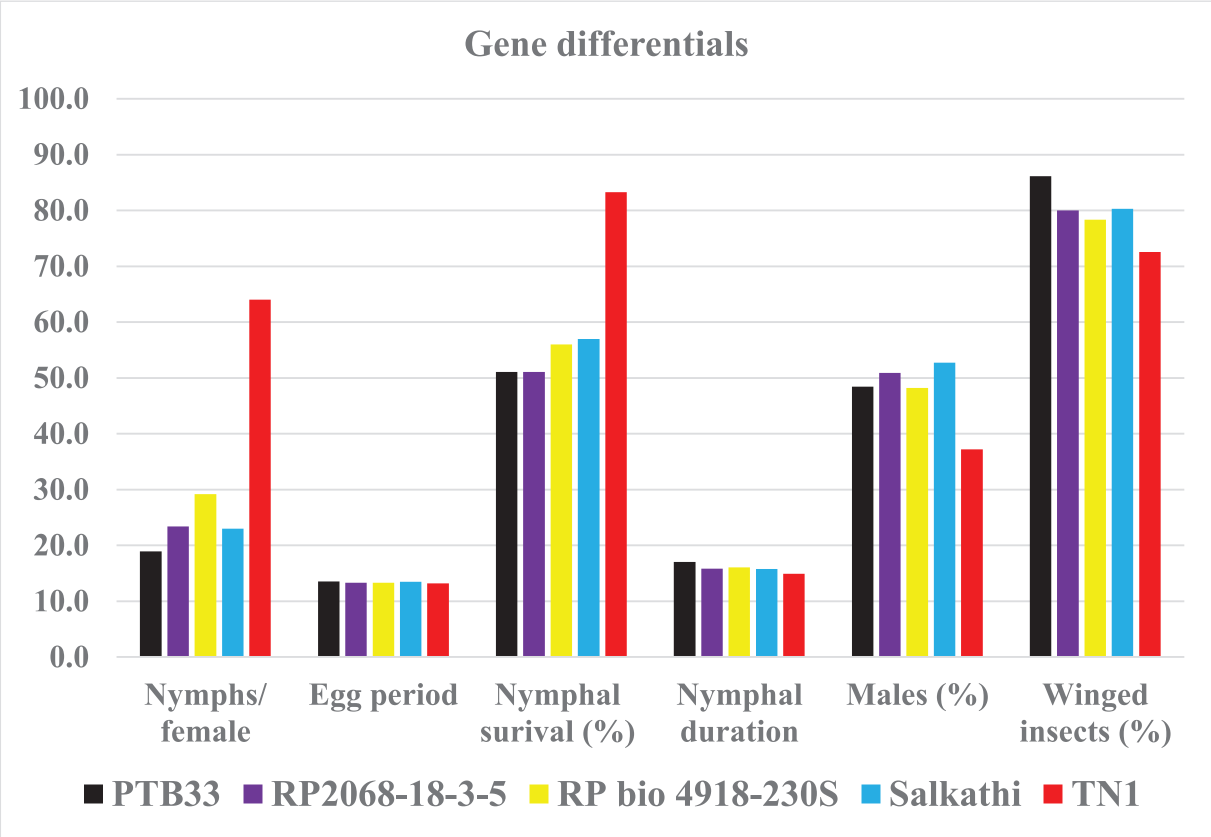


Fig. 1 Virulence of brown planthopper populations on gene differentials

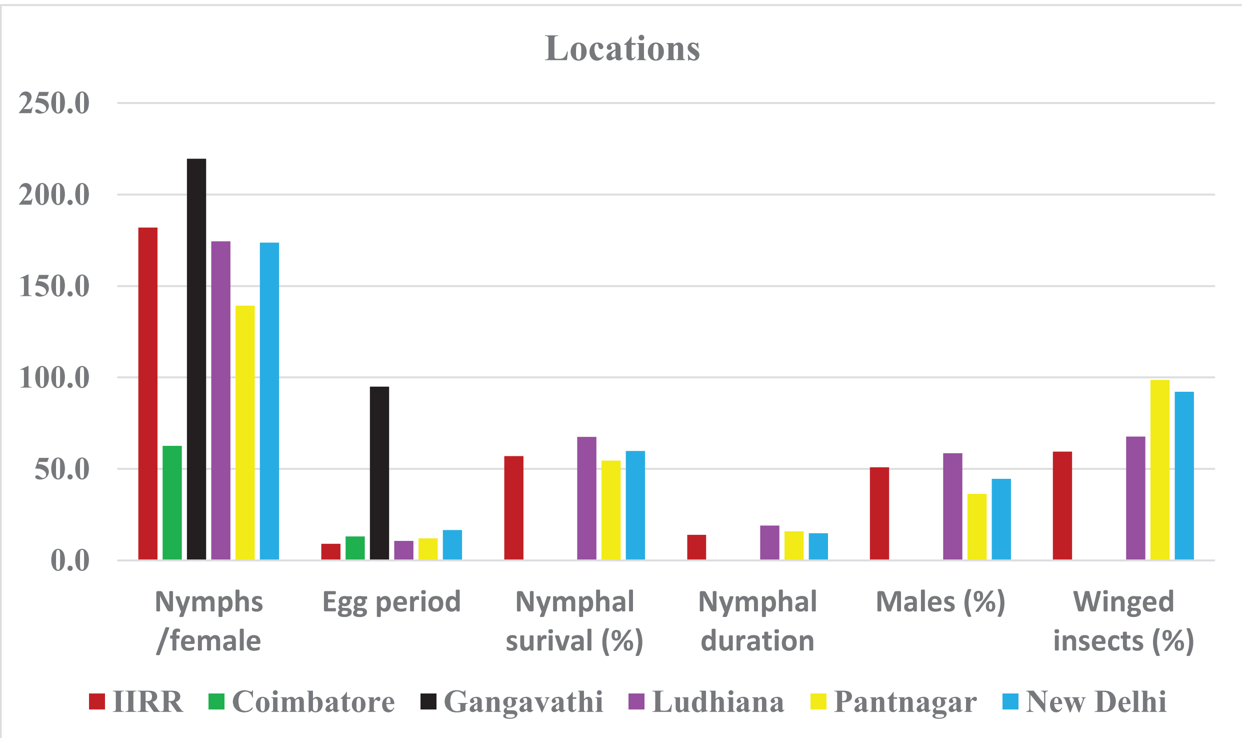


Fig. 2 Virulence of brown planthopper populations of different locations

Table: 2.2.3 Virulence monitoring of brown planthopper population in PHPM, kharif 2023

Locations	IIRR					Coimbatore					Gangavathi				
Gene differential	**PTB33**	**RP2068-18-3-5**	**RP bio 4918-230S**	**Salkathi**	**TN1**	**PTB33**	**RP2068-18-3-5**	**RP bio 4918-230S**	**Salkathi**	**TN1**	**PTB33**	**RP2068-18-3-5**	**RP bio 4918-230S**	**Salkathi**	**TN1**
No. females released	25					10					25				
Virulent females (%)	100					100					100				
No. nymphs hatched/female	15.0	20.0	30.0	25.0	92.0	4.6	4.3	4.9	5.6	43.2	29.1	39.9	47.0	33.0	70.5
Total nymphs/female	182					62.6					219.48				
Egg period	9	9	9	9	9	13	13	13	13	13	19	19	19	19	19
Nymphalsurival (%)	51.9	44.4	55.6	50.0	83.3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nymphal duration	16.9	13.1	14.9	12.7	12.6	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Males (%)	44.4	60.8	52.5	60.5	35.6	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sex ratio	1.26:1.0	0.70:1.0	0.95:1.0	0.66:1.0	2.21:1.0	NR	NR	NR		NR	NR	NR	NR		NR
winged females(%)	35.6	24.0	13.3	18.3	28.9	NR	NR	NR		NR	NR	NR	NR		NR
wingless females(%)	20.0	15.1	34.1	44.2	35.6	NR	NR	NR		NR	NR	NR	NR		NR
Winged males (%)	35.6	36.9	43.3	35.2	26.7	NR	NR	NR		NR	NR	NR	NR		NR
Wingless males (%)	8.9	23.9	9.2	2.4	8.9	NR	NR	NR		NR	NR	NR	NR		NR

Table: 2.2.3 Virulence monitoring of brown planthopper population in PHPM, kharif 2023

Locations	Ludhiana					Pantnagar					New Delhi				
Gene differential	**PTB33**	**RP2068-18-3-5**	**RP bio 4918-230S**	**Salkathi**	**TN1**	**PTB33**	**RP2068-18-3-5**	**RP bio 4918-230S**	**Salkathi**	**TN1**	**PTB33**	**RP2068-18-3-5**	**RP bio 4918-230S**	**Salkathi**	**TN1**
No. females released	**20**					**25**					**12**				
Virulent females (%)	**100**					**100**					**100**				
No. nymphs hatched/female	21.2	23.9	26.9	25.9	76.5	18.5	24.9	26.9	24.1	44.8	25.2	27.3	39.4	24.5	57.3
Total nymphs/female	**174**					**139**					**174**				
Egg period	10.8	10.8	11	10.8	10.3	12	12	12	12	12	17.5	16	16	17	16
Nymphalsurival (%)	60.8	63.3	62.5	**64.2**	86.7	43.2	42.8	44.8	59.6	82.0	48.3	53.8	61.3	54.2	81.3
Nymphal duration	20.6	19.6	18.5	19.7	17.1	15.7	15.7	16.0	16.0	15.6	14.9	15.1	14.9	14.9	14.5
Males (%)	61.7	60.2	64.3	64.8	41.3	41.5	39.4	33.3	36.5	31.2	46.3	43.3	42.8	49.3	40.8
Sex ratio	0.62:1.0	0.65:1.0	0.56:1.0	0.54:1.0	1.42:1.0	1.41:1.0	1.54:1.0	2.0:1.0	1.74:1.0	2.21:1.0	1.16:1.0	1.31:1.0	1.34:1.0	1.03:1.0	1.45:1.0
winged females(%)	22.8	27.9	25.2	25.8	23.9	58.6	59.6	66.7	63.2	64.9	53.7	46.2	46.0	53.8	42.4
wingless females(%)	15.5	11.9	10.5	9.4	34.9	0.0	1.0	0.0	0.3	3.8	0.0	10.5	11.3	0.0	17.3
Winged males (%)	50.6	43.6	42.8	42.6	32.7	41.4	38.5	33.3	36.1	30.5	46.3	43.3	42.8	46.2	40.3
Wingless males (%)	11.1	16.7	21.5	22.2	8.6	0.0	0.9	0.0	0.3	0.7	0.0	0.0	0.0	0.0	0.0

c) 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 to a set of three gene differentials *viz.*, W1263 (*Gm1*), Aganni (*Gm8*), Akshayadhan PYL (*Gm4* + *Gm8*) and Purple variety (no resistance gene but highly susceptible) would generate information on the virulence pattern of the gall midge population. This year the trial was conducted at seven locations *viz.*, Gangavathi, Moncompu, Pattambi, Jagtial, Ragolu, Warangal and Brahmavar. The results are presented in Table **2.2.4** and discussed location wise.

Ragolu: At this location, 250 single females were tested and the results suggest that the population was highly virulent on W1263 (68.2%) followed by Akshyadhan (*Gm4*+ *Gm8 (66.36%) and* the purple variety (48.6%). None were virulent on Aganni. The sex ratio in W1263 was in favour of males and the male progeny (%) was high in W1263.

Jagtial: Of the 250 female insects tested, only 65.2% were virulent on Purple variety (no resistance gene); 25.5% were virulent on W1263 (*Gm1*), and none were virulent on Aganni (*Gm8*) and Akshayadhan (*Gm4*+ *Gm8*). This is similar to the last years result. The sex ratio was favorable to females in W1263 and purple varieties. Male progeny was 30.7 % on W1263 as compared to 36.5% on purple variety. These results support the reaction of these differentials in GMBT trial at Jagtial suggesting Aganni and Akshayadhan (*Gm4*+*Gm8*) as promising donors at this location.

Warangal: At this location, 250 female insects were tested. Low virulence of tested females was recorded on Aganni (5.2%). Sex ratio was skewed towards females in all the test entries except Akshayadhan. Damage was <10% SS in Aganni and Akshayadhan (*Gm4*+ *Gm8*). Male progeny (%) was very high in Akshayadhan PYL (58.3%) followed by Aganni (38.5%), purple variety (32.9%) and W1263 (32.5%). The results are similar to the reaction pattern observed in GMBT trial conducted this year at this location, but low virulence was observed in Aganni in this trial.

Pattambi: At this location, 220 female insects were tested. Low virulence (14.1%) was observed on W1263 (*Gm1*) with 11.8 % SS. The other two differentials and purple variety were highly susceptible with more than 54 % of the females being virulent. Male progeny varied from 23.2-31.1% in all the differentials. Sex ratio is highly skewed towards females which is similar to the high pest incidence in other trials.

Moncompu: Single female progeny test was done with 150 females of which 92 % were virulent. Of the virulent insects, only 4.7% were virulent on purple entry (no gene), 46.7% on W1263 (*Gm1*), 66.0% on Aganni (*Gm8*) and 50.07 % on Akshayadhan (*Gm4*+*Gm8*). It is interesting to note that virulence was very high in the gene differentials as compared to purple variety. 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.

Table 2.2.4 Virulence composition of gall midge populations in GMPM, kharif 2023

Sl No	Locations	Total females tested	Differentials	No of virulent females	virulent females (%)	%SS	Total progeny	% Male progeny	Sex ratio (M:F)
1	Ragolu	250	Aganni	avirulent	-	-	-	-	-
			Akshayadhan PYL	107	66.36	24.8	154	47.3	1.0M:1.11F
			W1263	88	68.2	15.7	106	58.5	1.0M:0.71F
			Purple	146	48.6	25.6	174	41.4	1.0M:1.42F
2	Jagtial	250	Aganni	avirulent	-	-	-	-	-
			Akshayadhan PYL	avirulent	-	-	-	-	-
			W1263	56	25.5	5.96	75	30.7	1.0M:2.3F
			Purple	138	65.2	13.7	170	36.5	1.0M:1.74F
3	Warangal	250	Aganni	13	5.2	1.3	13	38.5	1.0M:1.6F
			Akshayadhan PYL	12	4.8	1.5	12	58.3	1.0M:0.71F
			W1263	147	58.8	40.15	379	32.5	1.0M:2.08F
			Purple	163	65.2	43.63	420	32.9	1.0M:2F
4	Pattambi	220	Aganni	149	67.7	54.3	350	23.2	1.0M:4.30F
			Akshayadhan PYL	180	81.8	69.5	431	28.3	1.0M:3.5F
			W1263	31	14.1	11.8	55	31	1.0M:3.2F
			Purple	194	88.2	67.3	506	31.1	1.0M:3.2F
5	Moncompu	150	Aganni	76	50.7	13.4	86	45.3	1.0M:1.53F
			Akshayadhan PYL	99	66	23.6	136	54.4	1.0M:1.23F
			W1263	70	46.7	12.4	80	42.5	1.0M:1.5F
			Purple	7	4.7	0.93	7	42.9	1.0M:1.33F
6	Gangavathi	250	Aganni	103	41.2	14.48	176	21.4	1.0M:4.7F
			Akshayadhan PYL	59	23.6	9.04	110	19.6	1.0M:5.1F
			W1263	92	36.8	11.92	144	21	1.0M :4.8F
			Purple	167	66.8	25.44	315	24	1.0M:4.2F
7	Brahmavar	47	Aganni	2	4.3	4.3	2	100	1.0M:0.0.F
			Akshayadhan PYL	14.9	14.9	14.9	7	14.3	1.0M:0.25F
			W1263	avirulent	-	-	-	-	-
			Purple	37	78.7	93.6	44	40.9	1.0M:1.06F

Gangavathi: Of the 250 female insects tested 66.8% were virulent on Purple variety (no gene), 36.8% on W1263 (*Gm1*), 28.6% on Aganni (*Gm8*) and 14.48% on Akshayadhan PYL (*Gm4* + *Gm8*). The sex ratio was very much skewed towards females in all the test entries which is similar to the high silver shoot damage reported in other trials. Male progeny ranged from was 19.6-24.0 % in this trial. These results support the reaction of these differentials at Gangavathi in GMBT trial except for recording of high virulence on Aganni in this test.

Brahmavar: At this location 47 females were tested. None of the tested females were virulent on W1263, 2.0 % were virulent on Aganni, 14.9% on Akshayadhan PYL and 78.7% on Purple variety. It is interesting to note that there is a very low level of virulence on Aganni though in GMBT trial nil damage was recorded.

Studies on virulence composition of gall midge populations in GMPM trial conducted at seven locations across four southern states in India suggest that there is variation in the pattern of virulence to gene differentials. Aganni (Gm8) holds promise at Jagtial, and Ragolu but low virulence was observed at Warangal. Low virulence against W1263 (Gm1) was observed at Pattambi. Akshayadhan (with Gm4 + Gm8) was promising at Jagtial and low virulence was recorded at Warangal. At Brahmavar, the populations were avirulent on W 1263, but low virulence was recorded on Aganni. However, a close monitoring of the virulence pattern in endemic areas is important.

2.3.1 Evaluation of granular insecticides for the management of gall midge (EIGM)

Asian gall midge (*Orseolia oryzae* Wood-Mason) is one of the key pests of rice at vegetative phase of crop growth particularly in the rainy season. Of late, there is an uptrend in its incidence in many areas leading to severe yield losses. In order to identify the effective granular insecticides/combination of granular insecticides for the management of gall midge, a field trial was conducted at 8 locations (MTU, WGL, GNV, ADT, PTB, JDP, ABP, and CHP) during 2023 *Kharif* season.

Treatments:

Crop Stage	Trt. No.	Insecticide	Dosage (formulation)
Seed Treatment alone	T_1	Thiamethoxam 25% WG	4 g/kg seed
Nursery alone (15 DAS/one week before transplantation)	T_2	Carbofuran 3% CG (Check1)	33 Kg per ha (3.3 g/m$^{2)}$
	T_3	Fipronil 0.3 GR	25 Kg per ha (2.5 g/m^2)
	T_4	Chlorantraniliprole 0.4 GR	10 Kg per ha (1.0 g/m^2)
Main field alone (20-25 DAT)	T_5	Carbofuran 3% CG (Check2)	33 Kg per ha (3.3 g/m^2)
	T_6	Fipronil 0.3 GR	25 Kg per ha (2.5 g/m^2)
	T_7	Chlorantraniliprole 0.4 GR	10 Kg per ha (1.0 g/m^2)
	T_8	Cartap hydrochloride 4% GR	18.75 kg per ha(1.9g/m^2)
Seed Treatment + Main field	T_9	**T_1 + T_6**	
	T_{10}	**T_1 + T_7**	
	T_{11}	**T_1 + T_8**	
Nursery + Main field	T_{12}	**T_3 + T_7**	
	T_{13}	**T_3 + T_8**	
Untreated control	T_{14}	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:

Effect on gall midge damage at different locations:

Percent silver shoots (SS) in the untreated control plot ranged from 7.8 (ABP) to 69.9 (MTU) and is above the ETL (5.0%). At all the locations, the treatment effects were significant in comparison to the untreated control. Location wise results are given below in terms of mean of %SS at 35, 50, and 65 days after treatment (DAT) (Table 1).

ADT: T13 (3.4 %SS) was the most effective treatment followed by T9 (3.1 %SS), and T10 (3.4 %SS), T12 and T13 (3.4 % SS) as compared to the remaining treatments.

AMB: T10 (3.4 %SS) was most effective treatment followed by T11 and T12 (4.3 %SS each) as compared to the remaining treatments. In untreated plot 20.16 %SS were recorded.

CHP: All the treatments were significantly effective as compared to the untreated control (T14) (18.6 %SS) and T6 (2.8%SS) was most effective treatment followed by T5 and T9 (3.7 % SS each).

GNV: All the treatments were significantly effective as compared to the untreated control (T14) (31.6 %SS) and T10 (6.6 %SS) was most effective treatment followed by T9 and T12 (7.1 and 8.2 % SS respectively).

JDP: All the treatments were significantly effective as compared to the untreated control (T14) (31.8 %SS). T12 was the most effective (11.8 %SS) treatment. T13, T4 and T4 (12.0, 13.3 and 13 %SS respectively %) were comparable to the best performing treatment.

MTU: Gall midge incidence was very high (81.4 %SS) at this centre. In the untreated control SS were 69.9%. Treatment mean differences were not significant. However, in T3 relatively lower damage was recorded (40.0 %SS).

PTB: T12 Treatment (32.2 %SS) was the most effective treatment followed by T6 (36.4 %SS) and were significantly superior to untreated control (8.61 %SS) but were on par with rest of the treatments.

WGL: Treatment effects were significant and in all the treatments significantly lower damage was recorded as compared to the untreated control (12.7 %SS). T2 was most effective with significantly lower SS (3.8%) followed by T5 (4.0 % SS), and T9 (4.4 %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. T12 (fipronil 0.3 GR in nursery + chlorantraniliprole 0.4 GR in the main field) was most effective with significantly lower SS (9.1%) with 49.2 % reduction in silver shoots. T13, T10 and T9 were comparable to the best treatment (Table 1).

Stem borer:

Effect on stem borer damage at different locations:

Data from eight locations were considered for analysis. Only at GNV and JDP, DH damage crossed ETL of 10.0%. Dead hearts ranged from 4.7% (CHP) to 20.1% (JDP) in the untreated control. Treatment effects were significant at all the locations compared to untreated control. Location wise results are given below based on the mean of 35, 50, and 65 DAT (Tables 2 and 3).

ADT: T1 was the most effective treatment with significantly lower DH (2.1%). With respect to WE, all the treatments were at par and significantly superior to the untreated control. In T1, comparatively lower WE (3.5%) were recorded.

ABP: In the T10 treatment, significantly lower dead hearts were recorded. However, T4, T8, T9, T11, T12, and T13 treatments were at par with the best treatment T10. For WE, T10 was the most effective treatment (5.9% WE) and comparable to remaining treatments except T1, T2, T4 and T14 (18.5 %WE).

CHP: DH occurrence was lowest in T12 (0.8%) followed by T10 (1.0%), T13 and T4 (1.3 % each). With respect to WE, treatment effects were not significant but in T13, comparatively lower WE (4.1%) were recorded as compared to the remaining treatments.

GNV: T10 and T9 were most effective treatments with significantly lower DH (3.3% and 3.9% respectively). In untreated control (T14) 18.2% DH were recorded. For WE, T1 is the most effective treatment (3.5%WE) followed by T3 and is at par with the remaining treatments except T6 and T14.

JDP: T12 was most effective treatment with significantly lower DH (2.1%) as compared to rest of the treatments. T10 (2.2%) and T5 closely followed the best treatment. With respect to WE, T12 was the most effective treatment followed by T13 (13.3 and 13.6% WE respectively).

MTU: Only T4 was significantly effective in reducing DH damage (3.2 %) as compared to the untreated control (11.4 %). T13 was significantly superior with 11.8 % WE and was at par with remaining treatments except T3, T8 and T10.

WGL: All the treatments were significantly superior to untreated control (9.8 %DH) and T10 was the most effective one (1.5 %DH). T10 was the most effective treatment in reducing white ears (4.7 %WE).

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

For dead hearts (DH); T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole 0.4 GR in the main field) was the most effective treatment with 77.9% reduction over the untreated control. In case of WE, T13 (fipronil 0.3 GR in nursery+ cartap hydrochloride 4% GR in the main field) (47.7 % reduction over control) was the best treatment followed by T12 (fipronil 0.3 GR + chlorantraniliprole 0.4 GR in the main field) (47.4% reduction over control).

Effect on leaf folder damage across the locations (locationXtreatment):

In all the treatments, significantly lower leaf damage was recorded as compared to the untreated control (13.8 %) and T10 was the most effective with 48.1 % reduction in damage as compared to the control (Table 4).

Effect on spiders across the locations (locationXtreatment):

In T10 treatment, significantly higher number of spiders was recorded as compared to the control treatment followed by the untreated control (T14, 9.4). There was no significant difference between the remaining treatments (Table 4).

Effect on yield at different locations:

In general, treatments involving two rounds of application *i.e.*, ST+main field or nursery +main field resulted in higher yields as compared to untreated control and single application treatments (Table 5).

AMB: In T10 treatment, significantly higher yield was recorded (6025.4 kg/ha) as compared to the untreated control (T14) (4225.4 kg/ha).

ADT: T11 treatment resulted in better yield (3016.7 kg/ha) as compared to the untreated control (T14) (1766.7 kg/ha) and T1 (2306.7 kg/ha), but was at par with the remaining treatments.

CHP: Significantly higher yield (4341.7 kg/ha) was recorded in T12 treatmentas compared to remaining treatments and T9 and T10 treatments were comparable.

GNV: In T10 treatment, significantly higher yield (7351 kg/ha) was recorded followed by T9 (7246.3 kg/ha).

JDP: Significantly higher yield was recorded in T12 treatment (5020 kg/ha).

MTU: In T6 treatment, highest yield (5338.2 kg/ha) was recorded and was followed by T2 (5162 Kg/ha).

PTB: T7 treatment gave higher yield (2678.3 kg/ha) followed by T13 (2641 Kg/ha).

WGL: T5 was superior and gave highest yield (2309.5 kg/ha) amongst the treatments.

Effect on yield across the locations (location X treatment):

Treatment effects were significant and in all the treatments higher yield was recorded as compared to the untreated control (T14) (2615.9 kg/ha). T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole granules in main field) was the best treatment with significantly higher yield (4372.5 kg/ha) as compared to remaining treatments with 67.2 % increase over control. T9 (seed treatment with thiamethoxam + fipronil granules in main field) (4205.9 kg/ha) was second best treatment with 60.8 % increase over control (Table 5).

Conclusions:

For gall midge, T12 (fipronil 0.3 GR in nursery + chlorantraniliprole 0.4 GR in the main field) was most effective with significantly lower SS (9.1%) with 49.2 % reduction in silver shoots. T13 (fipronil 0.3 GR in nursery+ cartap hydrochloride 4% GR in the main field), T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole granules in main field) and T9 (seed treatment with thiamethoxam + fipronil granules in main field) were comparable to the best treatment.

For dead hearts (DH); T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole 0.4 GR in the main field) was the most effective treatment with 77.9% reduction over the untreated control. In case of WE, T13 (fipronil 0.3 GR in nursery+ cartap hydrochloride 4% GR in the main field) (47.7 % reduction over control) was the best treatment followed by T12 (fipronil 0.3 GR+ chlorantraniliprole 0.4 GR in the main field) (47.4% reduction over control).

With respect to yield, T10 (seed treatment with thiamethoxam 25% WG + chlorantraniliprole granules in main field) was the best treatment with significantly higher yield (4372.5 kg/ha) as compared to remaining treatments with 67.2 % increase over control. T9 (seed treatment with thiamethoxam + fipronil granules in main field) (4205.9 kg/ha) was the second best treatment with 60.8 % increase in yield over control.

Table 1. Field efficacy of granular insecticides against rice gall midge at different locations and across the locations (Treatment*Location)

Crop Stage	Treatment		Silver shoots (%)									
			Location*								Treatment* Location#	
			ADT	AMB	CHP	GNV	JDP	MTU	PTB	WGL	Mean	%ROC
Seed Treatment alone	T_1	Thiamethoxam 25% WG	4.3 (2.5)$^{b-e}$	7.1 (4.1)^{ab}	8.0 (4.6)^{de}	21.8 (12.7)^{b}	16.2 (9.5)^{b}	50.8 (3.7)^{b}	38.6 (23.9)$^{b-d}$	6.2 (3.6) $^{c-f}$	11.4 (4.9)^{b}	36.6
Nursery alone (15 DAS/one week before transplantation)	T_2	Carbofuran 3% CG (Check1)	9.4 (5.4)^{a}	5.4 (3.1)^{cd}	9.9 (5.7)^{cd}	16.2 (9.3)^{d}	13.0 (7.5)^{ef}	70.6 (4.6)^{ab}	40.2 (24.6)$^{b-e}$	3.8 (2.2)^{f}	12.7 (4.8)^{b}	28.8
	T_3	Fipronil 0.3 GR	5.1 (2.9)$^{b-e}$	5.3 (3.1)^{cd}	4.5 (2.6)^{fg}	19.8 (11.5)^{c}	14.3 (8.3)$^{c-e}$	40.0 (3.5)^{b}	37.9 (21.1)^{de}	5.0 (2.9)$^{d-f}$	9.7 (4.2)$^{d-f}$	46.0
	T_4	Chlorantraniliprole 0.4 GR	3.8 (2.2)$^{c-e}$	4.9 (2.8)$^{c-e}$	10.5 (6.0)^{c}	16.9 (9.8)^{d}	13.3 (7.7)^{ef}	72.7 (5.0)^{ab}	52.2 (28.7)^{a}	7.7 (4.4)$^{b-d}$	12.3 (4.5)$^{b-d}$	31.1
Main field alone (20-25 DAT)	T_5	Carbofuran 3% CG (Check2)	8.4 (4.8)^{a}	4.5 (2.6)^{de}	3.7 (2.1)^{g}	14.0 (8.0)^{e}	15.7 (9.1)$^{b-d}$	59.5 (4.0)^{ab}	38.8 (25.0)$^{a-d}$	4.0 (2.3)^{f}	10.9 (4.3)$^{d-f}$	39.1
	T_6	Fipronil 0.3 GR	4.4 (2.5)$^{b-d}$	6.2 (3.6)^{bc}	2.8 (1.6)^{g}	12.8 (7.3)$^{e-g}$	15.3(8. 9)$^{b-d}$	81.4 (4.7)^{ab}	38.0 (23.8)$^{b-d}$	4.7 (2.7)$^{d-f}$	11.8 (3.9)$^{f-h}$	34.3
	T_7	Chlorantraniliprole 0.4 GR	4.2 (2.4)$^{b-e}$	4.9 (2.8)$^{c-e}$	11.0 (6.4)^{c}	11.7 (6.8)$^{f-h}$	14.1 (8.2)^{de}	72.9 (4.7)^{ab}	47.3 (24.7)$^{a-d}$	9.3 (5.4)^{b}	12.0 (4.3) $^{c-e}$	32.8
	T_8	Cartap hydrochloride 4% GR	5.0 (2.9)^{bc}	5.1 (2.9)^{cd}	14.3 (8.3)^{b}	13.4 (7.7)^{eh}	14.1 (8.2)^{de}	69.6 (4.5)^{ab}	36.4 (22.6)$^{c-e}$	9.7 (5.6)^{b}	12.2 (4.6)$^{b-d}$	31.9
Seed Treatment + Main field	T_9	$T_1 + T_6$	3.1 (1.8)^{ef}	4.6 (2.6) ^{de}	3.7 (2.1)^{g}	7.1 (4.1) i	14.7 (8.5)$^{b-e}$	72.7 (5.5)^{ab}	43.6 (27.1)$^{a-c}$	4.4 (2.5)^{f}	10.3 (3.5)^{ij}	42.5
	T_{10}	$T_1 + T_7$	3.3 (1.9)$^{d-f}$	3.4 (2.0)^{e}	6.1 (3.5)^{ef}	6.6 (3.8)^{i}	15.1 (8.8)$^{b-d}$	63.7 (3.9)^{ab}	45.5 (27.9)$^{a-c}$	9.3 (5.4)^{b}	10.2 (3.6)$^{h-j}$	43.2
	T_{11}	$T_1 + T_8$	2.6 (1.5)^{f}	4.3 (2.5)^{de}	8.8 (5.1)^{cd}	11.2 (6.5)^{gh}	16.0 (9.3^{bc})	60.9 (5.1)^{ab}	42.1 (24.3)$^{a-d}$	7.4 (4.3)$^{b-e}$	10.6 (4.0)$^{e-g}$	41.1
Nursery + Main field	T_{12}	$T_3 + T_7$	3.4 (2.0)$^{d-f}$	4.3 (2.5)^{de}	6.3 (3.6)^{ef}	8.2 (4.7) ^{i}	11.8 (6.9)^{f}	54.5 (3.8)^{b}	32.2 (18.9)^{ec}	8.7 (5.0)^{bc}	9.1 (3.3)^{j}	49.2
	T_{13}	$T_3 + T_8$	3.4 (1.9)$^{d-f}$	4.8 (2.7)$^{c-e}$	9.2 (5.3)^{c}	10.3 (5.9)^{h}	12.0 (6.9)^{f}	57.8 (4.3)^{ab}	40.7 (23.6)$^{b-e}$	7.9 (4.5)^{bc}	10.0 (3.7)$^{g-j}$	44.0
Untreated control	T_{14}	Untreated Control	9.5 (5.5)^{a}	7.8 (4.5)^{a}	18.6 (10.8)^{a}	31.6 (18.6)^{a}	31.8 (18.9)^{a}	69.9 (5.0)^{ab}	50.9 (28.8)^{a}	12.7 (7.3)^{a}	17.9 (8.00)^{a}	0.0
LSD (P=0.05)			0.6964	0.8819	1.2754	1.1679	1.0255	1.6904	4.7469	1.7	0.3273	

Figures in the parenthesis are *Arcsine and #Atken's transformed values. Means within a column followed by same alphabet are not significantly different from each other (LSD, P<0.05).

Table 2. Field efficacy of granular insecticides on stem borer in terms of dead hearts at different locations and across the locations (Treatment*Location)

Crop Stage	Treatment		Dead hearts (%)								
			Location*							Treatment* Location#	
			ADT	ABP	CHP	GNV	JDP	MTU	WGL	Mean	%ROC
Seed Treatment alone	T_1	Thiamethoxam 25% WG	3.0 (1.7)^{bc}	5.2 (3.0)^{b}	2.7 (1.6)^{b}	15.3 (8.8)^{b}	8.7 (5.0)^{b}	4.3 (2.4)$^{a-c}$	2.1 (1.2)^{b}	2.9 (2.2)^{b}	46.2
Nursery alone (15 DAS/one week before transplantation)	T_2	Carbofuran 3% CG (Check1)	3.1 (1.8)^{bc}	4.9 (2.8)^{b}	3.1 (1.8)^{b}	13.8 (7.9)^{c}	7.5 (4.4)^{b}	4.1 (2.3)$^{a-c}$	2.1 (1.2)^{b}	2.7 (2.2)^{bc}	49.6
	T_3	Fipronil 0.3 GR	3.3 (1.9)^{bc}	4.1 (2.3)$^{b-d}$	1.8 (1.0)^{cd}	11.9 (6.8)^{d}	4.2 (2.4)$^{c-e}$	11.7 (6.7)^{a}	2.5 (1.5)^{b}	2.6 (1.9)^{cd}	52.4
	T_4	Chlorantraniliprole 0.4 GR	3.3 (1.9)^{bc}	3.3 (1.9)^{de}	1.3 (0.8)^{de}	10.4 (6.0)^{e}	6.4 (3.7)^{bc}	3.2 (1.8)^{c}	2.0 (1.1)^{b}	2.1 (1.6)^{de}	60.4
Main field alone (20-25 DAT)	T_5	Carbofuran 3% CG (Check2)	7.6 (4.4)^{a}	4.1 (2.4)$^{b-d}$	2.5 (1.4)^{bc}	9.5 (5.5)^{ef}	2.2 (1.3)^{de}	4.4 (2.5)$^{a-c}$	2.0 (1.1)^{b}	2.4 (2.1)^{bc}	54.8
	T_6	Fipronil 0.3 GR	4.2 (2.4)^{b}	4.0 (2.3)$^{b-d}$	1.5 (0.9)^{de}	8.4 (4.8)^{fg}	2.9 (1.7)^{de}	8.8 (5.0)$^{a-c}$	2.6 (1.5)^{b}	2.2 (1.7)^{de}	59.2
	T_7	Chlorantraniliprole 0.4 GR	3.3 (1.9)^{bc}	4.5 (2.6)$^{b-d}$	1.4 (0.8)^{de}	7.6 (4.3)^{gh}	3.3 (1.9)^{de}	4.7 (2.7)$^{a-c}$	2.1 (1.2)^{b}	2.2 (1.7)$^{d-f}$	59.1
	T_8	Cartap hydrochloride 4% GR	6.6 (3.8)^{a}	3.8 (2.2)$^{b-e}$	2.6 (1.5)^{bc}	11.9 (6.8)^{d}	6.3 (3.7)^{bc}	3.4 (1.9)^{bc}	2.1 (1.2)^{b}	2.7 (2.2)^{b}	49.3
Seed Treatment + Main field	T_9	**$T_1 + T_6$**	4.1 (2.4)^{b}	3.3 (1.9)^{de}	1.8 (1.0)^{cd}	3.9 (2.3)^{j}	2.4 (1.4)^{de}	3.3 (1.9)^{bc}	2.5 (1.4)^{b}	1.6^{e-g} (1.5)	71.2
	T_{10}	**$T_1 + T_7$**	2.5 (1.4)^{c}	2.3 (1.3)^{e}	1.0 (0.5)^{de}	3.3 (1.9)^{j}	2.2 (1.3)^{de}	4.4 (2.5)$^{a-c}$	1.5 (0.9)^{b}	1.2 (1.0)^{h}	77.9
	T_{11}	**$T_1 + T_8$**	2.1 (1.2)^{c}	3.8 (2.2)$^{b-e}$	1.7 (1.0)^{cd}	6.1 (3.5)^{i}	4.8 (2.8)^{cd}	3.2 (1.8)$^{a-c}$	2.1 (1.2)^{b}	1.7 (1.4)$^{e-g}$	69.1
Nursery + Main field	T_{12}	**$T_3 + T_7$**	3.0 (1.7)^{bc}	3.1 (1.8)^{de}	0.8 (0.5)^{e}	6.9 (3.9)^{hi}	2.1 (1.2)^{e}	3.9 (2.2)$^{a-c}$	2.1 (1.2)^{b}	1.5 (1.2)^{gh}	71.4
	T_{13}	**$T_3 + T_8$**	2.5 (1.4)^{c}	3.4 (2.0)$^{c-e}$	1.3 (0.8)^{de}	6.3 (3.6)^{hi}	4.5 (2.6)$^{c-e}$	5.2 (3.0)$^{a-c}$	1.8 (1.0)^{b}	1.7 (1.4)^{fg}	68.0
Untreated control	T_{14}	Untreated Control	7.8 (4.5)^{a}	8.5 (4.9)^{a}	6.2 (3.6)^{a}	18.2 (10.5)^{a}	20.1 (11.8)^{a}	11.4 (6.6)^{ab}	9.8 (5.7)^{a}	5.4 (5.0)^{a}	0.0
LSD (P=0.05)			0.8114	0.9567	0.501	0.7891	1.5067	4.6958	0.7	0.3258	

Figures in the parenthesis are *Arcsine and #Atken's transformed values. Means within a column followed by same alphabet are not significantly different from each other (LSD, P<0

Table3. Field efficacy of granular insecticides on stem borer in terms of white ears at different locations and across the locations (Treatment*Location)

Crop Stage	Treatment		White ears (%)								
			Location*							Treatment* Location#	
			ADT	ABP	CHP	GNV	JDP	MTU	WGL	Mean	%ROC
Seed Treatment alone	T_1	Thiamethoxam 25% WG	3.5 (2.0)^{c}	12.2 (7.1)$^{b-d}$	9.6 (5.5)^{a}	3.5 (2.0)^{c}	16.3 (9.5)^{bc}	12.5 (7.2)$^{b-d}$	12.6 (7.3)^{b}	4.7 (2.7)^{de}	43.3
Nursery alone (15 DAS /one week before Transplan-tation)	T_2	Carbofuran 3% CG (Check1)	3.9 (2.2)^{bc}	14.2 (8.4)^{ab}	7.2 (4.2)^{ab}	3.9 (2.2)^{bc}	14.5 (8.4)^{cd}	15.9 (9.2)$^{a-d}$	10.8 (6.2)^{bc}	4.8 (2.7)^{de}	42.4
	T_3	Fipronil 0.3 GR	3.6 (2.1)^{c}	10.0 (5.8)$^{b-e}$	7.4 (4.2)^{ab}	3.6 (2.1)^{c}	15.6 (9.1)$^{b-d}$	19.6 (11.5)^{a}	11.0 (6.4)^{bc}	4.6 (2.6)^{de}	44.4
	T_4	Chlorantrani-liprole 0.4 GR	4.2 (2.4)^{bc}	13.0 (7.6)$^{a-c}$	7.5 (4.3)^{ab}	4.2 (2.4)^{bc}	15.5 (9.0)$^{b-d}$	13.0 (7.5)$^{b-d}$	12.1 (7.0)^{b}	5.0 (2.8)^{de}	40.3
Main field alone (20-25 DAT)	T_5	Carbofuran 3% CG (Check2)	5.6 (3.2)^{bc}	9.1 (5.3)$^{b-e}$	7.4 (4.2)^{ab}	5.6 (3.2)^{bc}	16.2 (9.4)^{bc}	15.1 (8.7)$^{a-d}$	9.8 (5.7)$^{b-d}$	5.9 (3.4)^{bc}	29.1
	T_6	Fipronil 0.3 GR	6.1 (3.5)^{ab}	6.5 (3.8)^{de}	6.9 (4.0)^{ab}	6.1 (3.5)^{ab}	17.6 (10.2)^{b}	17.6 (10.2)$^{a-d}$	9.6 (5.5)$^{b-d}$	6.1 (3.5)^{b}	26.7
	T_7	Chlorantrani-liprole 0.4 GR	5.8 (3.3)^{bc}	7.5 (4.3)$^{c-e}$	7.0 (4.0)^{ab}	5.8 (3.3)^{bc}	16.9 (9.9)^{bc}	16.1 (9.3)$^{a-d}$	6.0 (3.4)^{cd}	5.9 (3.4)^{bc}	28.8
	T_8	Cartap hydrochloride 4% GR	5.4 (3.1)^{bc}	7.8 (4.6)$^{c-e}$	5.4 (3.1)^{bc}	5.4 (3.1)^{bc}	16.6 (9.6)^{bc}	18.8 (11.0)^{ab}	6.5 (3.7)^{cd}	5.8 (3.1)$^{b-d}$	35.1
Seed Treatment + Main field	T_9	$T_1 + T_6$	5.0 (2.8)^{bc}	7.8 (4.5)$^{c-e}$	5.4 (3.1)^{bc}	5.0 (2.8)^{bc}	16.4 (9.5)^{bc}	15.1 (8.7)$^{a-d}$	10.6 (6.1)^{bc}	5.0 (2.9)$^{c-e}$	39.5
	T_{10}	$T_1 + T_7$	4.9 (2.8)^{bc}	5.9 (3.4)^{e}	5.2 (3.0)^{bc}	4.9 (2.8)^{bc}	16.8 (9.8)^{bc}	18.4 (10.6)$^{a-c}$	4.7 (2.7)^{d}	4.8 (2.8)^{de}	41.7
	T_{11}	$T_1 + T_8$	4.5 (2.6)^{bc}	8.3 (4.8)$^{c-e}$	5.4 (3.1)^{bc}	4.5 (2.6)^{bc}	17.4 (10.1)^{b}	17.4 (10.1)$^{a-d}$	8.0 (4.6)$^{b-d}$	4.7 (2.7)^{de}	43.7
Nursery + Main field	T_{12}	$T_3 + T_7$	4.4 (2.5)^{bc}	9.1 (5.2)$^{b-e}$	5.1 (2.9)^{bc}	4.4 (2.5)^{bc}	13.3 (7.7)^{d}	12.3 (7.1)^{cd}	6.4 (3.7)^{cd}	4.3^{e} (2.5)	47.4
	T_{13}	$T_3 + T_8$	4.2 (2.4)^{bc}	10.3 (6.1)$^{b-e}$	4.1 (2.4)^{c}	4.2 (2.4)^{bc}	13.6 (7.9)^{d}	11.8 (6.8)^{d}	9.9 (5.7)$^{b-d}$	4.3 (2.5)^{e}	47.7
Untreated control	T_{14}	Untreated Control	8.5 (4.9)^{a}	18.5 (10.8)^{a}	5.4 (3.1)^{bc}	8.5 (4.9)^{a}	30.8 (18.1)^{a}	14.9 (8.6)$^{a-d}$	24.0 (14.0)^{a}	8.8 (4.8)^{a}	0.0
LSD (P=0.05)			1.4639	3.3257	1.6038	1.4639	1.4511	3.7946	3.1327	0.5197	

Figures in the parenthesis are *Arcsine and #Atken's transformed values. Means within a column followed by same alphabet are not significantly different from each other (LSD, P<0.05).

Table 4. Field efficacy of granular insecticides on leaf folder and spiders in rice across the locations (Treatment* Location)

Crop Stage	Treatment		Damaged leaves (%)		No. of spiders per hill
			Damaged leaves (%)	%ROC	
Seed Treatment alone	T_1	Thiamethoxam 25% WG	10.3 (6.8) ^{bc}	25.9	7.5 (11.15) ^{cd}
Nursery alone (15 DAS/one week before transplantation)	T_2	Carbofuran 3% CG (Check1)	9.8 (6.6)$^{b-d}$	29.4	7.4 (11.07)^{bc}
	T_3	Fipronil 0.3 GR	10.0 (6.7)$^{b-d}$	27.5	8.1 (11.53)^{bc}
	T_4	Chlorantraniliprole 0.4 GR	9.8 (6.7)$^{b-d}$	29.5	7.4 (11.07)^{cd}
Main field alone (20-25 DAT)	T_5	Carbofuran 3% CG (Check2)	10.7 (7.1)^{b}	22.8	8.0 (11.30)$^{b-d}$
	T_6	Fipronil 0.3 GR	9.3 (6.5)$^{b-e}$	33.0	7.5 (11.18)$^{b-d}$
	T_7	Chlorantraniliprole 0.4 GR	7.9 (6.0)^{ef}	43.0	7.5 (11.09)^{cd}
	T_8	Cartap hydrochloride 4% GR	8.0 (5.8)^{f}	42.4	7.3 (11.13)^{cd}
Seed Treatment + Main field	T_9	$T_1 + T_6$	8.2 (6.2)$^{c-f}$	40.6	9.3 (11.32)$^{b-d}$
	T_{10}	$T_1 + T_7$	7.1 (5.8)^{f}	48.5	13.3 (12.12)^{a}
	T_{11}	$T_1 + T_8$	7.2 (5.8)^{f}	48.1	7.3 (11.19)$^{b-d}$
Nursery + Main field	T_{12}	$T_3 + T_7$	6.9 (5.7) ^{f}	50.2	6.9 (11.11)^{cd}
	T_{13}	$T_3 + T_8$	7.9 (6.1)$^{d-f}$	43.0	6.7 (10.92)^{d}
Untreated control	T_{14}	Untreated Control	13.8 (7.9)^{a}	0.0	9.4 (11.62)^{b}
LSD (P=0.05)			0.6582		0.4637

Figures in the parenthesis are Atken's transformed values. Means within a column followed by same alphabet are not significantly d each other (LSD, P<0.05).

Table 5. Effect of granular insecticides on yield in rice at different locations and across the locations (Treatment*Location)

Crop Stage	Treatment		Grain yield (Kg/ha)									
			Location								Treatment* Location	
			ADT	ABP	CHP	GNV	JDP	MTU	PTB	WGL	Mean	%IOC
Seed Treatment alone	**T_1**	Thiamethoxam 25% WG	2306.7^{bc}	4803.2^{b-d}	3586.7^{h}	3670.7^{k}	4237.3^{d}	4151.5^{d-f}	2321.7^{ab}	1702.4^{e}	3347.5(6.7)^{f}	28.0
Nursery alone (15 DAS/one week before transplantation)	**T_2**	Carbofuran 3% CG (Check1)	2686.7^{ab}	4666.7^{cd}	3658.3^{gh}	4404.3^{j}	4578.7^{b-d}	5162.0^{ab}	2261.7^{ab}	1865.1^{cde}	3660.4(7.2)^{e}	39.9
	T_3	Fipronil 0.3 GR	2723.3^{ab}	4946.0^{b-d}	3741.7^{fg}	4808.3^{i}	4616.0^{a-d}	4468.4^{b-f}	2228.3^{ab}	1857.1^{de}	3673.7(7.2)^{e}	40.4
	T_4	Chlorantraniliprole 0.4 GR	2583.3^{ab}	5219.0^{a-c}	3850.0^{ef}	5215.7^{h}	4461.3^{cd}	4539.3^{b-f}	2408.3^{ab}	1726.2^{e}	3750.4(7.2)^{e}	43.4
Main field alone (20-25 DAT)	**T_5**	Carbofuran 3% CG (Check2)	2463.3^{ab}	4858.7^{b-d}	4025.0^{cd}	5847.3f^{g}	4788.0^{a-c}	4331.3^{a}	2220.0^{ab}	2309.5^{a}	3855.4(7.5)$^{b-e}$	47.4
	T_6	Fipronil 0.3 GR	2623.3^{ab}	5509.5a-c	4050.0^{cd}	6105.3^{ef}	4545.3^{b-d}	5338.2^{a}	2560.0^{ab}	2188.5^{ab}	4115.0(7.9)^{ab}	57.3
	T_7	Chlorantraniliprole 0.4 GR	2510.0^{ab}	4833.3^{b-d}	4133.3^{bc}	6216.3^{de}	4757.3^{a-c}	4695.7^{a-e}	2678.3^{a}	2222.2^{ab}	4005.9(7.8)^{bc}	53.1
	T_8	Cartap hydrochloride 4% GR	2725.0^{ab}	5007.9^{b-d}	3933.3^{de}	5716.3^{g}	4768.0^{a-c}	3877.4^{f}	2535.0^{ab}	1924.6^{c-e}	3811.0(7.5)^{cde}	45.7
Seed Treatment + Main field	**T_9**	**$T_1 + T_6$**	2941.7^{a}	5401.6^{a-c}	4233.3^{ab}	7246.3^{a}	4861.3^{a-c}	4881.0^{a-d}	2018.3^{b}	2063.5^{b-d}	4205.9(7.9)^{ab}	60.8
	T_{10}	**$T_1 + T_7$**	2816.7^{ab}	6025.4^{a}	4325.0^{ab}	7351.0^{a}	4925.3^{ab}	4923.6^{a-c}	2510.0^{ab}	2103.2^{a-c}	4372.5(8.2)^{a}	67.2
	T_{11}	**$T_1 + T_8$**	3016.7^{a}	5290.5^{a-c}	4166.7^{bc}	6457.0^{cd}	4866.7^{a-c}	4076.2^{ef}	2341.7^{ab}	2004^{b-d}	4027.4(7.8)^{bc}	54.0
Nursery + Main field	**T_{12}**	**$T_3 + T_7$**	2641.7^{ab}	5657.1^{ab}	4341.7^{a}	6830.0^{b}	5020.0^{a}	2341.7^{gh}	2581.7^{a}	1904.8^{c-e}	3914.9(7.7)^{bc}	49.7
	T_{13}	**$T_3 + T_8$**	2591.7^{ab}	5250.8^{a-c}	4133.3^{bc}	6672.7^{bc}	4900.0^{ab}	2961.7^{g}	2641.7^{a}	1884.9^{c-e}	3879.6(7.6)^{bcd}	48.3
Untreated control	**T_{14}**	Untreated Control	1766.7^{c}	4225.4^{d}	2516.7i	3028.0^{i}	3809.3^{e}	1843.3^{a}	2388.3^{ab}	1349.2f	2615.9(5.4)^{g}	0.0
LSD (P=0.05)		LSD (0.05)	615.86	866.73	148.92	266.51	419.85	745.98	546	244.24	182.37	

Figures in the parenthesis are Atken's transformed values. Means within a column followed by same alphabet are not significantly different from each other (LSD, P<0.05).

2.3.2. Prophylactic management of rice hoppers in southern black streak virus disease affected areas

The trial was conducted at four locations *viz.*, Ludhiana, Kaul, Chatha and Pantnagar. Experiment at Kaul was vitiated due to heavy rains during the cropping season. Pest incidence at Chatha was negligible, hence not considered for analysis. The findings at two locations, Pantnagar and Ludhiana are presented here under.

Treatments:

Module 1: Protected

Time of application	Treatment
Seed treatment	Thiamethoxam 25% WG @4g/kg seed
One week before transplanting in nursery	Neem Azal 1% EC @ 2 ml/litre of water
15-20 days after transplanting	Flupyrimin 2% GR @ 6.25 kg/ha
50-55 days after transplanting	Dinotefuran 20% SG @ 200 g/ha

Module 2: Protected

Time of application	Treatment
One week before transplanting in nursery	Flupyrimin 2% GR @ 6.25 kg/ha
15-20 days after transplanting	Pymetrozine 50% WG @ 300 g/ha
50-55 days after transplanting	Triflumezopyrim 10% SC @ 236 ml/ha

Module 3: Unprotected (untreated control)

Results:

Pantnagar:

The incidence of vector pests namely, brown planthopper (BPH) and whitebacked planthopper (WBPH) was significantly lower as compared to the untreated control. (Table 1). BPH population was significantly lower in Module-2 (41.1/hill) and Module-1 (43.8/hill) as compared to the untreated control (68.1/hill). With respect to WBPH, also similar effects were observed, significantly lower population was recorded in Module-1 (8.8/hill) and Module -2 (9.0/hill) as compared to the untreated control (16.2/hill). Efficacy against yellow stem borer also was recorded. Module-2 was most effective with significantly lower dead hearts (DH) (14.3%) followed by Module-1 (14.3%) as compared to the untreated control (19.8%). However, with respect to white ears (WE), Module-1 was most affective with significantly lower WE (13.7%) followed by Module-2 (20.9%) as compared to the untreated control (34.5%). With respect to spiders there was no adverse impact of the insecticides on their abundance. Significantly higher yield (5375 Kg/ha) was recorded in Module-1 followed by Module-2 (5155 Kg/ha) as compared to the untreated control (4533 Kg/ha).

Ludhiana:

In module-2 significantly lower planthoppers were recorded (27.5/hill) followed by Module-1 (30.4/hill) as compared to the untreated control (54.3/hill). However, spider population was significantly lower in the module 1 and 2 as compared to the untreated control. Yield was significantly higher in Module-2 (6790 kg/ha) followed by module-1 (6757 kg/ha) as compared to the untreated control (5862 kg/ha) (Table 2).

The two tested modules were effective and resulted in 36.0 to 49.0 per cent reduction in planthopper population over the untreated control. At Ludhiana, Module-2 was superior with 49.0 per cent reduction in the planthopper population. However, during the crop season, southern black streak virus disease was not recorded in the experimental locations. Application of insecticides resulted in significant gain in grain yield. At Pantnagar, Module -1 was superior with 18.6 per cent yield increase (5375 Kg/ha) over the untreated control (4533 Kg/ha). At Ludhiana also, both the modules showed similar positive effect on grain yield and Module-2 resulted in 15.8 per cent higher grain yield (6790 Kg/ha) over the untreated control (5862 Kg/ha).

Table 1. Efficacy of insecticides on brown planthopper, whitebacked planthopper, yellow stem borer, spiders and yield at Pantnagar.

Treatment	BPH* (No. /10h)	%ROC	WBPH* (No. /10h)	%ROC	%DH **	%ROC	%WE **	%ROC	Spiders* (No. /10h)	Yield (Kg/ha)	%IOC
Module-1	43.8 (6.1)[b]	35.8	8.8 (2.4)[b]	45.8	14.3 (8.3)[b]	27.5	13.7 (7.9)[c]	60.3	5.3 (2.2)[a]	5375[a]	18.6
Module-2	41.1 (5.8)[b]	39.7	9.0 (2.4)[b]	44.6	8.8 (5.1)[c]	55.7	20.9 (12.1)[b]	39.3	5.9 (2.3)[a]	5155[a]	13.8
Module-3 (Untreated control)	68.1 (7.8)[a]		16.2 (3.6)[a]		19.8 (11.6)[a]		34.5 (20.2)[a]		6.2 (2.4)[a]	4533[b]	
CD (0.05)	0.275		0.618		1.653		3.528		NS	473.976	

Figures in the parenthesis are square root (*) and arcsine (**) transformed values. Means followed by the same alphabet are significantly not different from each other. ROC- reduction over control IOC-increase over control

Table 2. Efficacy of insecticides against planthoppers, spiders and yield at Ludhiana.

Treatment	Planthoppers* (No. /10h)	%ROC	Spiders* (No. /10h)	%IOC	Yield (Kg/ha)	%IOC
Module-1	30.4 (9.6)[b]	44.1	8.3 (2.9)[b]	-31.3	6757[a]	15.3
Module-2	27.5 (9.0)[c]	49.4	8.3 (2.9)[b]	-31.3	6790[a]	15.8
Module-3 (Untreated control)	54.3 (13.7)[a]		12 (3.5)[a]		5862[b]	
CD (0.05)	0.34		0.275		10.395	

Figures in the parenthesis are square root (*) transformed values. Means followed by the same alphabet are significantly not different from each other. ROC- reduction over control IOC-increase over control

2.4 Optimum Pest Control Trial (OPCT)

The trial was constituted to evaluate the performance of the identified multiple pest resistant rice cultures under protected and unprotected conditions against the pest damages in a location. This is the second year of conduct of this trial. The trial was conducted at 10 locations *viz.,* Ambikapur, Chinsurah, Gangavati, IIRR, Kaul, Ludhiana, Pattambi, Raipur, Warangal, and Titabar. Nine insect pest resistant cultures *viz.*, V1-CUL M9, V2-CR 3006-8-2, V3-CR Dhan 317, V4-Akshaydhan PYL, RP5587-273-1-B-B-B, KMR 3, Suraksha, W1263, RP2068 -18-3-5 along with the susceptible check TN1 were raised in 3 replications in a split plot design with main treatments being protected and unprotected conditions and varieties as sub treatments. Observations on pest incidence were recorded along with the grain yield. Insecticide treatments were taken up based on the intensity of the damage. At Gangavati, Chinsurah, Pattambi, Warangal, and Ludhiana observations were recorded before and after imposition of insecticide treatments. The general information pertaining to the trial is given in Table 2.4.1.

The reaction of test entries across locations to gall midge (Table 2.4.2), stem borer dead heart damage (Table 2.4.3), stem borer white ear damage (Table 2.4.4), leaf folder (2.4.5) and the grain yield (2.4.6) are tabulated pest wise and discussed location wise.

Ambikapur: Observations on gall midge (% SS) and stem borer damage (%DH) at 34 DAT, 48 DAT and 67 DAT were recorded in the trial. SS (%) was significantly low in Cul M9, Suraksha, W1263 and Akshayadhan PYL and RP5587-273-1-B-B-B at 67 DAT. Dead heart (%) damage was significantly low in KMR3, W 1263 and Suraksha at 67 DT. No significant difference in silver shoot and stem borer dead heart damage was observed between protected and unprotected treatments.

Chinsurah: Incidence of stem borer and leaf folder were recorded in this trial. Dead heart damage (35DAT), white ear damage and leaf folder damage (77DAT) were significantly lower in protected treatments. Among the varieties tested, RP 2068-18-3-5 recorded significantly lower dead hearts damage followed by RP5587-273-1-B-B-B as compared to other entries. Cul M9, CR Dhan317, Suraksha and RP 2068-18-3-5 had significantly low white ear damage. Suraksha, W1263 and CR 3006-8-2 had significantly lower leaf folder damage at 77 DAT.

Gangavathi: Incidence of gall midge, stem borer, planthoppers and leaf folder along with counts on spiders, mirids bugs, damsel and dragonflies were observed at this location. Granular application had significantly reduced the gall midge damage in the protected treatments (8.08%SS) as compared to unprotected treatments (10.69%SS). Suraksha (5.3%SS) and W1263 (5.6%SS) had significantly lower damage as compared to other test entries.

Stem borer damage was significantly higher in unprotected treatments (10.03% DH and 13.77%WE) as compared to the protected (8.01%DH and 9.68% WE) treatments. Suraksha, and W1263 recorded significantly lower SBDH, SBWE & LFDL damage while KMR3 had lower SBDH damage. Planthopper population (375.6 hoppers/10 hills) was recorded and treatments had no effect on the population.

Table 2.4.1 General information pertaining to OPCT trial, Kharif 2023

Location	Common name	Date of insecticide/ fungicide application	Time of application	Observations recorded
Ambilkapur D/S 07-07-2023 D/P 04-08-2023	Azoxystrobin +tebuconazol	two sprays for blast disease management but not recovered		GM, SBDH, * Suraksha and W 1263 were severely damaged by blast disease. (2) Gall midge infestations were very less due to lowland field situation.
Chinsurah D/S 03-07-2023 D/P 28-07-2023	Cartap hydrochloride	21.07.23 & 07.09.23	7 days before transplanting and at 40 DAT	SBDH, SBWE, LFDL
Gangavathi D/S 13-09-2023 D/P 10-10-2023	Fipronil 0.3 GR	10.11.2023	30 DAT	SS, SBDH, SBWE, LFDL, BPH and WBPH. Mirid bugs, spiders,& other Natural enemy counts;Incidence of brown spot and false smut recorded
ICAR-IIRR D/S 14-07-2023 D/P 07-08-2023	Carbofuran 3%CG.	11-09-2023	34 DAT	SBDH, SBWE, spiders, coccinellids
	Twice application of herbicide	Pretilachlor 50%EC herbicide applied on 13/08/2023.	20-09-2023 (Ammonium salt of glyphosate 71%S.G	
Kaul D/S 01-07-2023 D/P 14-08-2023	Cartap Hydrochloride	For leaf folder	-	LFDL, SBDH,
	Flubendamide	For stem borer		
	Flubendamide	For stem borer		
	Copper Oxychloride			
	Streptocycline			
Ludhiana D/P 29-06-2023 D/P 27-07-2023	Fame 480 SC @ 20 ml/acre	12-09-2023	47 DAT	SBDH, SBWE, LFDL, PH, Spiders
	Osheen 20 SG@ 80 g/acre	25-09-2023	60 DAT	
Pattambi D/P 31-07-2023		20.08.23,10.09.23, 26.9.23		SS, SBDH, SBWE, LF, WM, spiders, damsel flies & Coccinellids
Raipur D/S 20-07-2023 D/P 19-08-2023	Spraying of Fipronil was started from 20.09.2023 and it was repeated in 15 days interval for four times.	20.09.2023, 06.10.2023, 21.10.2023, 07.11.2023	32 DAT, 48 DAT, 63 DAT, 80 DAT	SBDH, SBWE, Hispa , Leaf folder, WMD and Planthopper
Titabar D/S 13-07-2023 D/P 12-08-2023	Chlorantraniliprole 18.5 SC		50 DAT & 65 DAT	DP, SS, SBDH, SBWE, LFDL, Caseworm, Mirid bugs, spiders, Dragonflies/Damselfly, Coccinellids
Warangal D/S 22-07-2023 D/P 23-08-2023	Fipronil	08-10-2023		SS, SBDH, LF
	Chlorantraniliprole 18.5 SC	01-11-2023		SBWE

Mirid bugs (39.28/ 10 hills), dragon flies and damsel flies (9.4 ± 0.47/10 hills) in protected treatment were slightly less as compared to unprotected treatment (12.2 ± 0.49 dragon flies/10 hills and 42.7bugs/10 hills). Spiders were observed in both protected (20.92 /10 hills and unprotected (18.74 /10 hills) treatments. Suraksha recorded higher grain yield followed by W1263.

IIRR: Stem borer white ear damage was recorded in the trial under infested conditions. CR Dhan 317 (24.6% WE) and RP 5587-273-1- B-B-B (29.9% WE) had significantly lower WE damage as compared to other test entries. No significant difference in damage was observed between protected and unprotected treatments where a singular granular application was given. Spiders, coccinellids and grasshoppers were recorded but treatments had no significant difference in their numbers. Grain yield was significantly high in protected plots (6168kg/ha) as compared to unprotected plots (5541kg/ha) and the interaction effects were significant.

Kaul: Leaf folder incidence was evident but insecticide treatments were not statistically significant. W 1263, Suraksha and CR3006-8-2 had significantly lower SBDH damage.

Ludhiana: Incidence of stem borer, leaf folder and counts of natural enemies *viz.,* spiders, dragon and damsel flies were recorded at this location. Pre-count and post-count of pest damages before and after an insecticide spray were recorded. SBDH and SBWE were significantly low in the insecticide treated plots (2.9 %DH, 5.01 %WE) as compared to unprotected control (6.4%DH, 6.4% WE). CR Dhan 3006-8-2, CR Dhan 317, 1263, Suraksha, KMR3 and CR Dhan 317 recorded significantly lower SBDH. KMR3, CR Dhan 3006-8-2 and CR Dhan 317 had lower white ear damage as compared to other test entries. Leaf folder damage was significantly low in W1263, RP 2068 and Suraksha. The insecticide treated plots had lower damage as compared to untreated plots. Interaction effects were also significant (Table 2.4.5). Treatments had no effect on the spider population. The grain yield in the protected plots (3215kg/ha) was significantly higher than that of the unprotected plots (2172kg/ha). Among the test entries, CR 3006-8-2, RP5587-273-1-B-B-B, and KMR3 had higher grain yield as compared to other test entries.

Raipur: In the protected treatments spraying of Fipronil 0.3%SC was taken up at 15 days interval for four times starting from 30 DAT. Observations were recorded on the incidence of gall midge, stem borer, planthoppers, case worm, rice hispa and leaf folder. Despite 4 sprays of insecticidal application SBDH and SBWE did not differ significantly between the insecticide treated plots (23.60 % DH, 22.53 % WE and unprotected plots (21.72% DH, 21.11%WE). Cul M9, KMR3 CR Dhan 317 and RP5587-273-1-B-B-B had significantly lower WE damage as compared to other test entries. No significant difference in hispa and leaf folder damage was observed among the varietal treatments. Counts on natural enemies like ground beetles, coccinellids, rove beetles, spiders were recorded. CR Dhan 317, KMR3, CR3006-8-2 recorded higher grain yield among the test entries.

Pattambi: Observations on silver shoots, dead hearts, white ears and leaf folder damaged leaves were recorded in this trial. Silver shoot damage was recorded at 35 DAT, 45 DAT, 55 DAT and 85 DAT but the varietal treatments had significant effect only at 55 DAT. W 1263 had significantly lower damage at all dates of observation though there was heavy incidence at 85 DAT. Dead heart damage was recorded but it was not statistically significant across the varieties or insecticidal treatments. But the white ear damage was significantly low in the unprotected treatments as compared to protected treatments. This was attributed to incessant rain followed by water logging in the protected treatments. Among the varieties, RP2068-18-3-5 had the least damage. Leaf folder damage was significantly lower in CuL M9, W1263 and Suraksha at 45, 55, 75 and 85 DAT. The damage was significantly lower in insecticide treated plots as compared to untreated plots. Grain yield was significantly high in CR3006-8-2 and low in Suraksha.

Warangal: Observations were recorded on the incidence of gall midge before and after the insecticide treatments. Granular application alone reduced the silvr shoot damage significantly. W1263 (*Gm1*), CUL M9, Suraksha (*Gm11*), Akshyadhan PYL, RP2068- 18- 3-5 (*gm3*) recorded significantly lower silver shoot damage in all the four observations as compared to other entries. Dead heart damage was significantly different among varieties at 61 DAT and 85 DAT. KMR3 and CR Dhan 317 recorded significantly lower dead heart damage compared to other test entries. CR Dhan 317, Cul M9 and RP5587-273-1-B-B-B, had significantly lower white ear damage whereas insecticide application had no effect. CR Dhan 317, Akshyadhan PYL, RP5587-273-1-B-B-B, and KMR3 had significantly higher grain yield.

Titabar: Incidence of gall midge, stem borer, leaf folder and case worm were reported from this location. Two sprays of Chlorantraniliprole were given at this location. Silver shoot damage was significantly low in the protected (4.49%SS) plots as compared to unprotected plots (14.31% SS). Silver shoot damage in test entries (8.01-10.88% SS) was not significantly different. The dead heart and white ear damages were significantly low (6.01 % DH and 8.13 % WE) in the protected plots as compared to unprotected plots (11.5% DH and 19.4% WE). The mirid bug population (0.48/10 hills), and dragonflies (1.2 ± 0.12 flies/10 hills) were significantly low as compared to untreated control (1.8 mirid mugs /10 hills and 2.5 ± 0.14 dragon flies /10 hills).

Reaction across locations: In this trial, 9 insect pest resistant cultures were evaluated at 10 locations along with susceptible check TN1 under both protected and unprotected conditions. At TTB, GNV and LDN, CUL M9 was not tested as it is a long duration variety. At IIRR and Pattambi it did not flower.

Silver shoot damage by gall midge was reported from 5 locations *viz.*, Pattambi, Ambikapur, Gangavati, Warangal and Titabar at different dates after transplantation. Observations revealed that across locations, the silver shoot damage was significantly lower (1.43-2.71% SS) in W1263 (*Gm1*), CUL M9, Suraksha (*Gm11*), followed by Akshayadhan PYL, as compared to other varieties (F val, 10.00 at 9 df, P =0) where the damage ranged from 6.3-9.61% SS. These entries were possessing different gall midge resistance genes and can be utilized as donors in the breeding programs for development of gall midge resistant varieties for the endemic locations. Mean silver shoot damage was significantly lower in protected treatments as compared to unprotected treatments (F val 12.49 P= 0.0123).

Dead heart damage by stem borer was reported from 9 locations at different dates of observations (13 Nos) and it was significantly lower in insecticide treatments at 6 locations as compared to unprotected control (F val 22.66, P val0.0005). CUL M9, W1263, and Suraksha recorded a significantly lower damage across locations (0.9-2.13%DH) followed by CR 3006-8- 2 and RP2068-18-3-5 (F val 6.56, P val 0.0000). **White ear damage** by stem borer was reported from 8 locations. White ear damage was significantly lower in protected treatments at 5 locations (Fval 17.93; P val 0.0039) and interaction effects were significant at 2 locations. This variation could be due to the type of insecticide used and the timing of insecticidal application. CulM9 and Suraksha recorded significantly lower damage followed by W 1263 and KMR3 as compared to other test lines (F val 24.78 P val 0.0000).

Leaf folder damage was significant in 6 locations. Protected treatments had significantly lower damage (4.11% DL) as compared to unprotected (6.3% DL) treatments. Among the test entries, damage was significantly low in CulM9 (0.5%DL) followed by Suraksha (3.56 % DL) and W1263 (4.2% DL).

Grain Yield: Analysis of grain yield from 8 locations suggested that grain yields were significantly higher under protected conditions (F al, 5.45, Pval 0.0522). Statistical analysis revealed that among the test entries, yields were higher in KMR 3 and RP5587-273-1-B-B-B (4.2-4.3/ha) followed by CR Dhan 317(F val 4.94, P val 0.0). Interaction effects were not significant. Cul M9 and Suraksha had lower damage for gall midge, stem borer and leaf folder though the yields are very low.

Table 2.4.2 Reaction of resistant cultures to gall midge damage, OPCT, kharif 2023.

Treatments	ABP	ABP	ABP	GNV	PTB	PTB	PTB	PTB	PTB	WGL	WGL	WGL	WGL	TTB
	34 DAT	48 DAT	67 DAT	Post count	35 DAT	45 DAT	55 DAT	75 DAT	85 DAT	45 DAT	61 DAT	69 DAT	85 DAT	
	%Silver Shoots													
					Aft. appln.	Bef. appln.	Aft. appln.	Bef. appln.	Aft. appln.					
CUL M9	1.10(1.22)abc	0.04(0.73)c	0.55(0.94)de	NT	0.59(0.94)cd	5.59(2.34)d	14.88(22.53)e	19.08(25.74)c	25.56(29.42)d	2.03(1.58)d	2.61(1.76)d	1.68(1.43)e	0.69(1.06)bc	NT
CR 3006-8-2	1.29(1.31)ab	0.77(1.02)bc	1.73(1.34)ab	13.40(3.72)a	0.97(1.12)bcd	10.84(3.22)c	34.16(35.64)cd	48.38(44.11)b	43.57(41.19)c	7.35(2.75)bc	11.77(3.46)bc	7.85(2.87)c	0.72(1.07)c	9.21(2.98)
CR Dhan 317	0.93(1.11)bc	0.58(0.97)bc	2.25(1.53)ab	11.85(3.51)b	1.70(1.34)bcd	11.05(3.26)bc	45.92(42.61)ab	64.49(53.80)b	59.91(52.71)ab	13.93(3.77)a	25.21(5.06)a	12.92(3.53)b	1.08(1.22)ab	10.88(3.27)
akshayadhan PYL	0.65(1.02)cd	0.67(1.00)bc	0.64(1.01)cd	10.32(3.28)d	2.79(1.53)abc	17.31(4.10)ab	36.37(36.99)abcd	49.86(44.89)b	60.15(52.27)b	3.31(1.95)d	4.57(2.21)cd	3.99(2.11)d	0.00(0.71)c	8.10(2.82)
RP5587-273-1-B-B-B	1.02(1.15)bc	0.57(0.96)bc	0.43(0.92)de	10.96(3.38)cd	1.44(1.26)bcd	11.22(3.30)bc	33.70(34.13)d	55.10(48.13)b	48.22(44.06)bc	6.47(2.60)c	10.51(3.29)bc	7.74(2.81)c	0.82(1.06)bc	8.01(2.67)
KMR3	0.21(0.83)d	0.49(0.95)bc	1.29(1.26)bc	7.46(2.81)f	0.79(1.07)bcd	13.71(3.59)abc	43.76(41.30)abc	75.73(64.14)a	52.63(47.01)ab	9.71(3.16)b	21.34(4.64)a	17.52(4.21)a	0.92(1.15)ab	8.23(2.71)
Suraksha	0.31(0.87)d	0.00(0.71)c	0.00(0.71)e	5.33(2.38)g	0.42(0.92)d	11.80(3.46)bc	16.62(23.54)e	20.91(26.61)c	23.53(28.70)d	1.56(1.39)e	1.61(1.43)d	1.66(1.46)e	0.00(0.71)bc	9.87(2.89)
W1263	0.60(1.00)cd	0.00(0.71)c	0.00(0.71)e	5.60(2.45)g	0.35(0.87)d	5.22(2.33)d	7.31(14.89)f	6.40(12.92)d	21.00(27.02)d	1.08(1.22)e	2.19(1.61)d	1.58(1.43)e	0.38(0.87)bc	10.73(3.19)
RP2068-18-3-5	0.65(1.02)cd	0.99(1.09)ab	0.99(1.15)bc	11.29(3.43)bc	2.33(1.60)ab	12.06(3.52)abc	42.55(40.59)abc	59.19(50.40)b	64.84(55.65)a	2.37(1.67)d	4.47(2.21)cd	4.47(2.22)d	0.13(0.78)c	9.33(3.04)
TN1	2.23(1.46)a	1.97(1.37)a	3.12(1.72)a	8.27(2.95)e	4.49(2.11)a	18.93(4.33)a	46.80(43.11)a	76.57(64.90)a	67.26(55.74)a	18.51(4.32)a	24.67(5.01)a	20.52(4.57)a	1.99(1.51)a	10.24(3.18)
CD(0.05)	0.25	0.31	0.39	0.12	0.59	0.84	6.33	9.94	9.97	0.52	0.46	0.58	0.36	ns
CV(%)	19.62	27.55	29.44	3.42	46.45	25.24	18.87	22.82	22.99	18.21	12.98	18.6	30.06	20
Main plot treatments														
Protected	0.22(0.82)	0.05(0.73)	0.35(0.84)	8.08(2.88)	1.22(1.14)	11.91(3.38)	29.25(31.68)	45.42(41.77)	43.12(41.30)	6.62(2.49)	10.81(3.04)	7.63(2.60)	0.45(0.92)	4.49(2.15)
UnProtected	1.57(1.38)	1.17(1.17)	1.85(1.42)	10.69(3.32)	1.96(1.41)	11.63(3.31)	35.16(35.39)	49.73(45.35)	50.22(45.46)	6.64(2.39)	10.98(3.10)	8.35(2.73)	0.90(1.10)	14.31(3.80)
CD(0.05)	0.28	ns	0.41	0.13	0.26	ns	2.47	ns	ns	0.08	ns	ns	ns	1.26
CV(%)	23.02	90.43	32.76	3.55	29.09	28.65	10.37	41.72	68.85	2.97	6.11	13.15	67.42	36.23
Interaction														
Protection and Variety	0.36	ns	0.55	0.18	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Variety and Protection	0.4	ns	0.61	0.19	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Experimental Mean	1.1	0.95	1.13	3.1	1.28	3.34	33.53	43.56	43.38	2.44	3.07	2.66	1.01	2.97

Note: Means in a column followed by same letter are not significantly different from one other. Values in parentheses are square root transformed values.

Table 2.4.3 Reaction of resistant cultures to dead heart damage by stem borer at vegetative phase, OPCT, kharif2023.

Treatment No	ABP	ABP	ABP	CHN	CHN	RPR	RPR	RPR	KUL	KUL	LDN	LDN	GNV	GNV
	34 DAT	48 DAT	67 DAT	DH35DAT	DH52DAT	%DH 40DAT	%DH 60DAT	%DH 80DAT	%DH	%DH	46%DH	54%DH	%DH30DAT	%DH
				Before appln.	After appln.				1st obs.	2nd obs.	Before appln.	After appln.	Precount	Post count
CUL M9	1.91(1.43)c	3.67(1.79)cd	3.13(1.86)de	2.43(1.69)a	6.25(2.59)	0.00(0.71)b	11.19(3.38)	21.61(27.41)	NT	NT	NT	NT	NT	NT
CR 3006-8-2	1.51(1.37)c	5.52(2.39)abc	5.80(2.39)bc	1.32(1.28)bc	5.16(2.36)	0.00(0.71)b	11.60(3.40)	20.52(25.63)	1.16(1.13)bc	3.19(1.73)c	4.08(2.13)d	3.62(1.97)c	16.16(4.06)	12.10(3.55)a
CR Dhan 317	5.61(2.40)ab	4.79(2.17)bc	5.11(2.28)bcd	1.44(1.27)c	4.94(2.32)	0.62(0.98)a	13.24(3.66)	19.34(25.83)	0.61(0.98)c	4.79(2.16)bc	5.02(2.35)c	3.93(2.05)c	13.77(3.70)	10.85(3.36)ab
GMSS 20-74	5.08(2.27)b	6.97(2.53)abc	6.27(2.58)b	1.12(1.22)c	5.62(2.47)	0.00(0.71)b	11.84(3.42)	22.01(27.78)	0.75(1.02)c	4.85(2.29)abc	7.08(2.75)b	7.31(2.77)a	15.28(3.92)	9.72(3.19)b
RP5587-273-1-B-B-B	2.38(1.63)c	3.76(1.92)bcd	4.03(1.96)cde	2.21(1.58)abc	9.03(3.04)	0.00(0.71)b	12.47(3.50)	24.81(29.77)	1.36(1.20)abc	9.13(2.73)ab	7.11(2.76)b	6.33(2.60)b	15.26(3.89)	10.66(3.34)ab
KMR3	2.27(1.60)c	7.98(2.82)ab	2.03(1.57)ef	3.49(1.96)a	7.63(2.80)	0.00(0.71)b	13.26(3.64)	22.38(28.08)	1.15(1.09)c	8.93(2.90)ab	3.79(2.07)d	3.54(1.97)c	14.95(3.86)	7.31(2.78)c
Suraksha	4.71(2.23)b	1.23(1.15)d	1.06(1.16)f	3.21(1.93)a	6.62(2.64)	0.00(0.71)b	13.64(3.72)	25.43(30.09)	2.42(1.53)ab	3.14(1.88)c	4.18(2.16)d	3.55(1.97)c	18.20(4.17)	6.87(2.66)c
W1263	1.77(1.48)c	0.84(1.04)d	0.95(1.10)f	2.46(1.66)ab	6.21(2.42)	0.00(0.71)b	11.79(3.46)	20.57(26.43)	0.46(0.89)c	1.80(1.39)d	4.16(2.16)d	3.58(1.97)c	18.89(4.29)	5.40(2.39)d
RP2068	2.26(1.61)c	3.81(2.00)bcd	2.68(1.73)e	1.14(1.18)d	6.62(2.66)	0.00(0.71)b	11.67(3.47)	28.29(31.27)	2.36(1.57)a	10.60(3.07)a	4.05(2.13)d	3.18(1.89)d	14.71(3.83)	10.60(3.33)ab
TN1	7.71(2.84)a	10.56(3.29)a	9.69(3.17)a	2.65(1.76)a	8.29(2.96)	0.35(0.86)ab	12.62(3.57)	21.66(27.47)	2.75(1.58)a	8.43(2.86)ab	7.89(2.89)a	7.13(2.73)a	15.12(3.81)	7.68(2.85)c
CD(0.05)	**0.52**	**0.93**	**0.52**	**0.38**	**ns**	**0.18**	**ns**	**ns**	**0.41**	**0.79**	**0.09**	**0.08**	**ns**	**0.23**
CV(%)	**23.52**	**37.91**	**22.45**	**21.18**	**19.32**	**20.65**	**11.37**	**20.27**	**28.52**	**28.96**	**3.29**	**3.04**	**22.47**	**6.41**
Main treatments														
Protected	2.40(1.60)	3.76(1.90)	2.76(1.66)	1.49(1.33)	6.53(2.58)	0.20(0.79)	12.47(3.54)	23.60(28.79)	0.51(0.94)	3.32(1.80)	5.36(2.39)	2.90(1.81)	13.45(3.66)	8.01(2.87)
UnProtected	4.64(2.17)	6.06(2.32)	5.39(2.30)	2.80(1.77)	6.75(2.67)	0.00(0.71)	12.19(3.50)	21.72(27.17)	2.38(1.50)	8.87(2.87)	5.16(2.36)	6.47(2.62)	18.18(4.24)	10.03(3.23)
CD(0.05)	**0.54**	**ns**	**ns**	**0.31**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.07**	**0.14**	**0.12**
CV(%)	**25.83**	**20.36**	**40.65**	**17.94**	**20.55**	**26.31**	**82.26**	**64.14**	**128.08**	**46.05**	**5.72**	**2.54**	**3.09**	**3.41**
Interaction														
Protection and Variety	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.13**	**0.11**	**ns**	**0.32**
Variety and Protection	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.17**	**0.12**	**ns**	**0.32**
Experimental Mean	**1.89**	**2.11**	**1.98**	**1.55**	**2.62**	**0.75**	**3.52**	**27.98**	**1.22**	**2.34**	**2.38**	**2.21**	**3.95**	**3.05**
CD(0.05)	**0.54**	**ns**	**ns**	**0.31**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.07**	**0.14**	**0.12**
CV(%)	**25.83**	**20.36**	**40.65**	**17.94**	**20.55**	**26.31**	**82.26**	**64.14**	**128.08**	**46.05**	**5.72**	**2.54**	**3.09**	**3.41**

Note: Means in a column followed by same letter are not significantly different from one other. Values in parentheses are arc sine transformed values.

Table 2.4.3 Reaction of resistant cultures to dead heart damage by stem borer at vegetative phase, OPCT, kharif2023 (Contd...)

Treatment No	PTB	PTB	PTB	PTB	PTB	TTB	TTB	WGL	WGL	WGL	WGL
	%DH 30DAT	%DH 45DAT	%DH 55DAT	%DH 75DAT	%DH 85DAT	%DH	%DH 50DAT	%DH 45DAT	%DH61DAT	%DH 69DAT	%DH 85DAT
	After appln	Bef. appln	Aft. appln	Bef appln	Aft. appln	1ST Obser	2ND Obser				
CUL M9	0.67(0.99)a	7.12(2.52)	3.26(1.70)	3.39(1.71)	1.71(1.35)	NT	NT	0.35(0.91)	0.65(0.98)bc	0.34(0.88)	0.57(1.01)bc
CR 3006-8-2	0.00(0.71)b	3.63(1.85)	1.59(1.37)	2.56(1.62)	0.91(1.07)	11.13(3.35)	7.87(2.85)	1.79(1.39)	0.66(1.01)bc	1.00(1.17)	0.43(0.91)bc
CR Dhan 317	0.00(0.71)b	3.18(1.83)	1.25(1.25)	1.66(1.42)	0.13(0.77)	11.48(3.33)	8.86(3.03)	0.63(1.00)	0.83(1.11)bc	3.02(1.43)	0.14(0.78)c
GMSS 20-74	0.00(0.71)b	3.74(1.81)	2.40(1.59)	5.06(2.14)	1.12(1.17)	11.23(3.39)	8.54(2.97)	0.76(1.02)	2.40(1.62)a	2.19(1.62)	0.31(0.87)bc
RP5587-273-1-B-B-B	0.36(0.88)ab	6.44(2.54)	2.60(1.55)	4.07(1.98)	0.40(0.91)	10.66(3.23)	9.01(3.03)	1.23(1.21)	1.52(1.40)ab	1.53(1.30)	0.43(0.94)bc
KMR3	0.00(0.71)b	4.09(2.03)	1.42(1.26)	1.98(1.46)	0.61(1.02)	10.59(3.19)	8.85(3.02)	1.12(1.25)	1.09(1.24)abc	1.09(1.19)	0.12(0.77)c
Suraksha	0.00(0.71)b	2.23(1.58)	1.10(1.19)	1.08(1.15)	0.37(0.88)	9.62(3.10)	8.70(3.02)	0.18(0.81)	0.11(0.77)d	0.00(0.71)	0.56(0.98)bc
W1263	0.19(0.80)ab	3.87(1.90)	1.75(1.37)	1.52(1.35)	0.26(0.84)	9.10(3.03)	9.38(3.08)	0.62(1.01)	0.28(0.85)c	0.10(0.76)	0.75(1.05)bc
RP2068	0.00(0.71)b	4.28(2.06)	2.55(1.67)	3.03(1.74)	0.76(1.08)	9.46(3.01)	8.43(2.95)	1.23(1.29)	2.42(1.65)a	1.16(1.22)	0.85(1.09)b
TN1	0.00(0.71)b	2.31(1.54)	2.11(1.54)	5.28(2.16)	0.39(0.91)	9.28(2.86)	9.15(3.06)	0.27(0.83)	0.78(1.06)bc	0.64(1.03)	4.18(2.10)a
CD(0.05)	**0.19**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.43**	**ns**	**0.29**
CV(%)	**25.24**	**43.62**	**46.99**	**50.75**	**41.82**	**16.64**	**6.36**	**37.49**	**31.66**	**45.28**	**23.88**
Main treatments											
Protected	0.07(0.74)	4.09(1.98)	1.56(1.32)	2.79(1.59)	0.44(0.91)	7.01(2.68)	6.01(2.55)	0.65(1.02)	1.24(1.25)	0.87(1.10)	0.42(0.91)
UnProtected	0.18(0.78)	4.08(1.95)	2.45(1.58)	3.13(1.76)	0.89(1.09)	13.55(3.65)	11.50(3.46)	0.99(1.13)	0.91(1.09)	1.34(1.17)	1.24(1.19)
CD(0.05)	**ns**	**ns**	**ns**	**ns**	**0.16**	**ns**	**0.41**	**ns**	**ns**	**ns**	**0.24**
CV(%)	**41.69**	**62.53**	**37.83**	**40.55**	**22.69**	**74.67**	**11.8**	**48.36**	**43.71**	**34.29**	**20.97**
Interaction											
Protection and Variety	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.41**
Variety and Protection	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.44**
Experimental Mean	**0.76**	**1.97**	**1.45**	**1.67**	**1.0**	**3.17**	**3.0**	**1.07**	**1.17**	**1.13**	**1.05**
CD(0.05)	**ns**	**ns**	**ns**	**ns**	**0.16**	**ns**	**0.41**	**ns**	**ns**	**ns**	**0.24**
CV(%)	**41.69**	**62.53**	**37.83**	**40.55**	**22.69**	**74.67**	**11.8**	**48.36**	**43.71**	**34.29**	**20.97**

Note: Means in a column followed by same letter are not significantly different from one other. Values in parentheses are arc sine transformed values.

Table 2.4.3 Reaction of resistant cultures to white ear damage by stem borer at reproductive phase, OPCT, kharif 2023.

Treatments	CHN	CHN	GNV	IIRR	LDN	PTB	RPR	TTB	TTB	WGL
	77DAT	101DAT	100DAT	Pr harvest	102DAT	Pr harvest	100 DAT	1ST Obser	120 DAT 2nd Obs	107DAT
	White ears (%)									
CUL M9	6.36(2.59)	9.73(3.17)d	NT	NF	NT	17.63(24.68)ab	9.25(17.67)e	NT	NT	0.60(1.02)f
CR 3006-8-2	4.41(2.19)	12.24(3.55)b	17.96(4.29)a	40.55(39.52)a	6.25(2.60)e	22.61(27.99)a	37.13(37.42)a	16.43(4.04)	12.56(3.48)	11.56(3.28)b
CR Dhan 317	4.85(2.26)	7.73(2.84)d	18.05(4.29)a	24.61(29.62)e	7.17(2.76)d	16.90(24.02)ab	14.40(22.15)d	11.99(3.40)	13.09(3.54)	1.04(1.21)e
Akshayadhan PYL	5.44(2.41)	14.90(3.92)a	15.77(4.02)b	29.17(32.67)cd	10.73(3.34)a	19.92(25.94)ab	21.63(27.61)c	17.95(4.24)	14.36(3.82)	5.04(2.14)cd
RP5587-273-1-B-B-B	6.16(2.43)	11.52(3.44)bc	13.14(3.67)c	29.16(32.58)d	11.27(3.42)a	20.02(25.24)ab	15.61(23.23)d	14.26(3.73)	10.41(3.22)	3.37(1.82)de
KMR3	4.84(2.27)	11.57(3.47)bc	13.40(3.68)c	30.10(32.93)cd	6.38(2.62)e	11.74(19.84)b	13.96(21.73)d	12.41(3.44)	12.39(3.55)	3.00(1.69)d
Suraksha	7.14(2.73)	9.01(3.07)d	1.89(1.53)e	29.26(32.72)cd	9.41(3.10)b	13.09(19.69)b	29.39(32.58)b	12.72(3.53)	14.72(3.83)	9.11(3.04)b
W1263	6.36(2.58)	10.48(3.29)cd	0.82(1.14)f	34.94(36.17)abc	8.50(2.98)c	15.59(22.94)ab	29.20(32.51)b	13.61(3.67)	11.81(3.43)	7.52(2.75)bc
RP2068	6.62(2.65)	9.13(3.09)d	14.41(3.84)bc	34.18(35.72)bcd	NT	7.78(11.55)c	25.65(30.29)bc	11.70(3.21)	11.31(3.34)	4.72(2.16)cd
TN1	4.84(2.28)	12.42(3.58)b	10.10(3.23)d	37.75(37.87)ab	10.87(3.36)a	8.28(11.98)c	22.00(27.75)c	12.63(3.48)	10.57(3.25)	16.33(4.09)a
CD(0.05)	**ns**	**0.25**	**0.26**	**3.52**	**0.11**	**6.68**	**3.88**	**ns**	**ns**	**0.77**
CV(%)	**19.11**	**6.42**	**6.78**	**8.75**	**3.15**	**31.21**	**12.2**	**18.01**	**13.98**	**28.49**
Main treatments										
Protected	4.88(2.29)	9.33(3.10)	9.68(3.03)	32.17(34.43)	7.41(2.80)	17.02(23.49)	22.53(27.86)	8.13(2.85)	8.03(2.87)	6.28(2.34)
UnProtected	6.52(2.59)	12.41(3.58)	13.77(3.57)	32.21(34.41)	10.23(3.25)	13.69(19.28)	21.11(26.73)	19.36(4.42)	16.68(4.12)	6.18(2.31)
CD(0.05)	**ns**	**0.18**	**0.54**	**ns**	**0.1**	**4**	**ns**	**0.2**	**0.85**	**ns**
CV(%)	**29.15**	**4.76**	**13.87**	**3.21**	**2.76**	**26.32**	**39.7**	**4.59**	**20.85**	**79.96**
Interaction										
Protection and Variety	**ns**	**ns**	**ns**	**ns**	**0.16**	**9.44**	**ns**	**ns**	**ns**	**ns**
Variety and Protection	**ns**	**ns**	**ns**	**ns**	**0.17**	**9.53**	**ns**	**ns**	**ns**	**ns**
Experimental Mean	**2.44**	**3.34**	**3.3**	**34.42**	**3.02**	**21.39**	**27.29**	**3.64**	**3.5**	**2.32**

NF- no flowering; NT- not tested; Means in a column followed by same letter are not significantly different from one other. Values in parentheses are arc sine transformed values.

Table 2.4.5 Reaction of resistant cultures to leaffolder damage, OPCT, kharif 2023

Treatment	CHN	CHN	GNV	GNV	KUL	KUL	KUL	LDN	LDN	PTB	PTB	PTB	PTB	PTB	RPR	RPR	RPR	TTB	TTB
	52DAT	77DAT	Precount	45DAT	25DAT	35DAT	51DAT	46DAT	54DAT	30DAT	45DAT	55DAT	75DAT	85DAT	40DAT	60DAT	80DAT		65DAT
	% Damaged leaves																		
CUL M9	2.32(1.67)bc	1.39(1.37)	NT	NT	NT	NT	NT	NT	NT	0.18(0.80)	1.71(1.46)	1.11(1.21)b	1.08(1.20)d	4.53(2.13)e	2.92(1.82)	2.81(1.76)	10.39(3.20)	NT	NT
CR 3006-8-2	2.25(1.65)c	1.47(1.39)	6.07(2.42)	8.77(3.04)a	11.05(3.26)	11.23(3.30)ab	2.31(1.55)	5.93(2.53)c	5.01(2.32)de	0.11(0.78)	2.44(1.66)	2.28(1.63)a	9.67(3.15)a	13.22(3.61)ab	2.35(1.63)	2.60(1.74)	7.27(2.75)	7.99(2.79)	10.42(3.22)
CR Dhan 317	3.12(1.88)ab	1.05(1.24)	6.74(2.67)	7.68(2.86)b	8.31(2.95)	9.23(3.09)b	4.01(1.98)	6.12(2.57)c	5.63(2.44)cd	0.11(0.77)	1.81(1.43)	2.52(1.70)a	8.71(3.02)ab	11.57(3.40)abc	3.18(1.87)	2.94(1.81)	7.99(2.86)	8.37(2.88)	9.19(3.06)
Akshayadhan PYL	2.37(1.69)bc	1.13(1.28)	8.60(3.02)	5.78(2.50)d	12.48(3.56)	13.04(3.51)ab	7.66(2.37)	7.01(2.74)ab	7.88(2.85)ab	0.11(0.78)	2.21(1.56)	2.75(1.75)a	8.07(2.89)ab	11.68(3.37)abc	3.10(1.83)	2.74(1.78)	7.40(2.75)	8.22(2.91)	9.68(3.15)
RP5587-273-1-B-B-B	3.30(1.92)a	1.29(1.33)	6.02(2.39)	4.91(2.32)e	11.34(3.40)	11.23(3.36)	4.55(1.97)	6.74(2.69)b	7.53(2.80)b	0.10(0.77)	1.97(1.55)	2.48(1.69)a	6.92(2.65)b	10.31(3.15)bcd	3.62(1.95)	2.03(1.56)	8.11(2.92)	7.81(2.78)	10.18(3.22)
KMR3	2.65(1.77)abc	1.33(1.35)	7.50(2.79)	3.70(2.05)f	8.52(2.96)	9.91(3.16)b	4.51(2.02)	6.85(2.71)b	5.84(2.50)c	0.06(0.75)	1.18(1.28)	2.36(1.65)a	6.65(2.64)b	8.99(3.02)cd	2.74(1.73)	2.12(1.61)	10.04(3.22)	7.04(2.67)	8.78(3.01)
Suraksha	1.96(1.57)c	1.30(1.34)	9.06(3.02)	1.89(1.54)h	8.81(2.98)	5.20(2.36)ab	1.49(1.34)	5.38(2.42)d	4.69(2.26)e	0.03(0.72)	2.05(1.52)	0.74(1.06)c	2.22(1.59)c	7.75(2.74)d	2.53(1.71)	2.29(1.65)	7.55(2.75)	6.38(2.52)	8.54(2.98)
W1263	2.16(1.62)c	1.42(1.38)	5.80(2.48)	1.37(1.36)i	10.32(3.24)	9.82(3.11)b	2.17(1.56)	3.94(2.10)f	3.85(2.07)f	0.01(0.72)	0.75(1.07)	1.79(1.45)ab	2.87(1.72)c	8.26(2.75)d	2.07(1.55)	2.31(1.65)	7.86(2.85)	6.28(2.55)	9.76(3.15)
RP2068	2.72(1.79)abc	1.49(1.41)	7.64(2.83)	6.75(2.69)c	11.54(3.38)	15.15(3.87)a	3.61(1.90)	4.79(2.30)e	4.24(2.16)e	0.06(0.75)	1.44(1.36)	2.08(1.57)ab	6.27(2.56)b	12.25(3.52)abc	3.04(1.83)	2.68(1.74)	7.89(2.84)	7.28(2.73)	9.39(3.12)
TN1	2.39(1.69)bc	1.48(1.40)	8.70(2.99)	2.98(1.86)g	11.55(3.44)	13.23(3.69)ab	2.42(1.65)	7.61(2.84)a	8.70(2.98)a	0.10(0.77)	1.87(1.53)	2.53(1.72)a	6.59(2.57)b	14.26(3.75)a	2.46(1.62)	3.24(1.86)	7.86(2.85)	6.31(2.52)	9.67(3.15)
CD(0.05)	**0.22**	**ns**	**ns**	**0.07**	**ns**	**0.6**	**ns**	**0.10**	**0.16**	**ns**	**ns**	**0.36**	**0.46**	**0.51**	**ns**	**ns**	**ns**	**ns**	**ns**
CV(%)	**10.75**	**9.51**	**21.48**	**2.55**	**13.97**	**15.7**	**31.44**	**3.43**	**5.49**	**13.38**	**26.04**	**23.2**	**19**	**16.1**	**19.04**	**18.29**	**13.18**	**11.23**	**5.68**
Main treatments																			
Protected	2.57(1.74)	1.28(1.33)	7.62(2.79)	4.52(2.17)	11.79(3.47)	8.62(2.98)	0.99(1.19)	6.30(2.59)	4.03(2.12)	0.14(0.79)	1.78(1.44)	1.76(1.43)	4.80(2.15)	7.89(2.74)	3.12(1.83)	2.69(1.74)	8.74(3.00)	4.08(2.11)	6.44(2.63)
UnProtected	2.48(1.72)	1.39(1.37)	7.07(2.68)	5.22(2.33)	9.08(3.02)	13.17(3.56)	6.28(2.44)	5.78(2.50)	7.83(2.85)	0.03(0.73)	1.71(1.44)	2.36(1.66)	7.02(2.65)	12.67(3.55)	2.48(1.67)	2.46(1.69)	7.73(2.79)	10.52(3.29)	12.58(3.61)
CD(0.05)	**ns**	**ns**	**ns**	**0.02**	**ns**	**ns**	**ns**	**ns**	**0.22**	**ns**	**ns**	**0.12**	**0.21**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.13**
CV(%)	**20.75**	**15.43**	**31.05**	**0.84**	**15.24**	**45.11**	**68.51**	**4.85**	**7.39**	**12.2**	**38.54**	**11.24**	**12.38**	**71.89**	**107.18**	**69.16**	**82.1**	**40.18**	**3.56**
Interaction																			
Protection and Variety	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.23**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**
Variety and Protection	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**0.27**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**
Experimental Mean	**1.73**	**1.35**	**2.73**	**2.25**	**3.24**	**3.27**	**1.81**	**2.55**	**2.49**	**0.76**	**1.44**	**1.54**	**2.4**	**3.14**	**1.75**	**1.72**	**2.9**	**2.7**	**3.12**

Note: Means in a column followed by same letter are not significantly different from one other. Values in parentheses are square root transformed values.

Table 2.4.6 Grain yield of resistant cultures tested in OPCT kharif 2023

Treatments	Grain yield (kg/ha)							
	ABP	CHN	GNV	IIRR	LDN	PTB	RPR	WGL
CUL M9	700.76e	5600c	NT	NF	NT	NF	4166.67d	2006.17d
CR 3006-8-2	2838.64bc	6030a	1783.33e	6611.11a	3466.98a	2059.17a	4777.78c	4356.6c
CR Dhan 317	3871.97a	5967.78ab	2268d	6685.19a	3089.62c	1708.33abc	6347.22a	6422.13a
Akshayadhan PYL	2784.85bcd	3925.56e	2788.67cd	4661.11b	2830.19d	1704.17abc	3458.33e	5282.53b
RP5587-273-1-B-B-B	2784.85bcd	4506.67d	2418cd	6875.93a	3264.94b	1642.50bc	4736.11c	5092.59b
KMR3	2311.36cd	5902.22ab	2943.33c	5936.87ab	3202.04b	1549.17bc	5180.56b	5033.24b
Suraksha	645.45e	2662.22g	5053.33a	3432.41c	2637.58e	698.75d	2305.56f	735.99e
W1263	1310.61e	2870f	4093.33b	6345.37a	2633.65e	1848.75ab	2006.94f	1517.09d
RP2068	3210.61ab	3941.11e	2784cd	6594.44a	NF	1731.67abc	4125d	3774.93c
TN1	2138.64d	5823.33b	2432.67cd	5550ab	1352.2f	1410.42c	3368.06e	3948.24c
CD(0.05)	679	170	590	1387	83	392	381	646
CV(%)	26	3	17	16	3	25	8	15
Main plot treatments								
Protected	2516	4867	4208	6168	3216	1809	4758	4275
UnProtected	2003	4579	1696	5541	2172	1380	3336	3359
CD(0.05)	ns	ns	1453	461	147	84	111	316
CV(%)	21	6	42	2	5	7	2	7
Interaction								
Protection and Variety	ns	ns	835	1961	117	ns	ns	ns
Variety and Protection	ns	ns	1371	1866	159	ns	ns	ns
Experimental Mean	2260	4723	2952	5855	2694	1557	4047	3817

Note: Means in a column followed by same letter are not significantly different from one other. NF- No flowering; NT- Not tested

2.5.1 Influence of Establishment Methods on Pest Incidence (IEMP)

The increasing pressure on irrigated agriculture to use less water due to the global water shortage, particularly in Asia and India is forcing farmers and scientists to search for alternatives. India's traditional rice-growing practices pose a significant threat to water conservation. The System of Rice Intensification (SRI), aerobic rice, mechanical transplanting, direct seeding, and other alternative rice establishment techniques are already being used by rice farmers. With this in mind, a collaborative study with the Agronomy division was designed to evaluate the impact of crop establishment techniques on the incidence of insect pests.

During *Kharif* 2023, the trial was conducted at 12 locations, *viz.* Aduthurai, Chinsurah, Ghaghraghat, Jagdalpur, Malan, Moncompu, Nawagam, Pantnagar, Pusa, Pattambi, Rajendranagar and Titabar.

1. Aduthurai

Mechanical transplanting, direct seeding and normal transplanting methods were evaluated with ADT 56 variety at this location (**Table2.5.1.1**). Incidence of dead hearts and white ears caused by stem borer, silver shoots caused by gall midge; leaf folder, whorl maggot and hispa damaged leaves and brown planthopper numbers was observed in all three establishment methods. However, the incidence was low and at par in all the establishment methods.

Table 2.5.1.1 Influence of Crop Establishment Methods on Pest Incidence at Aduthurai, *Kharif* 2023

Treatments	% DH		% WE	% SS	% LFDL	% WMDL	% HDL	BPH / 5 hills
	45 DAT	60 DAT	Pre-harvest	45 DAT	75 DAT	45 DAT	30 DAT	60 DAT
T1 = Mechanical transplanting	6.7(2.5)a	7.6(2.8)a	10.2(3.3)a	0.3(0.8)a	0.2(0.8)b	1.4(1.3)a	0.1(0.8)a	0.4(0.9)a
T2 = Direct seeding	3.9(1.7)a	3.7(1.7)a	6.5(2.6)a	0.0(0.7)a	1.8(1.4)ab	2.5(1.6)a	10.4(2.6)a	6.2(2.0)a
T3 = Normal transplanting	11.0(3.2)a	5.0(1.9)a	10.5(2.8)a	0.2(0.8)a	3.6(1.9)a	2.1(1.3)a	3.0(1.8)a	2.0(1.2)a
LSD (0.05)	***1.68***	***2.07***	***1.91***	***0.33***	***0.93***	***0.39***	***2.35***	***2.34***
CV (%)	***17.86***	***24.14***	***37.04***	***24.04***	***38.18***	***15.25***	***15.96***	***15.75***

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

2. Chinsurah

At this location, three establishment methods, mechanised transplanting, puddled direct seeding and unpuddled dry direct seeding were evaluated as main plots and weedy check, mechanical weeding and chemical weed control as subplots with Manisha variety (**Table 2.5.1.2**). There was a high incidence of dead hearts at 45 DAT (13.4 – 34.4% DH) but they were at par in different establishment methods. A similar trend was observed with dead hearts at 30 DAT and 60 DAT. White ear damage varied from 17.1 to 20.3% with no significant differences among the establishment methods. A similar trend was noticed for whorl maggot damage (15.0

– 22.2% WMDL). Among the subplots, dead heart damage was high in mechanical weeding (32.6% DH) and was at par with chemical weed control (18.2% DH) and weedy check (13.3% DH) at 45 DAT. The same trend was noticed for white ear damage and whorl maggot damage among subplot treatments.

Table 2.5.1.2 Influence of Crop Establishment Methods on Pest Incidence at Chinsurah, *Kharif* 2023

Main plots		% DH			% WE	% LFDL	% WMDL
		30 DAT	45 DAT	60 DAT	Pre har	60 DAT	30 DAT
M1 = Mechanised transplanting		14.4(3.3)a	16.3(4.0)a	8.5(3.0)a	18.0(4.2)a	5.8(2.5)a	15.0(3.9)a
M2 = Puddled direct seeding		18.5(3.4)a	13.4(3.7)a	17.3(4.2)a	17.1(4.2)a	5.5(2.4)a	22.2(4.3)a
M3 = Unpuddled dry direct seeding		12.5(2.9)a	34.4(5.1)a	18.4(4.3)a	20.3(4.5)a	5.1(2.3)a	18.3(3.8)a
LSD (0.05)		**4.06**	**2.53**	**0.80**	**0.65**	**0.38**	**5.96**
CV(%)		**25.89**	**25.26**	**12.44**	**8.89**	**9.38**	**18.66**
Sub-plots							
S1 = Weedy check		11.0(2.8)a	13.3(3.7)a	14.9(3.8)a	18.0(4.3)a	6.1(2.5)a	21.2(4.1)a
S2 = Mechanical weeding		11.8(3.0)a	32.6(4.9)a	15.9(4.0)a	18.8(4.4)a	5.2(2.4)a	17.7(4.0)a
S3 = Chemical weed control		22.6(3.8)a	18.2(4.3)a	13.3(3.6)a	18.7(4.3)a	5.2(2.4)a	16.5(3.9)a
LSD (0.05)		**3.36**	**2.61**	**0.54**	**0.81**	**0.39**	**1.71**
CV(%)		**23.76**	**28.55**	**11.17**	**14.81**	**12.78**	**23.83**
M1 = Mechanised transplanting	Weedy check	11.1(3.0)a	12.2(3.5)a	9.2(3.1)b	17.3(4.2)a	5.0(2.3)a	13.7(3.7)a
	Mechanical weeding	13.3(3.1)a	21.5(4.7)a	9.0(3.1)b	16.3(4.1)a	6.5(2.6)a	14.9(3.9)a
	Chemical weed control	18.8(3.8)a	15.2(3.9)a	7.2(2.7)b	20.3(4.4)a	6.0(2.5)a	16.3(4.1)a
M2 = Puddled direct seeding	Weedy check	6.1(1.9)a	13.7(3.8)a	17.7(4.2)ab	16.7(4.1)a	7.1(2.7)a	25.7(4.4)a
	Mechanical weeding	11.6(3.0)a	9.6(3.2)a	17.1(4.2)ab	18.3(4.3)a	4.7(2.3)a	24.5(4.9)a
	Chemical weed control	37.8(5.1)a	17.0(4.2)a	17.0(4.2)ab	16.5(4.1)a	4.8(2.3)a	16.4(3.5)a
M3 = Unpuddled dry direct seeding	Weedy check	15.9(3.4)a	14.0(3.7)a	17.7(4.2)ab	19.8(4.5)a	6.1(2.6)a	24.3(4.2)a
	Mechanical weeding	10.4(2.9)a	66.7(6.8)a	21.6(4.7)a	21.8(4.7)a	4.4(2.2)a	13.8(3.2)a
	Chemical weed control	11.1(2.4)a	22.5(4.8)a	15.7(4.0)ab	19.2(4.4)a	4.9(2.3)a	16.9(4.1)a
LSD (0.05) M in S		**8.10**	**6.30**	**1.30**	**1.95**	**0.94**	**4.11**
LSD (0.05) S in M		**8.86**	**6.31**	**1.58**	**1.84**	**0.95**	**9.48**

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

3. Ghaghraghat

Three establishment methods, *viz.*, Direct seeding, Normal transplanting and Aerobic rice were evaluated with the NDR 2065 variety at this location. The incidence of dead hearts caused by stem borer was significantly high in Direct seeding (18.6%DH) and was at par with Aerobic rice (15.0%DH) as compared to normal transplanting (7.9%DH) at 60 DAT (**Table 2.5.1.3)** Similarly, white ear incidence was above ETL in direct seeding (10.8%WE) alone compared to the other two methods. Leaf folder damage was significantly high in aerobic rice (14.5%LFDL) and was at par with direct seeding (11.2%LFDL) as compared to normal transplanting (3.6%LFDL) at 60 DAT.

Table 2.5.1.3 Influence of Crop Establishment Methods on Pest Incidence at Ghaghraghat, *Kharif* 2023

Treatments	% DH			% WE	% LFDL	
	45 DAT	60 DAT	75 DAT	Pre har	60 DAT	75 DAT
T1 = Direct seeding	6.9(2.1)a	18.6(4.3)a	13.5(3.4)a	10.8(3.3)a	11.2(3.4)a	7.4(2.8)a
T2 = Normal transplanting	7.3(2.6)a	7.9(2.8)b	6.4(2.6)a	5.6(2.5)b	3.6(2.0)b	4.2(2.2)b
T3 = Aerobic rice	8.2(2.5)a	15.0(3.9)a	16.4(4.0)a	9.3(3.1)a	14.5(3.8)a	8.5(3.0)a
LSD (0.05)	***2.17***	***0.92***	***1.93***	***0.62***	***0.62***	***0.50***
CV(%)	***20.27***	***13.88***	***31.85***	***11.73***	***12.13***	***10.56***

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

4. Jagdalpur

Durgheswary variety was grown in 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 (**Table 2.5.1.4)**. Low incidence of dead hearts (<6% DH), white ears (<7% WE), silver shoots (<3%SS), leaf folder (<3% LFDL), whorl maggot (<4% WMDL) and thrips (11.2 – 11.7% THDL) was noticed in both main plot and subplot treatments and were at par with each other.

Table 2.5.1.4 Influence of Crop Establishment Methods on Pest Incidence at Jagdalpur, *Kharif* 2023

Main plots		% DH		% WE	% SS		% LFDL		% THDL	% WMDL
		45 DAT	75 DAT	Pre har	60 DAT	75 DAT	75 DAT	90 DAT	45 DAT	45 DAT
M1 = Normal transplanting		2.7(1.6)a	4.5(2.2)a	3.5(1.9)a	1.8(1.2)a	1.7(1.3)a	2.6(1.7)a	2.1(1.6)a	11.2(3.4)a	3.5(2.0)a
M2 = Puddled direct seeding		0.8(1.0)a	5.1(2.3)a	4.5(2.1)a	1.1(1.1)a	0.6(1.0)a	2.0(1.5)a	1.1(1.2)a	11.7(3.5)a	1.4(1.3)b
M3 = Unpuddled direct seeding		1.6(1.3)a	4.9(2.2)a	6.5(2.4)a	1.2(1.1)a	0.6(0.9)a	2.4(1.7)a	2.3(1.6)a	11.6(3.5)a	2.1(1.6)ab
LSD (0.05)		**0.99**	**1.06**	**1.96**	**1.77**	**0.59**	**0.49**	**0.54**	**0.54**	**0.62**
CV(%)		**24.91**	**28.28**	**24.31**	**21.05**	**33.48**	**17.73**	**22.16**	**9.33**	**22.54**
Sub-plots										
S1 = Weedy check		1.8(1.4)a	3.8(2.0)a	4.0(2.0)a	0.3(0.8)a	0.0(0.7)b	2.2(1.6)a	2.5(1.7)a	11.6(3.5)a	2.4(1.7)a
S2 = Mechanical weeding		1.8(1.3)a	4.5(2.1)a	6.3(2.5)a	2.7(1.5)a	1.0(1.0)ab	2.3(1.6)a	1.7(1.4)ab	11.3(3.4)a	2.0(1.5)a
S3 = Chemical weed control		1.5(1.2)a	6.2(2.5)a	4.2(2.0)a	1.1(1.1)a	2.0(1.4)a	2.5(1.7)a	1.2(1.3)b	11.7(3.5)a	2.6(1.7)a
LSD (0.05)		**0.98**	**0.74**	**1.02**	**0.95**	**0.62**	**0.51**	**0.39**	**0.29**	**0.42**
CV(%)		**28.83**	**26.17**	**37.72**	**25.47**	**27.04**	**24.45**	**21.39**	**6.59**	**20.57**
M1 = Normal transplanting	S1	1.8(1.4)a	4.2(2.2)a	2.8(1.6)a	0.0(0.7)a	0.0(0.7)b	1.8(1.5)a	2.9(1.8)a	12.2(3.6)a	3.7(2.0)a
	S2	3.1(1.7)a	3.4(1.9)a	4.2(2.2)a	4.6(2.0)a	0.0(0.7)b	2.9(1.8)a	1.5(1.4)a	10.8(3.3)a	3.6(2.0)a
	S3	3.3(1.8)a	5.9(2.5)a	3.5(1.8)a	0.9(1.1)a	5.1(2.4)a	3.1(1.8)a	1.9(1.5)a	10.6(3.3)a	3.3(1.9)a
M2 = Puddled direct seeding	S1	2.3(1.6)a	4.3(2.2)a	3.6(2.0)a	0.0(0.7)a	0.0(0.7)b	1.2(1.3)a	1.2(1.3)a	11.8(3.5)a	1.4(1.4)a
	S2	0.0(0.7)a	5.6(2.4)a	4.6(2.1)a	2.4(1.4)a	1.0(1.1)ab	1.6(1.4)a	0.8(1.1)a	10.1(3.2)a	0.8(1.1)a
	S3	0.0(0.7)a	5.4(2.4)a	5.3(2.4)a	1.1(1.1)a	0.9(1.1)ab	3.1(1.9)a	1.2(1.3)a	13.2(3.7)a	1.8(1.5)a
M3 = Unpuddled direct seeding	S1	1.2(1.1)a	3.0(1.7)a	5.7(2.2)a	1.1(1.1)a	0.0(0.7)b	3.5(2.0)a	3.3(1.9)a	10.8(3.3)a	2.2(1.6)a
	S2	2.3(1.6)a	4.5(2.0)a	9.9(3.2)a	1.3(1.2)a	2.0(1.3)ab	2.5(1.7)a	2.8(1.8)a	13.0(3.7)a	1.5(1.3)a
	S3	1.3(1.2)a	7.3(2.8)a	3.8(1.8)a	2.0(1.1)a	0.0(0.7)b	1.3(1.3)a	0.6(1.0)a	11.2(3.4)a	2.5(1.7)a
LSD (0.05) M in S		**2.35**	**1.78**	**2.47**	**2.30**	**1.50**	**1.21**	**0.95**	**0.69**	**1.02**
LSD (0.05) S in M		**2.39**	**2.12**	**3.52**	**3.20**	**1.49**	**1.22**	**1.11**	**0.98**	**1.23**

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

5. Malan

Direct seeding, normal transplanting and semi-dry rice methods were assessed with HPR 1068 variety at this location (**Table 2.5.1.5)**. At 90 DAT, the dead heart damage was significantly high in normal transplanting (21.5% DH) and was at par with semi-dry rice (18.6%DH) followed by direct seeding (15.5%DH). Though the dead heart damage varied from 10.1 to 18.1% DH at 75 DAT, it was at par in all the establishment methods. Leaf folder damage at 60 DAT was significantly greater in the normal transplanting method (21.8% LFDL) compared to semi-dry rice (14.2% LFDL) which was at par with direct seeding (12.9% LFDL). Though the leaf folder damage was high at 45 DAT (14.9 – 19.7% LFDL), 75 DAT (13.9 – 23.0% LFDL) and 90 DAT (13.6 – 22.3% LFDL), it was at par in all the three establishment methods.

Table 2.5.1.5 Influence of Crop Establishment Methods on Pest Incidence at Malan, *Kharif* 2023

Treatments	% DH			% LFDL			
	60 DAT	75 DAT	90 DAT	45 DAT	60 DAT	75 DAT	90 DAT
T1 = Direct seeding	6.3(2.2)a	10.1(3.2)a	15.5(4.0)b	17.9(4.3)a	12.9(3.6)b	19.0(4.4)a	18.9(4.3)a
T2 = Normal transplanting	11.9(3.3)a	18.1(4.3)a	21.5(4.5)a	19.7(4.5)a	21.8(4.7)a	23.0(4.8)a	22.3(4.7)a
T3 = Semi-dry rice	9.5(2.9)a	11.7(3.4)a	18.6(4.4)ab	14.9(3.9)a	14.2(3.8)b	13.9(3.8)a	13.6(3.7)a
LSD (0.05)	***1.5***	***1.19***	***0.51***	***0.62***	***0.71***	***1.18***	***1.27***
CV(%)	***29.84***	***18.21***	***6.59***	***8.28***	***9.81***	***15.26***	***16.52***

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

6. Moncompu

At this location, two crop establishment methods, 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. Low incidence of dead hearts caused by stem borer (<3% DH), hispa (<1% HDL), leaf folder (<3% LFDL), and BPH (<5/hill) was observed in all the main plot and sub-plot treatments (**Table 2.5.1.6)**.

Table 2.5.1.6 Influence of Crop Establishment Methods on Pest Incidence at Moncompu, *Kharif* 2023

Main plots		**% DH**		**%WE**	**%HDL**	**%LFDL**	**BPH (No./5 hills)**
		45 DAT	**60 DAT**	**Preharvest**	**30 DAT**	**30 DAT**	**60 DAT**
Drum seeding		1.1(1.1)a	1.2(1.2)a	1.2(1.2)a	0.08(0.7)a	1.8(1.5)a	5.3(2.2)a
Normal Transplanting		2.1(1.5)a	1.2(1.2)a	0.9(1.1)a	0.2(0.8)a	2.1(1.6)a	3.4(1.8)a
LSD (0.05)		**1.14**	**1.00**	**0.93**	**0.24**	**0.58**	**0.77**
CV(%)		**30.31**	**27.09**	**26.77**	**24.9**	**30.54**	**30.55**
Subplots							
Cono weeding		1.3(1.2)a	1.1(1.9)a	0.8(1.0)a	0.3(0.8)a	2.0(1.5)a	5.7(2.3)a
Chemical weed control		1.9(1.4)a	1.3(1.2)a	1.3(1.2)a	0.0(0.7)a	1.9(1.5)a	3.0(1.7)a
LSD (0.05)		**0.45**	**0.46**	**0.49**	**0.17**	**0.51**	**0.57**
CV(%)		**33.55**	**27.08**	**22.57**	**21.24**	**32.26**	**27.35**
Drum seeding	Cono weeding	0.8(1.0)a	1.1(1.2)a	1.3(1.9)a	0.2(0.8)a	1.7(1.5)a	9.0(3.0)a
	Chemical weed control	1.4(1.2)a	1.4(1.3)a	1.1(1.1)a	0.0(0.7)a	1.9(1.5)a	1.6(1.4)a
Normal Transplanting	Cono weeding	1.7(1.4)a	1.2(1.2)a	0.4(0.9)a	0.4(0.9)a	2.4(1.6)a	2.4(1.6)a
	Chemical weed control	2.4(1.6)a	1.2(1.2)a	1.5(1.2)a	0.0(0.7)a	1.9(1.5)a	4.4(2.0)a
LSD (0.05) M in S		**0.89**	**0.9**	**0.96**	**0.33**	**0.99**	**1.12**
LSD (0.05) S in M		**1.78**	**1.59**	**1.51**	**0.41**	**1.09**	**1.37**

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

7. Nawagam

Three establishment methods, mechanical transplanting, direct seeding and aerobic rice were evaluated with GAR 13 variety (**Table 2.5.1.7**). Dead heart damage was significantly high in aerobic rice (22.8%DH) and was at par with direct seeding (20.3%DH) as compared to the normal transplanting method (11.9% DH) at 75 DAT. A similar trend was observed at 60 DAT. However, white ear damage at the reproductive stage ranged between 12.8 and 19.4% WE and was at par with each other. Leaf folder damage at 75 DAT was significantly higher in aerobic rice (16.5% LFDL) and was on par with direct seeding (13.1% LFDL) as against mechanical transplanting (7.7% LFDL). A low incidence of WBPH was noticed in all three crop establishment methods.

Table 2.5.1.7 Influence of Crop Establishment Methods on Pest Incidence at Nawagam, *Kharif* 2023

Treatments	% DH			% WE	% LFDL		WBPH / 5 hills	
	45 DAT	60 DAT	75 DAT	Pre har	45 DAT	75 DAT	60 DAT	75 DAT
T1 = Mechanical transplanting	7.5(2.8)a	8.2(2.9)b	11.9(3.5)b	12.8(3.6)a	2.8(1.8)b	7.7(2.9)b	3.8(2.1)a	6.2(2.6)a
T2 = Direct seeding	11.9(3.5)a	15.0(3.9)a	20.3(4.4)ab	15.3(3.9)a	9.8(3.2)a	13.1(3.7)a	1.4(1.4)b	3.0(1.9)c
T3 = Aerobic rice	12.1(3.5)a	14.8(3.8)ab	22.8(4.8)a	19.4(4.4)a	9.5(3.1)a	16.5(4.1)a	1.5(1.4)b	4.2(2.2)b
LSD (0.05)	***0.83***	***1.06***	***1.24***	***1.13***	***0.85***	***0.78***	***0.18***	***0.29***
CV(%)	***14.18***	***16.54***	***16.33***	***15.84***	***17.48***	***12.26***	***6.3***	***7.45***

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

8. Pantnagar

PD 24 variety was grown in four establishment methods, *viz.*, wet direct seeded rice (Wet DSR), direct seeding, normal transplanting and aerobic rice. The incidence of white ears was significantly higher in aerobic rice (14.1% WE) as compared to direct seeded rice (3.0% WE) but was at par with normal transplanting (8.9% WE) and Wet DSR (8.6% WE). The incidence of dead hearts, leaf folder, whorl maggot, hispa and BPH was low in all four establishment methods (**Table 2.5.1.8**).

Table 2.5.1.8 Influence of Crop Establishment Methods on Pest Incidence at Pantnagar, *Kharif* 2023

Establishment methods	% DH		% WE	% LFDL	% WMDL	%HDL	BPH
	45 DAT	60 DAT	Pre har	45 DAT	45 DAT	45 DAT	75 DAT
Wet DSR	13.0(3.6)a	1.3(1.1)a	8.6(2.9)ab	0.5(1.0)a	3.0(1.8)a	2.8(1.7)a	1.6(1.3)a
Direct seeding	10.0(3.2)a	2.9(1.7)a	3.0(1.5)b	2.4(1.6)a	3.8(2.1)a	4.1(2.1)a	1.4(1.2)a
Normal transplanting	7.6(2.8)a	5.8(2.5)a	8.9(3.0)ab	1.6(1.4)a	2.4(1.7)a	2.1(1.6)a	4.8(2.2)a
Aerobic rice	10.8(3.2)a	4.7(2.1)a	14.1(3.7)a	1.1(1.2)a	4.3(2.2)a	2.6(1.7)a	2.6(1.6)a
LSD (0.05)	**1.39**	**1.43**	**1.99**	**0.90**	**0.89**	**0.90**	**1.31**
CV(%)	**23.28**	**21.72**	**38.29**	**36.94**	**24.82**	**26.91**	**24.82**

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

9. Pattambi

At this location, four establishment methods, *viz.*, line sowing with drum seeder, direct seeding, normal transplanting and semi-dry rice were evaluated with Aishwarya variety (**Table 2.5.1.9**). The incidence of silver shoots caused by gall midge was significantly high in direct seeding (30% SS) at 30 DAT and was at par with the other three establishment methods (11.3 – 22.0% SS). Whorl maggot incidence was significantly higher in normal transplanting method (8.9% WMDL) as compared to semi-dry rice (4.4% WMDL). Low incidence of dead hearts (<3% DH), white ears (<5% WE), caseworm (<5% CWDL) and blue beetle (<1% BBDL) was observed in all the crop establishment methods.

Table 2.5.1.9 Influence of Crop Establishment Methods on Pest Incidence at Pattambi, *Kharif* 2023

Treatments	% DH	% WE	% SS			% WMDL		% CWDL	%BBDL
	30 DAT	Pre har	30 DAT	50 DAT	75 DAT	30 DAT	65 DAT	30 DAT	30 DAT
T1 = Line sowing with drum seeder	1.4 (1.4)a	0.4 (0.9)a	22.0 (4.7)a	7.6 (2.8)a	20.7 (4.4)a	5.1 (2.4)ab	7.1 (2.7)ab	3.0 (1.7)a	0.0 (0.7)a
T2 = Direct seeding	1.0 (1.2)a	2.4 (1.6)a	30.0 (5.2)a	11.3 (3.2)a	20.0 (4.5)a	6.6 (2.6)a	6.3 (2.6)ab	4.0 (1.8)a	0.0 (0.7)a
T3 = Normal transplanting	2.4 (1.7)a	4.4 (2.1)a	11.3 (3.4)a	2.0 (1.5)a	8.0 (2.9)a	1.7 (1.4)b	8.9 (3.1)a	0.9 (1.1)a	0.4 (0.9)a
T4 = Semi-dry rice	1.2 (1.2)a	0.9 (1.1)a	17.3 (4.1)a	6.9 (2.4)a	18.2 (4.3)a	5.5 (2.4)ab	4.4 (2.2)b	1.1 (1.2)a	0.6 (1.0)a
LSD (0.05)	**0.78**	**1.88**	**3.55**	**2.39**	**2.32**	**1.07**	**0.61**	**1.53**	**0.71**
CV(%)	**20.22**	**26.72**	**28.82**	**34.28**	**20.51**	**17.08**	**8.1**	**37.57**	**30.44**

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

10. Pusa

Three establishment methods, puddled direct seeding, direct seeding and normal transplanting were assessed with Rajendra Bhagwati variety. At 30 DAT, dead heart damage was significantly high in direct seeding (33.3% DH) and was at par with puddled direct seeding (21.3% DH) as compared to normal transplanting (1.9% DH). The same trend was observed at 45 DAT also. However, at 75 DAT, the incidence of dead hearts was significantly high in puddled direct seeding (21.9% DH) compared to the other two methods (**Table 2.5.1.10**). White ear incidence was significantly low in normal transplanting (8.4% WE) as compared to direct seeding (14.8% WE). Leaf folder incidence varied from 9.8% to 13.8% and was at par in different crop establishment methods.

Table2.5.1.10 Influence of Crop Establishment Methods on Pest Incidence at Pusa, k*harif* 2023

Treatments	% DH				% WE	% LFDL	
	30 DAT	45 DAT	75 DAT	90 DAT	Pre har	45 DAT	75 DAT
T1 = Puddled direct seeding	21.3(4.1)ab	15.9(4.0)a	21.9(4.7)a	25.6(5.0)a	12.7(3.6)ab	9.8(3.2)a	13.1(3.6)a
T2 = Direct seeding	33.3(5.7)a	21.7(4.7)a	12.5(3.5)b	15.9(4.0)a	14.8(3.9)a	13.8(3.7)a	10.9(3.3)a
T3 = Normal transplanting	1.9(1.2)b	5.6(2.0)b	8.9(3.0)b	11.7(3.4)a	8.4(3.0)b	10.0(3.2)a	12.8(3.6)a
LSD (0.05)	***4.19***	***1.89***	***0.96***	***1.75***	***0.69***	***1.21***	***1.13***
CV(%)	***21.95***	***24.39***	***11.79***	***19.34***	***9.04***	***16.58***	***14.64***

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. Rajendranagar

RNR 15048 variety was grown in split plot design with three crop establishment methods as main plots and four weed management practices as sub-plots (**Table 2.5.1.11**). The three crop establishment methods include manual transplanting, puddled direct seeding by drum seeder, and unpuddled direct seeding by line sowing while the sub-plot treatments include weed-free, weedy check, mechanical weeding using weeder and chemical weed control. The incidence of dead hearts (<1% DH), white ears (<10% WE) and leaf folder (<1% LFDL) was very low in all the treatments and their interactions.

Table 2.5.1.11 Influence of Crop Establishment Methods on Pest Incidence at Rajendranagar, *Kharif* 2023

Main plots		%DH	% WE	%LFDL
			Pre har	60 DAT
M1 = Manual transplanting		0.2(0.8)a	8.9(3.0)a	0.2(0.8)a
M2 = Puddled direct seeding		0.0(0.7)a	5.3(2.3)a	0.2(0.8)a
M3 = Unpuddled dry direct seeding - line sowing		0.02(0.7)a	0.8(1.0)b	0.02(0.7)a
LSD (0.05)		**0.09**	**1.56**	**0.19**
CV(%)		**22.42**	**35.00**	**14.54**
Sub-plots				
S1 = Weed free		0.03(0.7)a	5.4(2.1)a	0.2(0.8)a
S2 = Weedy check		0.09(0.8)a	5.8(2.3)a	0.1(0.8)a
S3 = Mechanical weeding		0.04(0.7)a	4.7(2.1)a	0.1(0.8)a
S4 = Chemical weed control		0.09(0.7)a	4.2(1.9)a	0.1(0.8)a
LSD (0.05)		**0.14**	**1.89**	**0.06**
CV(%)		**16.62**	**31.93**	**7.00**
M1 = Manual transplanting	Weed free	0.0(0.7)a	9.5(2.9)ab	0.3(0.9)a
	Weedy check	0.3(0.9)a	9.5(3.1)a	0.2(0.8)a
	Mechanical weeding	0.1(0.8)a	8.4(3.0)ab	0.2(0.8)a
	Chemical weed control	0.3(0.9)a	8.3(2.9)ab	0.1(0.8)a
M2 = Puddled direct seeding	Weed free	0.0(0.7)a	5.7(2.4)ab	0.2(0.9)a
	Weedy check	0.0(0.7)a	5.7(2.3)ab	0.2(0.9)a
	Mechanical weeding	0.0(0.7)a	5.2(2.2)ab	0.1(0.8)a
	Chemical weed control	0.0(0.7)a	4.6(2.2)ab	0.3(0.9)a
M3 = Unpuddled dry direct seeding	Weed free	0.1(0.8)a	0.9(1.1)ab	0.05(0.7)a
	Weedy check	0.0(0.7)a	2.2(1.5)ab	0.0(0.7)a
	Mechanical weeding	0.0(0.7)a	0.6(1.0)ab	0.05(0.7)a
	Chemical weed control	0.0(0.7)a	0.4(0.5)b	0.0(0.7)a
LSD (0.05) M in S		**0.16**	**0.19**	**0.09**
LSD (0.05) S in M		**0.14**	**0.20**	**0.08**

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

12. Titabar

Four establishment methods, *viz.*, mechanical transplanting, direct seeding, normal transplanting and aerobic rice were assessed with Shraboni variety (**Table 2.5.1.12)**. 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 2.5.1.12 Influence of Crop Establishment Methods on Pest Incidence at Titabar, *Kharif* 2023

Establishment methods	% DH	% WE	%SS	% LFDL	% WMDL	% CWDL
	60 DAT	Pre harvest	45 DAT	60 DAT	45 DAT	45 DAT

Mechanical transplanting	4.2(1.9)a	8.1(2.9)a	4.0(1.9)a	2.3(1.5)ab	2.9(1.7)a	3.0(1.7)a
Direct seeding	6.4(2.6)a	4.3(2.2)ab	0.0(0.7)a	4.0(2.1)a	4.6(2.1)a	3.6(1.9)a
Normal transplanting	2.5(1.6)a	2.5(1.6)b	3.3(1.7)a	2.1(1.5)ab	2.4(1.6)a	3.3(1.9)a
Aerobic rice	3.9(2.0)a	2.7(1.6)ab	4.2(2.1)a	0.2(0.8)b	0.2(0.8)a	3.0(1.8)a
LSD (0.05)	**1.52**	**1.31**	**1.46**	**1.11**	**1.54**	**1.02**
CV(%)	**20.31**	**33.84**	**28.73**	**20.05**	**23.19**	**29.84**

Values in parenthesis 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 stem borer, gall midge, leaf folder, whorl maggot, hispa, caseworm, thrips, blue beetle, brown planthopper and white-backed planthopper was observed in all the crop establishment methods during *Kharif* 2023. The incidence of dead hearts was high in puddled direct seeding (12.9% DH) and was at par with direct seeding (12.1% DH) and aerobic rice as compared to other methods (**Figure 2.5.1.1**). The incidence of white ears was significantly higher in aerobic rice (11.4% WE) followed by mechanical transplanting (10% WE). White ear incidence was low in semi-dry rice, normal transplanting and puddled direct seeding. Gall midge incidence was significantly high in semi-dry rice (14.1% SS) and very low in puddled direct seeding, mechanical transplanting, normal transplanting and aerobic rice.

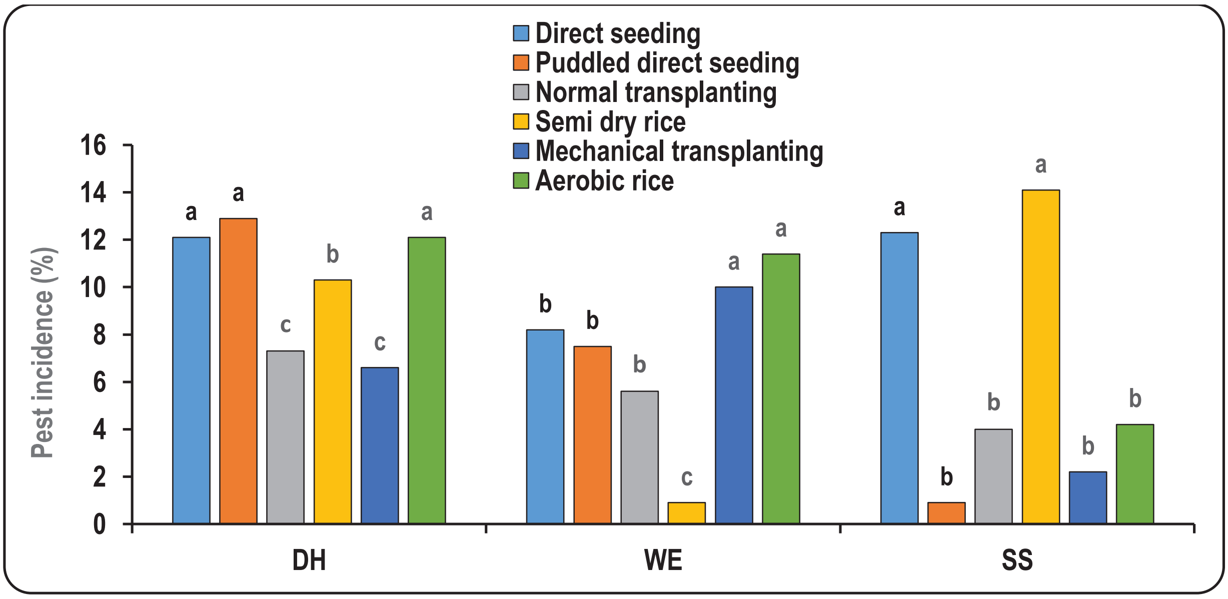


Figure2.5.1 Incidence of stem borer and gall midge in different crop establishment methods across locations

Among the foliage-feeding insects, leaf folder incidence was significantly high in semi-dry rice (14.2% LFDL) and low in mechanical transplanting (2.6% LFDL). The incidence of whorl maggot (4.5% WMDL), hispa (7.3% HDL) and caseworm (3.8% CWDL) were significantly high in direct seeding as compared to other establishment methods (**Figure 2.5.1.2**). The incidence of thrips was significantly high in puddled direct seeding (11.7% THDL) and was at par with normal transplanting (11.2% THDL) compared to direct seeding (0.8% THDL). Incidence of blue beetle was low in normal transplanting and semi-dry rice (<1% BBDL).

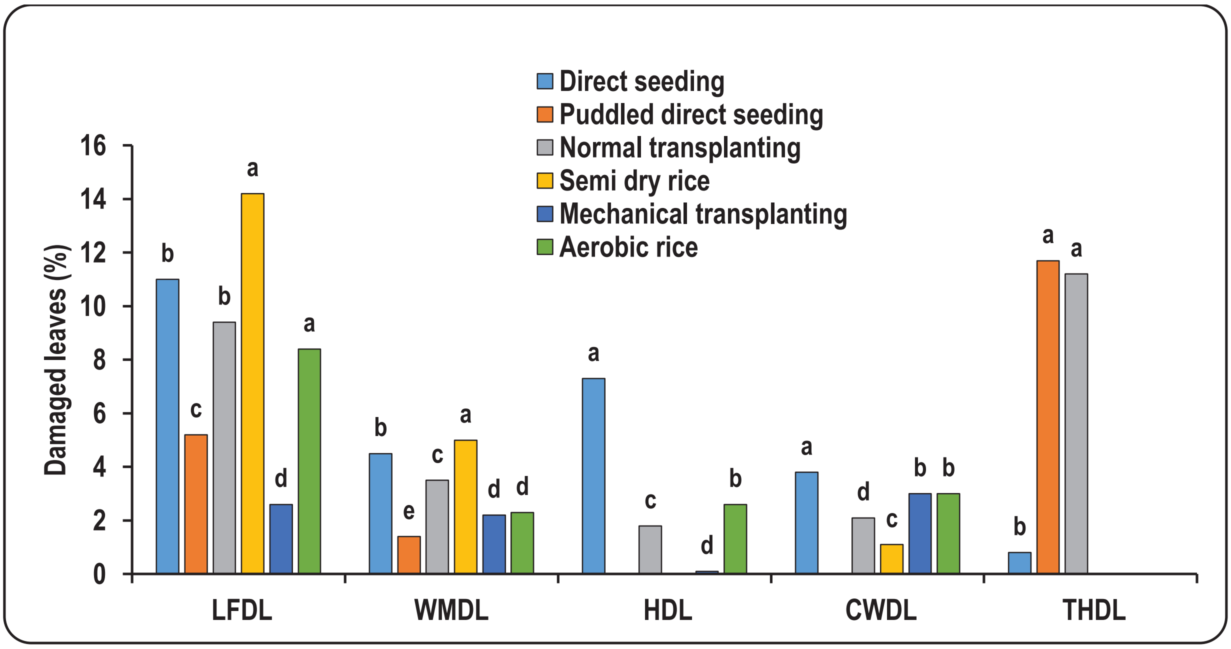


Figure 2.5.2 Incidence of foliage-feeding insects in different crop establishment methods across locations

Among the sucking pests, a low incidence of BPH (<4/5 hills) and WBPH (<6/5 hills) was observed in all four crop establishment methods such as direct seeding, normal transplanting, mechanical transplanting and aerobic rice (**Figure 2.5.1.3**).

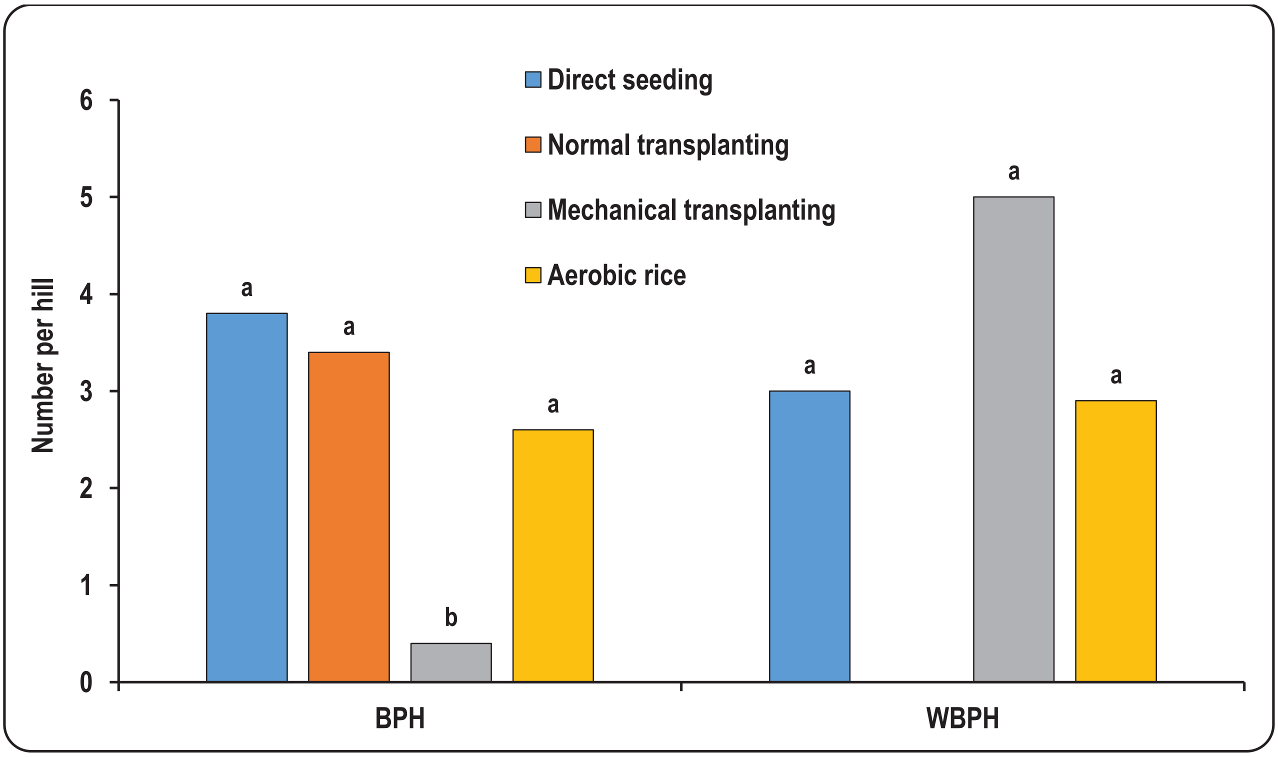


Figure 2.5.1.3 Incidence of sucking pests in different crop establishment methods across locations

Influence of crop establishment methods on pest incidence (IEMP), a collaborative trial with Agronomy, was conducted at 12 locations during Kharif 2023. Across the locations, the incidence of dead hearts (12.1%) and white ears (11.4%) caused by stem borer was significantly high in aerobic rice followed by direct seeding and *puddled direct seeding. Gall midge (14.1% SS) and leaf folder (14.2% LFDL) incidence was significantly high in semi-dry rice followed by direct seeding. The incidence of thrips was significantly high in puddled direct seeding (11.7% THDL) and was at par with normal transplanting (11.2% THDL). The incidence of caseworm, blue beetle, BPH and WBPH was low in all the establishment methods. Overall, the incidence of insect pests was high in aerobic rice followed by direct seeding and semi-dry rice while the incidence was low in normal transplanting and mechanical transplanting methods of crop establishment.*

2.5.2 Cropping Systems Influence on Pest Incidence (CSIP)

Cropping systems have a significant impact on the prevalence, carryover and spread of insect pests. The predominant agricultural systems in India are rice-based systems that rotate with cereals, pulses, cotton, and vegetables. Farmers are implementing water-saving techniques like aerobic rice, dry direct seeding, and wet direct sowing as a result of labour and water shortages. In rice-based cropping systems, the addition of crop residues is also recognised to benefit Rabi crops. Since rice straw has a potassium content of 1 to 2%, adding rice straw to crops that are cultivated after rice provides a good supply of nutrients. With this in view, a trial on the cropping system's influence on pest incidence (CSIP) was continued in collaboration with the Agronomy section (CA/SM 1- Conservation Agriculture/ System based management practices in rice and rice-based cropping systems to utilise resources and enhance the productivity and profitability) to evaluate the influence of different rice crop establishment methods under different residue management strategies to improve the overall productivity of the rice-based cropping system.

The field trial was laid out in a split-plot design with three replications. Main plot treatments comprised of three different crop establishment methods (M1: Transplanting, M2: Wet seeding (line sowing under puddled conditions), and M3: Aerobic rice – Dry rice cultivation). The subplot treatments comprised of three different Residue/straw management techniques, *viz.*, S1: No residue, S2: Incorporation of 15 cm height of rice straw from the ground, S3: Incorporation of 30 cm height of rice straw from the ground, to be superimposed for *Rabi* crops. During *Kharif* 2023, the trial was conducted at three locations, Ghaghraghat, Karjat and Titabar. The results are summarized below.

At **Ghaghraghat**, the incidence of stem borer and leaf folder was recorded in NDR 2065 variety in all the treatments. The incidence of dead hearts caused by stem borer was at par in all the main plots, subplot treatments and their interactions. However, white ear heads were significantly high in aerobic rice (15.9%WE) and were at par with wet seeding (14.8% WE) followed by normal transplanting (11.3% WE). Leaf folder damage was significantly high in the transplanting method (11.3% LFDL) compared to other main plot treatments (**Table 2.5.2.1**).

At **Karjat**, a low incidence of stem borer and leaf folder was observed in all three methods of rice cultivation (**Table 2.5.2.2**).

Table 2.5.2.1 Influence of cropping systems on pest incidence at Ghaghraghat, *Kharif* 2023

Treatments		DH (%)			WE (%)	LFDL (%)		
		45 DAT	60 DAT	75 DAT	Pre harvest	45 DAT	60 DAT	75 DAT
Main plots								
M1= Transplanting		12.5(3.6)^{a}	13.0(3.6)a	11.4(3.4)a	11.3(3.4)b	9.6(3.1)a	11.3(3.4)a	10.0(3.2)a
M2 = Wet seeding		9.0(2.6)^{a}	11.5(3.4)a	11.2(3.4)a	14.8(3.9)ab	5.1(2.3)a	4.2(2.2)c	3.1(1.9)b
M3 = Aerobic rice		15.2(3.9)^{a}	17.0(4.1)a	15.8(4.0)a	15.9(4.0)a	6.9(2.5)a	7.3(2.8)b	3.5(2.0)b
LSD (0.05)		**1.76**	**1.19**	**0.98**	**0.60**	**1.46**	**0.46**	**0.31**
CV (%)		**40.91**	**25.16**	**21.45**	**12.44**	**43.06**	**13.00**	**10.41**
Sub plots								
S1 = No residue		10.9(3.2)^{b}	13.6(3.7)^{a}	12.9(3.6)a	13.1(3.6)a	7.4(2.7)a	7.6(2.8)a	5.8(2.4)a
S2 = 15 cm ht. of rice straw		13.6(3.5)^{a}	14.1(3.7)^{a}	12.7(3.6)a	14.9(3.9)a	7.0(2.6)a	7.5(2.8)a	5.3(2.3)b
LSD (0.05)		**0.31**	**0.31**	**0.28**	**0.35**	**0.10**	**0.15**	**0.06**
CV (%)		**11.48**	**10.55**	**9.95**	**11.63**	**4.65**	**6.60**	**3.23**
M1= Transplanting	S1	11.0(3.4)^{a}	12.3(3.5)^{a}	11.8(3.5)a	9.9(3.2)a	10.2(3.2)a	11.4(3.4)a	10.8(3.3)a
	S2	14.0(3.8)^{a}	13.7(3.7)^{a}	11.0(3.4)a	12.8(3.6)a	9.0(3.1)a	11.1(3.4)a	9.3(3.1)b
M2 = Wet seeding	S1	9.0(2.6)^{a}	11.5(3.4)^{a}	11.2(3.4)a	13.1(3.7)a	5.1(2.3)a	4.2(2.2)b	3.1(1.9)c
	S2	9.0(2.6)^{a}	11.5(3.4)^{a}	11.2(3.4)a	16.5(4.1)a	5.1(2.3)a	4.2(2.2)b	3.1(1.9)c
M3 = Aerobic rice	S1	12.6(3.6)^{a}	17.0(4.1)^{a}	15.8(4.0)a	16.2(4.1)a	6.9(2.5)a	7.3(2.8)ab	3.5(2.0)c
	S2	17.9(4.3)^{a}	17.0(4.1)^{a}	15.8(4.0)a	15.5(4.0)a	6.9(2.5)a	7.3(2.8)ab	3.5(2.0)c
LSD (0.05)	**M in S**	**0.82**	**0.83**	**0.76**	**0.93**	**0.26**	**0.39**	**0.16**
	S in M	**2.33**	**1.64**	**1.37**	**1.01**	**1.88**	**0.65**	**0.42**

Figures in parenthesis are square root Transformed values. Means in a column followed by same letter are not significantly different from each other.

Table 2.5.2.2 Influence of cropping systems on pest incidence at Karjat, *Kharif* 2023

Treatments	% DH	% WE	% LFDL
	60 DAT	Pre har	75 DAT
M1= Aerobic rice	6.2(2.6)^{a}	8.3(2.9)a	2.3(1.7)a
M2 = Wet seeding	2.1(1.5)^{a}	6.1(2.5)a	2.3(1.7)a
M3 = Transplanting	3.9(2.1)^{a}	5.5(2.4)a	1.5(1.4)a
LSD (0.05)	**1.47**	**1.43**	**0.96**
CV (%)	**24.35**	**18.73**	**20.81**

Figures in parenthesis are square root Transformed values. Means in a column followed by same letter are not significantly different from each other

At **Titabar**, Shraboni variety was grown in all three establishment methods of main plots and residue treatments of subplots. Low incidence of stem borer, leaf folder, whorl maggot and caseworm was reported in all the treatments (**Table 2.5.2.3**). The incidence of coccinellids, spiders and mirid bugs was observed in all the main plots and sub-plot treatments.

Across the locations, the incidence of dead hearts was significantly higher in the subplot with a 15 cm height of rice straw in the transplanting method (12.4% DH) followed by aerobic rice (11.4% DH) (**Figure 2.5.2.1**). White ear damage was significantly higher in no residue treatment of aerobic rice (10.8% WE) which was at par with subplot 2 with 15 cm height of rice straw in wet seeding (10.4% WE).

Leaf folder damage was significantly high in the no residue treatment of the transplanting method (10.5% LFDL).

Table 2.5.2.3 Influence of cropping systems on pest incidence at Titabar, *Kharif* 2023

Treatments		% DH	% WE	% LFDL	%WMDL	%CWDL
		45 DAT	Pre har	30 DAT	30 DAT	45 DAT
Main plots						
M1= Transplanting		7.1(2.6)a	5.9(2.5)a	9.5(3.0)a	1.6(1.2)a	0.0(0.7)b
M2 = Wet seeding		6.4(2.5)a	4.6(2.2)a	5.3(2.3)b	0.8(0.9)a	1.2(1.1)b
M3 = Aerobic rice		5.1(2.3)a	4.6(2.2)a	5.7(2.3)b	1.6(1.3)a	3.3(1.8)a
LSD (0.05)		**0.48**	**0.63**	**0.45**	**0.50**	**0.51**
CV (%)		**18.58**	**26.57**	**17.1**	**41.88**	**40.47**
Sub plots						
S1 = No residue		6.2(2.5)a	4.6(2.2)ab	7.8(2.8)a	1.0(1.0)a	1.2(1.1)a
S2 = 15 cm ht. of rice straw		6.7(2.5)a	4.1(2.0)b	7.6(2.6)a	2.0(1.4)a	1.1(1.0)a
S3 = 30 cm ht of rice straw		5.7(2.4)a	6.3(2.6)a	5.1(2.2)a	1.0(1.1)a	2.2(1.5)a
LSD (0.05)		**0.73**	**0.41**	**0.69**	**0.53**	**0.46**
CV (%)		**32.26**	**19.71**	**29.87**	**50.43**	**42.07**
M1= Transplanting	S1	4.0(2.0)a	4.6(2.2)a	10.7(3.3)a	2.9(1.7)a	0.0(0.7)b
	S2	10.8(3.3)a	5.9(2.5)a	9.7(3.1)ab	1.9(1.3)a	0.0(0.7)b
	S3	6.7(2.5)a	7.2(2.7)a	8.2(2.8)abc	0.0(0.7)a	0.0(0.7)b
M2 = Wet seeding	S1	7.6(2.8)a	3.8(2.0)a	7.4(2.8)abc	0.0(0.7)a	0.0(0.7)b
	S2	4.7(2.1)a	4.3(2.1)a	3.5(1.8)bc	2.3(1.4)a	0.0(0.7)b
	S3	6.9(2.7)a	5.6(2.4)a	5.0(2.2)abc	0.0(0.7)a	3.6(1.9)a
M3 = Aerobic rice	S1	7.0(2.7)a	5.4(2.4)a	5.1(2.3)abc	0.0(0.7)a	3.6(1.9)a
	S2	4.8(2.1)a	2.2(1.6)a	9.7(3.1)abc	1.9(1.3)a	3.2(1.7)ab
	S3	3.7(2.0)a	6.1(2.5)a	2.3(1.5)c	3.0(1.8)a	3.0(1.8)ab
LSD (0.05)	**M in S**	**1.72**	**0.96**	**1.62**	**1.25**	**1.09**
	S in M	**1.55**	**1.19**	**1.47**	**1.24**	**1.14**

Figures in parenthesis are square root Transformed values. Means in a column followed by same letter are not significantly different from each other

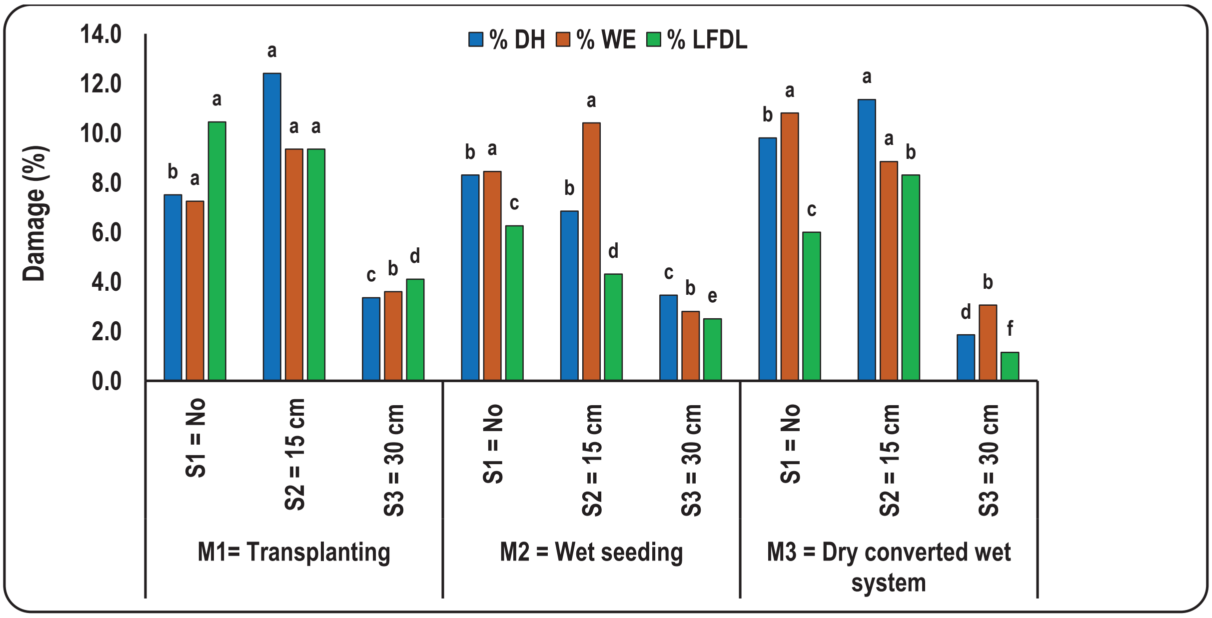


Figure 2.5.2.1 Influence of cropping systems on insect pest incidence across locations, *Kharif* 2023

Cropping system influence on insect pest incidence (CSIP), a collaborative trial with Agronomy was conducted at three locations, Ghaghraghat, Karjat and Titabar during

Kharif 2023. Low incidence of stem borer, leaf folder, whorl maggot, and case worm was observed in different main plots of crop establishment methods and sub-plots of straw incorporation techniques at all the locations.

2.5.3 Evaluation of Pheromone Blends for Insect pests of Rice (EPBI)

Monitoring insect pests is a critical component in developing methods for Integrated Pest Management in rice. Pheromones have great promise in the surveillance and management of insect pests in rice. Because pheromones are safe against natural enemies and specific to insect pests, they work well with other strategies in an integrated pest management (IPM) plan. The evaluation of normal and slow-release pheromone blends against yellow stem borer and leaf folder was the primary aim of this ongoing trial on pheromone blends for insect pests of rice.

The trial was conducted at 13 locations in *Kharif* 2023 and one location during *Rabi* 2022-2023. The field trial was constituted with two formulations, *viz.*, normal and slow-release formulations of yellow stem borer (YSB) and rice leaf folder (RLF). All the lures were placed randomly in delta traps, and installed in the field and each blend was replicated five times. Observations were recorded on adult catches in each trap at weekly intervals, after the installation of traps. Simultaneously, field population counts were taken through visual count for stem borers, disturb and count method (DCM) for leaf folder, sweep net catches and light trap (LT) catches for both the pests.

The yellow stem borer cumulative catches were high in slow-release pheromone formulations as compared to normal pheromone formulation at 9 locations (**Figure 2.5.3.1**). The catch was low in slow-release formulation at Pusa while it was at par in both the formulations at Karaikal, Maruteru and Navsari.

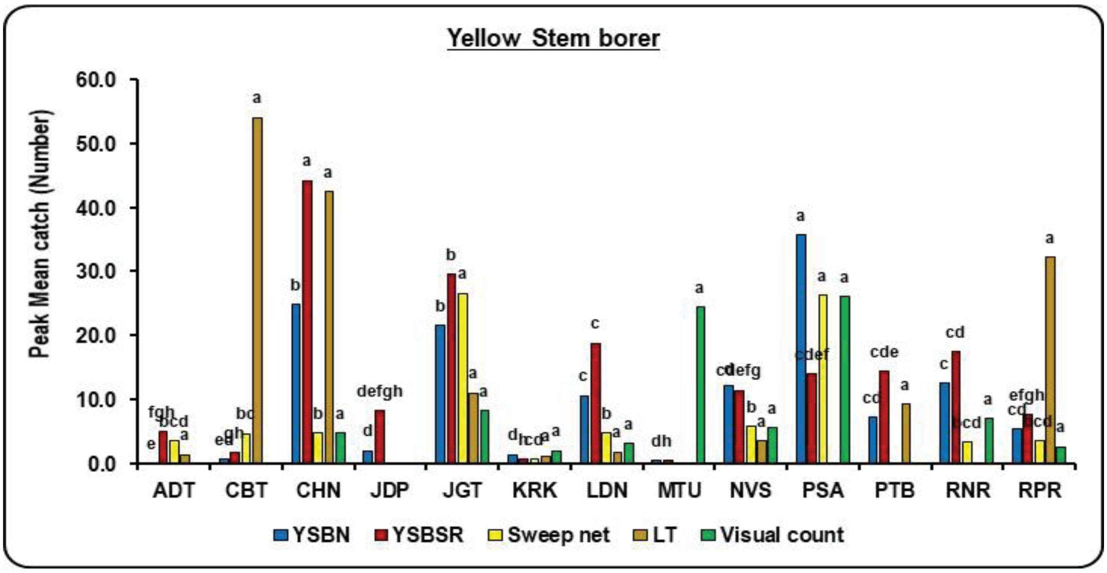


Figure 2.5.3.1: Evaluation of Yellow stem borer pheromone formulations at different locations, *Kharif* 2023

However, the incidence of stem borer was low at Aduthurai, Combatore, Jagdalpur, Karaikal, Maruteru, and Raipur. The peak mean catch was high in slow-release pheromone formulation at Chinsurah (44.2/week) followed by Jagtial

(29.6/week). Visual count was high at Pusa (26/week) while sweep-net counts were high at Jagtial (26.6/week) and Pusa (26.3/week) and were significantly different from other locations.

The peak leaf folder catch was significantly high in slow-release pheromone formulation at Chinsurah (45.8/week) followed by Navsari (26.4/week) compared to normal pheromone formulation (**Figure 2.5.3.2**). The catch was low at Aduthurai, Cimbatore, Jagdalpur, Karaikal, Maruteru, Pusa and Pattambi in both the pheromone formulations to draw valid conclusions. The adult counts were high at Raipur in disturb and count method (42/week) while sweep-net count was high at Titabar (38.4/week).

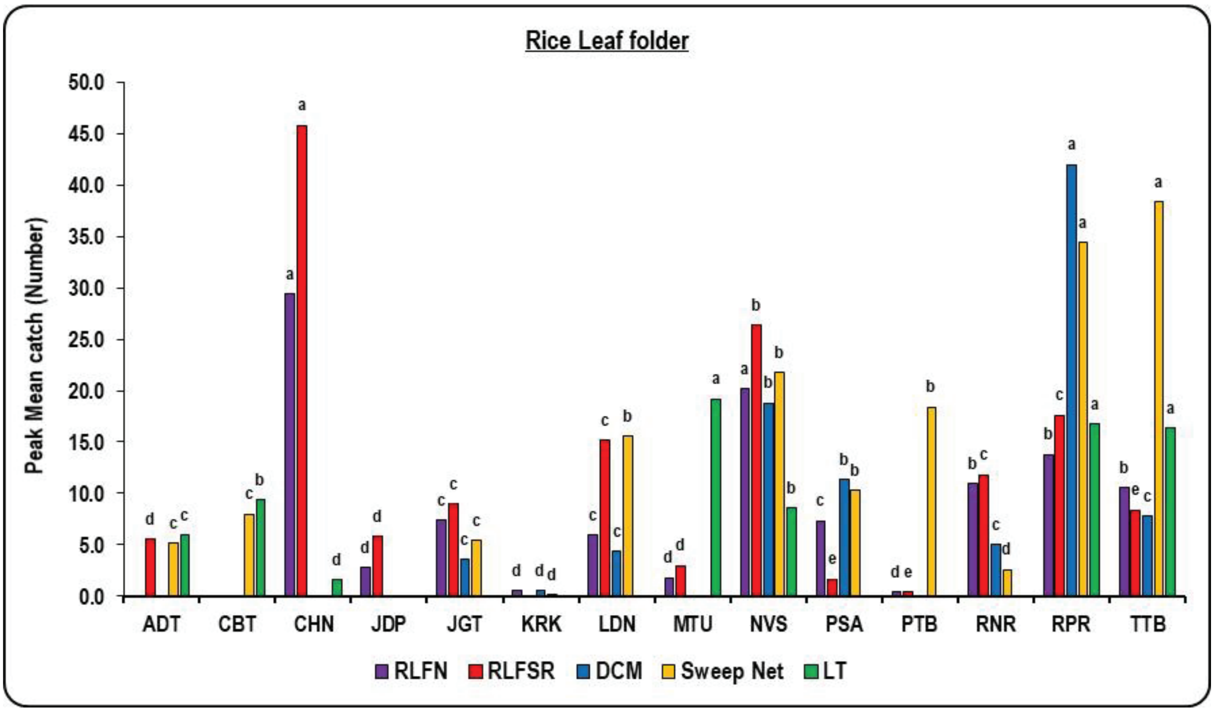


Figure 2.5.3.2 Evaluation of rice leaf folder, *Cnaphalocrocis medinalis* pheromone formulations at various locations, *Kharif* 2023

Evaluation of pheromone blends for insect pests of rice (EPBI) trial was conducted at 13 locations during Kharif 2023. The field trial was constituted with normal and slow-release formulations of yellow stem borer and rice leaf folder. The slow-release formulations recorded maximum catches compared to the normal formulations in the case of yellow stem borer and leaf folder across locations. The peak mean catches of yellow stem borer were high in slow-release pheromone formulation at Chinsurah (44.2/ week) followed by Jagtial (29.6/ week). Similarly, rice leaf folder catches were high at Chinsurah (45.8/ week) followed by Navsari (26.4/ week) compared to normal pheromone formulations.

2.6 EVALUATION OF ENTOMOPATHOGENES AGAINST SUCKING PESTS OF RICE

The trial was initiated in 2022 with the objective of evaluating effective entomopathogens against sucking pests of rice, identified though the AICRP on biocontrol programme, at multi-locations and hotspots. The trial tested the efficacy of different treatments in controlling sucking pests and influencing crop yields. The treatments include biological control agents (*Lecanicillium saksenae*, *Beauveria bassiana*, and *Metarhizium anisopliae*), a chemical pesticide (*Thiamethoxam*), and a control group with no treatment. During kharif 2023, the trial was taken up at eleven centres *viz.*, Brahmavar, Chatha, Coimbatore, Gangavati, Karjat, Ludhiana, Mandya, Moncompu, Navasari, Raipur and Ranchi.

1. *Brahmavar*

The number of ear head bugs at seven days after first spray was significantly lower with *Lecanicillium saksenae* treatment (0.85/ 5 hills) followed by *Beauveria bassiana* (1.00) compared with 3.60 bugs in untreated control (**Table 2.6.1**). At 15 days after first spray, the least number of ear head bugs were observed in *L. saksenae* sprayed plots (0.50/ 5 hills). Seven days after second spray, all the treatments showed significantly lesser number of ear head bugs compared to control (3.40), the least being observed with *L. saksenae* (0.70/5 hills). Similar trend was observed after second spray wherein all treatments showed significantly decreased number of ear head bugs, as compared to untreated control (16.25/25 hills). *Metarhizium anisopliae* with a population of 1.60 and 2.40/5 hills 15 days after first and second spray was the least effective among the bioagents tested Overall, *L. saksenae* was the most effective treatment.

The number of mirid bugs was significantly higher in the entomopathogen treatment plots. The highest number of mired bugs were observed in the control and *Beauveria bassiana* treated plots (5.0/ plot). The number of spiders per plot was significantly higher in control and *B. bassiana* treatments (5.00) followed by. *L. saksenae* (4.25). The number of coccinellids was significantly higher per plot in *B. bassiana* and *L. saksenae* treated plots (2.25). Overall, the natural enemy count was significantly higher in control followed by *L. saksenae*, *B. bassiana* and *M. anisopliae* treatments. Thiamethoxam registered lowest number of natural enemies. The highest yield was observed with *L. saksenae* treatment (4635.73 kg/ha) followed by thiamethoxam (4600.15 kg/ha. The least yield was observed in the control plot with 4199.05 kg/ha.

2. *Chatha*

Observations were recorded on populations of grasshoppers, white leafhopper, green leafhopper and gundhi bug. The population was low and did not differ among treatments. Population of gundhi bugs ranged from 1-2 individuals per sweep in all treatments. The yield was 2768.00, 2644.25, 2673.75, 2788.50, and

Table 2.6.1 Effect of entomopathogens on sucking pests and their natural enemies at Brahmavar, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 5 hills						Natural enemies No./ plot			Yield (kg/ha) *
	I SPRAY			II SPRAY			Mirid bugs	Spiders	Coccinellids	
	PC	7 DAS	15 DAS	21 DAS/PC	7 DAS	15 DAS				
Lecanicillium saksenae @ 1 x 107 cfu ml -1 KAU 7714 (20 g talc formulation/ L)	2.90	0.85 (1.16)	0.50 (0.99)	0.90 (1.18)	0.70 (1.09)	0.45 (0.99)	3.25 (1.90)	4.25 (2.17)	3.00 (1.86)	4635.73
Beauveria bassiana @1 x 108 cfu ml-1 NBAIR Bb 5 (20 g talc formulation / L)	2.60	1.00 (1.22)	0.80 (1.14)	1.20 (1.38)	1.00 (1.22)	0.60 (1.05)	5.00 (2.34)	5.00 (2.34)	3.00 (1.86)	4396.28
Metarhizium anisopliae @ 1 x 108 cfu ml -1 NBAIR Ma 4 (20 g talc formulation / L)	3.00	1.40 (1.37)	1.60 (1.45)	2.20 (1.64)	2.00 (1.58)	2.40 (1.70)	4.00 (2.12)	3.00 (1.86)	2.00 (1.56)	4355.20
Thiamethoxam	3.00	1.20 (1.38)	0.80 (1.14)	1.40 (1.38)	1.00 (1.22)	0.80 (1.14)	2.75 (1.79)	3.00 (1.86)	2.00 (1.56)	4600.15
Control	3.00	3.60 (2.03)	3.40 (1.98)	4.00 (2.12)	3.40 (1.98)	3.20 (4.09)	2.00 (1.56)	5.00 (2.34)	2.00 (1.56)	4199.05
SED		0.02	0.04	0.03	0.03	0.02	0.12	0.08	0.07	20.58
CD (0.05)	NS	0.05**	0.11**	0.09**	0.09**	0.07**	0.38**	0.23**	0.23**	62.87**

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; *extrapolated

Table 2.6.2 Effect of entomopathogens on sucking pests and their natural enemies at Coimbatore, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 5 hills					Natural enemies No./ plot			Yield (kg/ha) *
	I SPRAY			II SPRAY		Mirid bugs	Spiders	Coccinellids	
	PC	7 DAS	15 DAS	7 DAS	15 DAS				
Lecanicillium saksenae @ 1 x 107 cfu ml -1 KAU 7714 (20 g talc formulation/ L)	18.75	11.25 (3.41)	11.75 (3.49)	7.25 (2.78)	4.75 (2.29)	7.25 (2.76)	12.00 (3.53)	15.00 (3.92)	5772
Beauveria bassiana @1 x 108 cfu ml-1 NBAIR Bb 5 (20 g talc formulation / L)	24.75	19.50 (4.43)	18.50 (4.34)	9.25 (3.11)	6.25 (2.59)	6.75 (2.66)	13.00 (3.65)	14.00 (3.79)	5531
Metarhizium anisopliae @ 1 x 108 cfu ml -1 NBAIR Ma 4 (20 g talc formulation / L)	22.00	10.25 (3.24)	8.50 (2.99)	5.00 (2.33)	1.75 (1.40)	7.00 (2.71)	13.75 (3.76)	14.50 (3.83)	5820
Thiamethoxam	25.50	5.25 (2.38)	5.75 (2.50)	1.50 (1.34)	0.00 (0.71)	1.50 (1.34)	4.00 (2.11)	6.25 (2.59)	6032
Control	24.50	27.00 (5.23)	23.25 (4.87)	9.00 (3.07)	7.00 (2.74)	7.25 (2.76)	14.25 (3.83)	15.50 (13.98)	5615
SED	0.54	0.38	0.13	0.22	0.20	0.31	0.23	0.30	133.0
CD (0.05)	NS	1.17	0.39**	0.68**	0.62**	0.93**	0.66**	0.85**	NS

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; *extrapolated

2686.00 kg/ha in *L. saksenae, B. bassiana*, *Metarhizium anisopliae,* thiamethoxam and control plots respectively.

3. *Coimbatore*

The number of ear head bugs at seven days after first spray was significantly lower in thiamethoxam (5.25/25 hills) while among bioagents, *M. anisopliae and L. saksenae* treatments (10.25 and11.25/ 25 hills) had the lowest population (Table 2.6.2). Similar trend was observed at 15 days after first spray. After two sprays no bugs were observed in thiamethoxam treatment. Overall, *M. anisopliae* was the most effective treatment among bioagents. Overall, the natural enemy count was significantly higher in control followed by *L. saksenae*, *B. bassiana* and *M. anisopliae* treatments which were all on par. Thiamethoxam registered lowest number of natural enemies **(Table 2.6.2)**. The number of mirid bugs was highest in the control and *L. saksenae* treated plots (7.25/plot) whereas significantly lower number of mired bugs were found in thiamethoxam treatment (1.50/plot). Similar trend was observed for number of spiders and coccinellids per plot (**Table 2.6.2**). The highest yield was observed in thiamethoxam treated plots (6032 kg/ha) though statistically on par with other treatments.

4. *Gangavathi*

The population of hoppers was lowest thiamethoxam (22.58/ 25 hills) and on par with *L. saksanae* (29.03/25 hills) 7 days after first spray as compared to 44.42/ 25 hills in untreated control (**Table 2.6.3**). Chemical control was the most effective 15 days after second spray though all bioagents could bring down the population significantly. The least effective bioagent against hoppers was *B. bassiana* (**Table 2.6.3)**.

The number of ear head bugs after first spray was significantly lower in all treatments as compared to untreated control, but the chemical thiamethoxam recorded significantly lowest population of bugs (2.99 and 2.14/ 25 hills) at 7 and 15 days after first spray and reached nil population 15 fays after second spray **(Table 2.6.3).** 15 days after second spray, *M. anisopliae* treated plots had the lowest population of 1.75/ 25 hills. The population of mired bugs, spiders and coccinellids were significantly lower in thiamethoxam treated plots (3.23, 1.12 and 0.66/ m^2 respectively) **(Table xx)** while they were on par in all other treatments including untreated control (12.17, 5.34 and 3.32/ m^2 respectively) indicating minimal or no impact on natural enemy population **(Table 2.6.3)**. The yields were significantly lower in control plot (2698.50 kg/ ha) while it was significantly higher in *L. saksanae* treatment (7512.75 kg/ ha) **(Table 2.6.3)**.

5. *Karjat*

The number of ear head bugs at seven days after second spray was significantly lower with thiamethoxam and *L. saksenae* treatments (1.25 and 3.50/ 25 hills respectively) **(Table 2.6.4)**. At fifteen days after second spray, the least number of ear head bugs were observed in *L. saksenae* sprayed plots (1.50 / 25 hills) while

Table 2.6.3 Effect of entomopathogens on sucking pests and their natural enemies at Gangavathi, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 25 hills					No. of hoppers/ 25 hills					No. of natural enemies/m²			Yield (kg/ha)
		I SPRAY		II SPRAY			I SPRAY		II SPRAY					
	PC	7 DAS	15 DAS	7 DAS	15 DAS	PC	7 DAS	15 DAS	7 DAS	15 DAS	Mirid	Spider	Coccinellid	
Lecanicillium saksenae @ 1 x 107 cfu ml -1 KAU 7714 (20 g talc formulation/ L)	4.61	3.94 (2.10)	3.10 (1.89)	2.40 (1.70)	4.75 (2.29)	41.34	29.03	23.22	18.527	11.74	10.90	4.91	3.07 (1.89)	7512.75
Beauveria bassiana @1 x 108 cfu ml-1 NBAIR Bb 5 (20 g talc formulation / L)	4.57	4.38 (2.21)	3.53 (2.00)	3.06 (1.88)	6.25 (2.59)	40.71	33.29	28.03	23.08	15.04	10.26	4.30	2.95 (1.86)	6368.25
Metarhizium anisopliae @ 1 x 108 cfu ml -1 NBAIR Ma 4 (20 g talc formulation / L)	4.58	3.63 (2.03)	2.88 (1.83)	2.35 (1.69)	1.75 (1.40)	40.07	28.11	22.80	18.33	11.32	11.14	4.93	3.02 (1.87)	7281.75
Thiamethoxam	4.62	2.99 (1.86)	2.14 (1.62)	1.82 (1.52)	0.00 (0.71)	40.46	22.58	15.53	10.53	8.57	3.23	1.12	0.66 (1.07)	6137.25
Control	4.53	5.31 (2.41)	5.82 (2.51)	6.29 (2.60)	6.29 (2.60)	40.97	44.42	47.84	54.87	59.11	12.17	5.34	3.32 (1.95)	2698.50
SED	0.08	0.07	0.07	0.05	0.08		3.51	2.69	4.26	1.89	0.33	0.57	0.53	399.99
CD (0.05)	NS	0.16*	0.22	0.10	0.24	NS	7.64*	8.21**	13.02**	5.76**	1.00**	0.80**	0.16**	1221.80**

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; *extrapolated

Table 2.6.4 Effect of entomopathogens on sucking pests and their natural enemies at Karjat, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 25 hills					Spiders No./ plot	Yield Kg/ha*
		I SPRAY		II SPRAY			
	PC	7 DAS	15 DAS	7 DAS	15 DAS		
Lecanicillium saksenae @ 1 x 107 cfu ml -1 KAU 7714 (20 g talc formulation/ L)	54.00	17.50 (4.23)	9.50 (3.15)	3.50 (2.29)	1.50 (1.35)	7.75 (2.86)	4406.25
Beauveria bassiana @1 x 108 cfu ml-1 NBAIR Bb 5 (20 g talc formulation / L)	56.00	26.00 (5.13)	17.25 (4.22)	6.25 (2.59)	4.75 (2.24)	6.50 (2.64)	4178.13
Metarhizium anisopliae @ 1 x 108 cfu ml -1 NBAIR Ma 4 (20 g talc formulation / L)	54.00	30.50 (5.55)	22.00 (4.73)	9.75 (3.19)	6.75 (2.69)	7.00 (2.72)	4084.38
Thiamethoxam	57.25	8.75 (3.02)	3.00 (1.84)	1.25 (1.27)	0.00 (0.71)	5.50 (2.43)	4556.25
Control	55.50	64.25 (8.05)	67.00 (8.21)	78.75 (8.90)	80.50 (8.99)	8.50 (2.99)	3734.38
SED	0.35	0.28	0.30	0.30	0.21	0.17	53.19
CD (0.05)	NS	0.24**	0.91**	0.92**	0.64**	0.51*	162.46**

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; *extrapolated

it reached nil population in thiamethoxam treated plots. The other two bio-agents *B bassiana* and *M anisopliae* were also effective in reducing pest population (4.75 and 6.75/ 25 hills) as compared to Control (80.50). Overall, *L. saksenae* was the most effective treatment among bioagents. The natural enemy count was significantly higher in control followed by *L. saksenae*, *B. bassiana* and *M. anisopliae* treatments which were all on par. Thiamethoxam registered lowest number of natural enemies **(Table 2.6.4)**. The highest yield was observed in thiamethoxam treated plots (4556.25 kg/ha) followed by *L. saksenae* treatment (4406 kg/ha).

6. *Ludhiana*

The population of hoppers was lowest thiamethoxam (46.50/ 25 hills) followed by *L. saksanae* (99.25/25 hills) 7 days after first spray as compared to 199.75/ 25 hills in untreated control **(Table 2.6.5)**. Similar trends were observed 15 days after first and second spray. Chemical control was the most effective 15 days after second spray (20.5/25 hills) though all bioagents could bring down the population significantly. The most effective bioagent against hoppers was *L. saksanae* (73.50/25 hills) while the least effective was *B. bassiana* (107.00/ 25 hills) **(Table 2.6.5)**. The spider count was significantly higher in control (14.25/ 10 hills) followed by *L. saksenae*, *B. bassiana* and *M. anisopliae* treatments which were all on par (10-10.5/ 10 hills). Thiamethoxam registered lowest number of natural enemies **(Table 2.6.5)**. The highest yield was observed in thiamethoxam treated plots (7637.24 kg/ha) followed by *L. saksenae* treatment (7419.53 kg/ha).

7. *Moncompu*

Observations were recorded on population of green leafhopper, brown planthopper and ear head bug after imposing treatments. The population of leafhoppers ranged from 34.25-44.50/ 25 hills in untreated control. The population of hoppers was lowest thiamethoxam (15.75/ 25 hills) and on par with *L. saksanae* (15.00/25 hills) 7 days after first spray **(Table 2.6.6)**. Similar trend was observed 7 and 15 days after second spray with thiamethoxam and *L. saksanae* having a population of 2 and 5 / 25 hills as compared to 37.25 in the control plot **(Table 2.6.6)**. The population of brown planthopper ranged from 208.25 – 318.75/ 25 hills in untreated control. Population of planthoppers was on par and significantly lower in thiamethoxam and *L. saksanae* treated plots seven days after (85.25 and 84.25/ 25 hills respectively) and fifteen days after (45.00 and 54.5 / 25 hills) first spray **(Table 2.6.6)**. On the other hand, 15 days after second spray, thiamethoxam had significantly lower population (16.50/25 hills) while the bioagent treated plots were on par but superior to untreated. *L. saksanae* was second most effective treatment with population ranging from 54.0-68.0/25 hills after second spray **(Table 2.6.6)**.

Table 2.6.5 Effect of entomopathogens on sucking pests and their natural enemies at Ludhiana, EESP, *kharif* 2023

Treatment	No. of hoppers / 25 hills						Spiders No./ plot	Yield Kg/ha
	I SPRAY			II SPRAY				
	PC	7 DAS	15 DAS	PC	7 DAS	15 DAS		
Lecanicillium saksenae @ 1 x 107 cfu ml $^{-1}$ KAU 7714 (20 g talc formulation/ L)	177.75	99.25	90.25	103.25	78.50	73.50	10.00	7419.53
Beauveria bassiana @1 x 108 cfu ml^{-1} NBAIR Bb 5 (20 g talc formulation / L)	180.75	120.00	113.50	152.75	111.00	107.00	10.00	6890.98
Metarhizium anisopliae @ 1 x 108 cfu ml $^{-1}$ NBAIR Ma 4 (20 g talc formulation / L)	185.75	108.25	104.00	121.00	96.50	92.00	10.50	7187.50
Thiamethoxam	177.75	46.50	37.50	49.75	22.50	20.50	6.75	7637.24
Control	180.75	199.75	219.50	226.25	232.50	248.00	14.25	6818.23
SED	3.74	3.27	4.44	2.62	3.12	3.05	0.60	75.58
CD (0.05)	NS	9.99**	13.56**	8.02**	9.51**	9.32**	1.84**	230.87

Table 2.6.6 Effect of entomopathogens on hoppers at Moncompu, EESP, *kharif* 2023

Treatment	No. of GLH / 25 hills						No. of BPH/ 25 hills					
	I SPRAY			II SPRAY			I SPRAY			II SPRAY		
	PC	7 DAS	15 DAS	PC	7 DAS	15 DAS	PC	7 DAS	15 DAS	PC	7 DAS	15 DAS
Lecanicillium saksenae @ 1 x 107 cfu ml $^{-1}$ KAU 7714 (20 g talc formulation/ L)	34.75	15.75 (4.02)	8.00 (2.89)	15.00 (3.92)	9.50 (3.16)	5.00 (2.34)	239.75 (15.47)	85.25 (9.25)	54.50 (2.10)	162.25 (12.64)	68.50 (8.29)	54.00 (7.36)
Beauveria bassiana @1 x 108 cfu ml^{-1} NBAIR Bb 5 (20 g talc formulation / L)	34.25	21.75 (4.69)	11.75 (3.47)	13.75 (3.77)	10.00 (3.23)	7.00 (2.72)	218.25 (14.78)	95.25 (9.78)	76.50 (8.76)	132.75 (11.53)	71.75 (8.49)	60.00 (7.76)
Metarhizium anisopliae @ 1 x 108 cfu ml $^{-1}$ NBAIR Ma 4 (20 g talc formulation / L)	36.50	27.50 (5.28)	14.75 (3.90)	17.00 (4.16)	12.50 (3.58)	8.75 (3.02)	235.50 (15.35)	115.75 (10.75)	84.75 (9.23)	134.75 (11.61)	78.50 (8.87)	68.00 (8.24)
Thiamethoxam	42.50	15.00 (3.92)	7.50 (2.81)	13.50 (3.73)	6.50 (2.63)	2.00 (1.50)	230.50 (15.19)	84.25 (9.20)	45.00 (6.70)	121.25 (11.00)	47.50 (6.91)	16.50 (4.04)
Control	34.25	40.50 (6.39)	44.50 (6.70)	35.25 (5.97)	37.25 (6.13)	37.25 (6.14)	242.50 (15.57)	295.00 (17.16)	346.50 (18.61)	264.25 (16.24)	312.00 (17.67)	324.00 (18.00)
SED	0.07	0.32	0.26	0.30	0.28	0.26	0.58	0.48	0.48	0.86	0.37	0.46
CD (0.05)	NS	0.70*	0.78**	0.90**	0.87**	0.80**	NS	1.46**	1.46*	1.87**	1.13**	1.42**

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; *extrapolated

The population of ear head bugs ranged from 20.75 – 29.75/ 25 hills in untreated control. Population of bugs was significantly lower in thiamethoxam (14.75/ 25 hills) followed by *L. saksanae* treated plots (16.00/25 hills) seven days after first spray **(Table 2.6.7)**. On the other hand, 15 days after second spray, *L. saksanae* was the most effective and had significantly lower population (4.00 / 25 hills) even compared to thiamethoxam (7.25/25 hills). **(Table 2.6.7)**. The spiders and mirid population were on par in all treatments while coccinellids were higher in untreated control. The highest yield was observed in thiamethoxam treated plots (4900 kg/ha) followed by *L. saksenae* treatment (4800 kg/ha).

8. Mandya

At seven days after first spray number of earhead bugs was lowest thiamethoxam (2.14/25 hills) followed by *L. saksanae* (2.74/25 hills) 7 days after first spray as compared to 4.45/ 25 hills in untreated control **(Table 2.6.8)**. At 15 days after first spray, the least number of ear head bugs were observed in thiamethoxam sprayed plots (1.98/ 25 hills) followed by *L. saksenae* treated plots (2.26/25 hills). Similar trend was observed after second spray, wherein all the treatments showed significantly lesser number of ear head bugs compared to the control (5.70-6.14/25 hills). The least number of bugs was observed in chemical treatment followed by *L. saksenae* **(Table 2.6.8).** The number of natural enemies *viz.*, spiders and coccinellids were lowest in thiamethoxam treatment (11.50 and 4.25 /plot respectively). The highest yield was observed with thiamethoxam treatment (7716 kg/ha), but the treatment *L. saksenae* was on par with chemical control (7032 kg/ha respectively). The least yield was observed in the control plot with 2168 kg/ha.

9. *Navsari*

All treatments were significantly more effective than untreated control which recorded 13.25 – 19.75 bugs per 10 hills. The number of ear head bugs was significantly lower with thiamethoxam treatment (4.00 – 7.00/ 10 hills) after first and second spray. The three bioagents did not differ significantly in their effectiveness after two sprays **(Table 2.6.9)**. The population of natural enemies were highest in untreated control 9.75, 7.75 and 8.50 mirids, spiders and coccinellids per plot. Thiamethoxam registered lowest number of natural enemies. The three bioagent treatments were on par, with the highest population recorded in *L. saksanae* treatment with 9.75, 7.75 and 2.25 mirid bugs, spiders and coccinellids per plot. The highest yield was observed in thiamethoxam treatment (5392 kg/ha) but was statistically on par with other treatments **(Table 2.6.9)**.

10. *Raipur*

All treatments were significantly more effective than untreated control which recorded 9.00 – 11.75 ear head bugs per 25 hills. The number of ear head bugs were lowest in the chemical treatment plots (1.25-6.25/25 hills). Nevertheless,

Table 2.6.7 Effect of entomopathogens on hoppers at Moncompu, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 25 hills					Natural enemies No./ plot			Yield (kg/ha) *
		I SPRAY		II SPRAY		Mirid bugs	Spiders	Coccinellids	
	PC	7 DAS	15 DAS	7 DAS	15 DAS				
Lecanicillium saksenae @ 1 x 107 cfu ml -1 KAU 7714 (20 g talc formulation/ L)	26.50	16.00 (4.05)	11.25 (3.42)	5.50 (2.44)	4.00 (2.12)	38.75 (6.23)	38.75 (6.23)	29.50 (5.47)	4800.00
Beauveria bassiana @1 x 108 cfu ml-1 NBAIR Bb 5 (20 g talc formulation / L)	29.25	18.25 (4.31)	10.50 (3.29)	7.25 (2.75)	6.75 (2.67)	43.25 (6.61)	43.25 (6.61)	27.25 (5.26)	4625.00
Metarhizium anisopliae @ 1 x 108 cfu ml -1 NBAIR Ma 4 (20 g talc formulation / L)	26.25	18.00 (4.27)	12.25 (3.57)	7.75 (2.85)	6.25 (2.57)	34.50 (5.90)	34.50 (5.90)	22.75 (4.80)	4306.25
Thiamethoxam	30.50	14.75 (3.89)	11.50 (3.45)	8.25 (2.94)	7.25 (2.76)	40.25 (6.38)	40.25 (6.38)	24.50 (4.99)	4900.00
Control	29.75	28.50 (5.38)	27.00 (5.23)	20.75 (4.59)	21.75 (4.69)	44.75 (6.70)	44.75 (6.70)	32.50 (5.74)	4137.50
SED	0.22	0.33	0.26	0.28	0.30	0.32	0.32	0.23	95.68
CD (0.05)	NS	0.72*	0.78**	0.85**	0.92**	NS	NS	0.50*	292.28**

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; GLH- green leafhopper; BPH- brown planthopper *extrapolated

Table 2.6.8 Effect of entomopathogens on sucking pests and their natural enemies at Mandya, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 25 hills						Natural enemies No./ plot		Yield (kg/ha) *
		I SPRAY		II SPRAY			Spider	Coccinellid	
	PC	7 DAS	15 DAS	21 DAS/PC	7 DAS	15 DAS			
Lecanicillium saksenae @ 1 x 107 cfu ml -1 KAU 7714 (20 g talc formulation/ L)	3.47	2.74 (1.79)	2.26 (1.65)	2.85 (1.82)	2.05 (1.56)	1.42 (1.37)	19.00 (4.28)	14.75 (3.74)	7032.00
Beauveria bassiana @1 x 108 cfu ml-1 NBAIR Bb 5 (20 g talc formulation / L)	4.63	3.86 (2.07)	3.59 (2.02)	4.74 (2.29)	3.92 (2.09)	3.04 (1.86)	29.50 (5.36)	11.00 (3.31)	4060.00
Metarhizium anisopliae @ 1 x 108 cfu ml -1 NBAIR Ma 4 (20 g talc formulation / L)	3.35	3.27 (1.93)	3.05 (1.88)	3.48 (1.99)	3.12 (1.89)	2.78 (1.81)	25.25 (4.96)	18.75 (4.23)	5852.00
Thiamethoxam	4.16	2.14 (1.60)	1.98 (1.57)	2.23 (1.63)	1.47 (1.40)	0.96 (1.20)	11.50 (3.38)	4.25 (1.99)	7716.00
Control	3.81	4.45 (2.22)	5.12 (2.37)	5.36 (2.42)	5.70 (2.49)	6.14 (2.57)	42.75 (6.51)	27.00 (5.20)	2168.00
SED	0.21	0.17	0.10	0.13	0.19	0.17	0.88	0.79	848.34
CD (0.05)	NS	0.39*	0.22*	0.27*	0.41*	0.37*	1.91*	1.72*	1848.38*

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying;

Table 2.6.9 Effect of entomopathogens on sucking pests and their natural enemies at Navsari, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 25 hills					Natural enemies No./ plot			Yield (kg/ha) *	Straw yield kg/ha
		I SPRAY		II SPRAY		Mirid bugs	Spiders	Coccinellids		
	PC	7 DAS	15 DAS	7 DAS	15 DAS					
Lecanicillium saksenae @ 1 x 107 cfu ml $^{-1}$ KAU 7714 (20 g talc formulation/ L)	9.77	8.00 (2.90)	10.00 (3.23)	10.25 (3.28)	12.00 (3.53)	9.25 (3.12)	6.25 (2.60)	2.00	4871.32	7092.53
Beauveria bassiana @1 x 108 cfu ml^{-1} NBAIR Bb 5 (20 g talc formulation / L)	9.21	8.25 (2.95)	13.00 (3.67)	11.25 (3.42)	12.25 (3.56)	9.00 (3.08)	6.00 (2.55)	2.25	4883.58	7184.44
Metarhizium anisopliae @ 1 x 108 cfu ml $^{-1}$ NBAIR Ma 4 (20 g talc formulation / L)	8.90	6.75 (2.69)	8.25 (2.95)	9.75 (3.20)	12.50 (3.59)	8.50 (2.99)	6.75 (2.69)	3.00	5147.06	7153.80
Thiamethoxam	8.96	4.00 (2.11)	6.75 (2.68)	5.75 (2.49)	7.00 (2.73)	4.25 (2.18)	3.00 (1.86)	1.00	5392.16	7261.03
Control	8.92	13.25 (3.70)	12.00 (3.53)	20.93 (4.62)	19.75 (4.50)	9.75 (3.20)	7.75 (2.87)	2.25	5208.33	7383.58
SED	0.11	0.16	0.16	0.17	0.21	0.13	0.10	0.21	152.77	102.00
CD (0.05)	NS	0.49**	0.35*	0.52*	0.45*	0.28*	0.30*	NS	NS	NS

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; *extrapolated

Table 2.6.10 Effect of entomopathogens on sucking pests and their natural enemies at Raipur, EESP, *kharif* 2023

Treatment	No. of Ear head bugs / 25 hills					Natural enemies No./ plot				Yield (kg/ha) *
		I SPRAY		II SPRAY		Spiders	Ground beetles	Coccinellids	Rove beetles	
	PC	7 DAS	15 DAS	7 DAS	15 DAS					
Lecanicillium saksenae @ 1 x 107 cfu ml $^{-1}$ KAU 7714 (20 g talc formulation/ L)	4.75	4.50 (2.22)	2.00 (1.58)	6.25 (2.59)	3.00 (1.86)	3.00	3.25	3.75	3.25	6268.75
Beauveria bassiana @1 x 108 cfu ml^{-1} NBAIR Bb 5 (20 g talc formulation / L)	4.50	3.75 (2.06)	2.75 (1.80)	7.75 (2.87)	5.75 (2.49)	2.50	3.00	3.50	3.75	6100.00
Metarhizium anisopliae @ 1 x 108 cfu ml $^{-1}$ NBAIR Ma 4 (20 g talc formulation / L)	5.00	4.50 (2.22)	2.25 (1.65)	6.25 (2.59)	4.75 (2.28)	2.75	4.25	3.75	4.25	6162.50
Thiamethoxam	5.00	3.00 (1.86)	1.25 (1.27)	6.25 (2.56)	2.50 (1.73)	2.25	3.50	4.00	4.00	6518.75
Control	4.50	9.00 (3.07)	10.00 (3.23)	11.00 (3.37)	11.75 (3.48)	3.25	4.75	4.75	5.25	5687.50
SED	0.12	0.19	0.18	0.187	0.16	0.12	0.17	0.20	0.30	132.57
CD (0.05)	NS	0.42*	0.55**	0.41*	0.49**	NS	NS	NS	NS	288.85*

L.saksenae treated plots reached 3.0/ 25 hills fifteen days after second spray which was on par with 2.50/25 hills in thiamethoxam **(Table 2.6.10)**. Natural enemy population did not differ significantly among the treatments. The lowest yield was observed in the control plot with 5687 kg/ha, while all other were on par with a yield range of 6100 – 6518.75 kg/ha **(Table 2.6.10)**.

11. *Ranchi*

All treatments were significantly more effective than untreated control which recorded 11.35 ear head bugs per 25 hills. The number of ear head bugs were lowest in the chemical treatment plots (1.13/25 hills) and among the bioagents *M. anisopliae* recorded lowest population of 2.78 bugs/ 25 hills **(Table 2.6.11).**

Table 2.6.11 Effect of entomopathogens on sucking pests and their natural enemies at Ranchi, EESP, *kharif* 2023

Treatment	Ear head bugs No./ 25 hills	% damage
Lecanicillium saksenae @ 1 x 107 cfu ml $^{-1}$ KAU 7714 (20 g talc formulation/ L)	3.63 (2.02)	0.98
Beauveria bassiana @1 x 108 cfu ml^{-1} NBAIR Bb 5 (20 g talc formulation / L)	4.40 (2.21)	1.21
Metarhizium anisopliae @ 1 x 108 cfu ml $^{-1}$ NBAIR Ma 4 (20 g talc formulation / L)	2.78 (1.81)	0.89
Thiamethoxam	1.13 (1.27)	0.43
Control	11.35 (3.44)	2.8
SED	0.09	
CD (0.05)	0.26	NS

Figures in parenthesis are square root transformed; PC- pre-count; DAS- days after spraying; *extrapolated

Evaluation of entomopathogens against sucking pests of rice was taken up in eleven locations to test the effectiveness of entomopathogens Lecanicillium saksenae, Beauveria bassiana and Metarhizium anisopliae. Treatments with biological control agents generally demonstrated comparable or better results in reducing pest populations while maintaining crop yield compared to the chemical pesticide and the control group. L. saksenae, B. bassiana, and M. anisopliae treatments exhibit promising efficacy in controlling pests such as ear head bugs and hoppers. Natural enemies (Mirid bugs, Spiders, Coccinellids) were more abundant in plots treated with biological control agents, suggesting a potential ecosystem-friendly approach to pest management. Overall, the data suggests that biological control agents could be viable alternatives or supplements to chemical pesticides for pest management.

2.7 INTEGRATED PEST MANAGEMENT STUDIES (IPMs)

The rice crop is severely impacted by biotic constraints such as weeds, diseases and insect pests during the crop growth period. Farmers are deeply concerned about managing these pests holistically. IPM is a well-established concept that is widely acknowledged by stakeholders. However, IPM implementation at the farmer level is limited because it is a knowledge-intensive approach that requires specialised skills to make decisions and select IPM solutions for the sustainable management of pests. To get over these obstacles, a participatory IPMs trial was conducted in collaboration with plant pathologists and agronomists to validate IPM practices from a range of choices and show farmers how to manage pests (such as insects, diseases, and weeds) holistically and economically.

IPMs trial was conducted Zone-wise in 18 locations during *Kharif* 2023 and two locations during *Rabi* 2022-23 in 41 farmers' fields. The details of pest management practices followed and pest incidence zone-wise are discussed below:

Zone I – Hilly areas

The IPMs trial was conducted at five farmers' fields at two locations (Khudwani and Malan) in this zone. Details of farmers, their village and district are given in table below:

S.No	Location	State	Village/District	Farmer Name
1	Khudwani	Jammu & Kashmir	Khudwani village, Kulgam district	Sri Shabir Ahmad Mir S/o Ab Qadir
2	Khudwani	Jammu & Kashmir	Hiller village, Anantnag district	Sri. Hiller Arhama/ Nazir Ahmad Teeli
3	Khudwani	Jammu & Kashmir	Hardu-Deharna village, Anantnag district	Sri. Gh Hassan Rather / Hardu-Deharna
4	Khudwani	Jammu & Kashmir	Brazloo village, Kulgam district	Sri. M Abbas Malik
5	Malan	Himachal Pradesh	Jia Haar village, Kangra district	Sri Santokh Singh

1) Khudwani, Jammu and Kashmir: The incidence of grasshoppers (Number/ 5hills) and damaged leaves were reported from both IPM and Farmer's practice (FP) plots in Shalimar Rice-4 and Shalimar Rice -3. Practices followed in IPM and FP plots are given below:

Practices followed in IPMs trial at Khudwani, *Kharif* 2023

	IPM Practices	Farmer's Practices
Area	0.4 ha	0.4 ha
Variety	Shalimar Rice 4 & Shalimar Rice 3	Chena, local variety & Shalimar Rice 4
Nursery	• Seed treatment with Trichoderma @ 10g/ kg seed • Application of 3 kg urea, 2 kg DAP and 1 kg MOP.	• Application of 3 kg urea, 3 kg DAP
Main Field	• 25-30 days old seedlings transplanted at a spacing of 20 X 15 cm with 2-3 seedlings/hill • Applied 4 kg urea, 6.6 kg DAP, 2.5 kg MOP and 0.75 kg Zinc Sulphate per kanal. • Applied 1.5 kg a.i. of Butachlor 5G (Machete) per hectare, 3-5 days after transplanting (or) 0.5 kg Eros (Pyrazosulfuron + Pretilachlor) at 3-5 days after transplanting. • One-hand weeding • Foliar application of Tricyclazole @ 60g/ 100 litre water	• 40-45 days old seedlings transplanted at random with 5 seedlings/hill • Applied only DAP and Urea. • Applied 1.5 kg a.i. of Butachlor 5G (Machete) per hectare, 3-5 days after transplanting (or) 0.5 kg Eros (Pyrazosulfuron + Pretilachlor) at 3-5 days after transplanting. • One-hand weeding

Grasshopper damage was significantly low in IPM plots at Sri Ahmad Mir's field (9.2%) and Sri Gh Hassan Rather's field (6.9%) as compared to FP plots at both locations (**Table 2.7.1)**. Grasshopper numbers were the same in both IPM and FP plots except at Sri Nadeem Ahmad Malik's FP plot (14.2/5 hills) at 84 DAT. Grain yield was significantly higher in IPM plots (7625 – 8875 kg/ha) as compared to FP plots (5375 – 6875 kg/ ha). This high grain yield resulted in higher gross returns and a higher BC ratio in the IPM plots (1.91-2.15) as against FP plots (1.35-1.64).

Table 2.7.1 Pest incidence, grain yield and BC ratio in IPMs trial at Khudwani, *Kharif* 2023

Farmer Name	Treatments	% GHDL		GH No/5 hills		Yield (kg/ ha)	Gross Returns (Rs.)	Cost of Cultivation (Rs.)	Net Returns (Rs.)	BC Ratio
		30 DAT	84 DAT	30 DAT	84 DAT					
Sri. Shabir Ahmad Mir	IPM	9.2±0.9b	13.9±0.5b	1.4± 0.4	5.4±0.5	7625	152500	79800	72700	1.91
Sri M Shafi Bhat	FP	21.6±2.5a	23.5±0.9a	2.4±0.2	5.2 ± 0.4	5375	107500	79650	27850	1.35
Sri Nazir Ahmad Teeli	IPM	9.3 ±1.3a	11.2±0.7a	2.4±0.2	5.2±0.5	8125	162500	84625	77875	1.92
Sri M Yaqoob Teeli	FP	9.3 ±1.3a	11.2±0.7a	3.6±0.7	9.4± 0.5	6550	131000	82825	48175	1.58
Sri Gh Hassan Rather	IPM	6.9 ±0.7b	18.4 ± 0.5b	2.4±0.2	5.2 ±0.6	8125	162500	77875	84625	2.09
Sri Gh Nabi Bhat	FP	11.8 ±1.2a	23.3 ± 0.4a	2.6±0.2	4.6 ± 0.5	6050	121000	84675	36325	1.43
Sri M Abbas Malik	IPM	6.9 ± 0.8a	19.6 ± 0.4b	2.6±0.2	4.2 ± 0.6	8875	177500	82475	95025	2.15
Sri Nadeem Ahmad Malik	FP	6.9 ± 0.6a	22.3 ± 0.6a	3.6±0.4	14.2±1.2	6875	137500	83825	53675	1.64
	IPM					**8188**				**2.02**
	FP					**6213**				**1.50**

Price of Paddy = Rs. 2000/q ; GHDL = Grasshopper damaged leaves

2) Malan, Himachal Pradesh: The IPMs trial was conducted in Jia Haar village, Kangra district, Himachal Pradesh. Kasturi Basmati was grown in the IPM field and a local variety, Jheni was grown in the FP plot. The practices followed in IPM and FP plots are given below:

Practices followed in IPMs trial at Malan, *Kharif* 2023

	IPM Practices	Farmers Practices
Area	10 ha	10 ha
Variety	Kasturi Basmati	Jheni, a local variety
Nursery	• Line sowing • Applied FYM	• Broadcast nursery • Applied urea @ 30 kg
Main field	• Applied 90 kg N, 40 kg P_2O_5 and 40 kg K_2O. • Application of herbicide – Bispyribac sodium salt • Sprayed Chlorpyriphos • Applied Bavistin	• Applied 30 kg urea • Manual weeding

The incidence of black beetle, leaf folder and BPH was observed in both IPM and FP plots (**Table2.7.2**). Dead hearts caused by black beetle were significantly high in FP plots (32.7 – 36.4% DH) compared to IPM plots (20.0-20.6% DH) at both 29 and 36 DAT. However, leaf folder damage was significantly higher in IPM plot (21.6% LFDL) than that in the FP plot (12.9% LFDL). BPH incidence was low in both treatments. Grain yield was high in IPM plots (3600 kg/ ha) resulting in high gross returns and BC ratio (3.10). In this Zone, the weed population at Active Tillering and Panicle Initiation stage in IPM plots was lower than that in farmers practice by 4.65 and 16.27% respectively. The dry weed biomass was lower in IPM implemented fields by 59.82 and 19.28 % respectively **(Table 2.7.3)**. The mean grain yield advantage was 49.07 in IPM adopted plots.

Table2.7.2 Pest incidence, grain yield and BC ratio in IPMs trial at Malan, *Kharif* 2023

Treatments	% DH due to black beetle		% LFDL		BPH (No./5 hills)	Yield (kg/ ha)	Gross Returns (Rs.)	Cost of Cultivation (Rs.)	Net Returns (Rs.)	BC Ratio
	29 DAT	36 DAT	43 DAT	57 DAT	43 DAT					
IPM	20.0 ± 3.7b	20.6 ± 4.3b	18.7 ± 1.9a	21.6 ± 2.5a	5.8 ± 0.9b	3600 ± 112a	144000	46410	97590	3.10
FP	32.7 ± 2.9a	36.4 ± 2.9a	19.4 ± 2.2a	12.9 1.2b	7.0 ± 1.1a	1800 ± 33b	72000	35300	36700	2.04

Price of Paddy = Rs. 4000/q

Table 2.7.3 Weed parameters at Malan, *Kharif* 2023

Treatments	Weed population no/m²		Weed dry biomass g/m²	
	30 DAT	60 DAT	30 DAT	60 DAT
IPM	41.0(6.4)	36.0(6.0)	30.5	55.5
FP	43.0(6.5)	43.0(6.6)	75.8	68.8
Mean	6.5	6.3	53.2	62.2
CD (0.05)	2.7	0.1	55.0	20.0

Zone II – Northern areas

The IPMs trial was conducted in 6 farmers' fields in three locations. Location-wise details of farmers, their village and district are given below:

S. No	Location	State	Village, District	Farmer Name
1	Kaul	Haryana	Karsa Dod village, Kaithal district	Sri. Dalsher Singh
2	Kaul	Haryana	Kaul village/ Kaithal district	Sri Pardeep
3	Ludhiana	Punjab	Sudhar village/ Ludhiana district	Sri S Inderjeet Singh
5	Pantnagar	Uttarakhand	Chitranjanpur, Dineshpur, Udham Singh Nagar	Sri Amit Sarkar
6	Pantnagar	Uttarakhand	Chitranjanpur, Dineshpur, Udham Singh Nagar	Sri Prabhash Sarkar
7	Pantnagar	Uttarakhand	Arjunpur, Dineshpur, Udham Singh Nagar	Sri Prakash Sarkar

The IPM practices and farmer practices followed are given in the table below:

Practices followed in IPMs trial in Zone II (Northern areas), *Kharif* 2023

Practices followed in IPMs trial at Kaul, *Kharif* 2023		
	IPM Practices	**Farmer Practices**
Area	0.4 ha	0.4 ha
Variety	CSR 30	CSR 30
Nursery	• Seed treatment with Bavistin 10 g + Streptocycline 1g / 10 kg seed for 24 h • Application of 1 kg DAP, 1 kg urea and FYM 40 kg • Sprayed Bispyribacsodium 10% SC @ 0.4 ml/ liter water at 15 – 20 DAS	• Seed treatment with Bavistin 10 g + Streptocycline 1g / 10 kg seed for 12 h • Application of 1 kg DAP and 2 kg urea
Main Field	• clipping of leaf tips before transplanting • Application of 25 kg DAP, 40 kg Urea, Zinc sulphate (21%) 10 kg • Application of Pretilachlor @ 1250 – 1500 ml/ ha • Release of *Trichogramma chilonis* @ 40000/ acre, 3-4 times starting at 31 DAT • Installation of bird perches @ 10/ acre • Sprayed Cartap hydrochloride 50 SP @ 400 g/ acre • Mid-season drainage of the field • Sprayed Flubendiamide 20 WG @ 50 g/ acre • Applied Lustre (flusilazole + carbendazim) @ 400 ml/ acre for sheath blight control	• Application of 150 kg urea as top dressing • Application of Pretilachlor @ 1250 – 1500 ml/ ha • Application of cartap hydrochloride @ 10 kg/ acre • Sprayed Flubendamide @ 70gm/acre + Lamda cyhalothrin @30ml/acre • Two sprays of a mixture of insecticides • Spray of a mixture of insecticide and fungicide • Applied Streptocycline @ 15g/ha + Copper oxychloride @ 500g/ha, Propiconazole 25 EC @ 1000ml/ha
Practices followed in IPMs trial at Ludhiana, *Kharif* 2023		
Area	Half acre	Half acre
Variety	PR 126	PR 126
Nursery	• Application of urea @ 1.0 kg and Zinc sulphate @ 1 kg/ acre nursery	• Application of urea @ 1.0 kg/ acre nursery and Zinc sulphate @ 1 kg/ acre nursery
Main field	• Alleyways of 30 cm after every 2 m • Application of Butachlor @ 1.2 L/ acre • Sprayed Coragen @ 60 ml/ acre • Sprayed Pexalon @ 94 ml/ acre • Sprayed Tilt @ 200ml/ acre • Recommended dose of neem coated urea @90 kg/ acre • Growing flowering plants like marigold soybean, cowpea, moong, Mash and sesamum on bunds • Water management for planthoppers	• Applied neem coated urea @ 120 kg and zinc sulphate 25 kg/ acre • Application of Butachlor @ 1.2 L/ acre • Application of Mortar @ 170 g/ acre • Sprayed Chess @ 140g/ acre • Sprayed Tilt + Nativo (tebuconazole and trifloxystrobin) @ 200 + 80 ml/ acre
Practices followed in IPMs trial at Pantnagar, *Kharif* 2023		

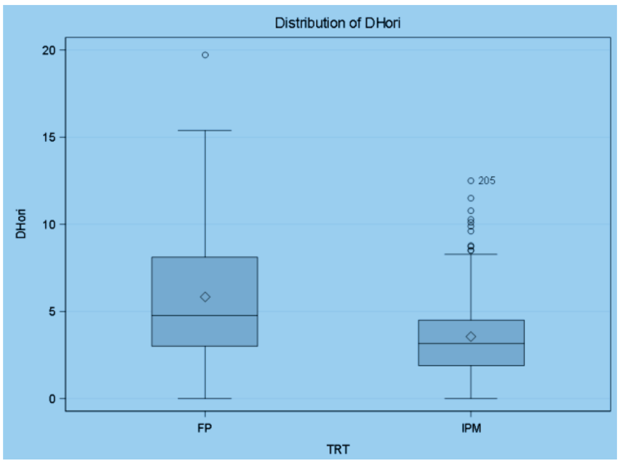
1) Sri Amit Sarkar, Chitranjanpur, Dineshpur village, Udhamsingh nagar district, Uttarakhand		
Area	4000 sq.m	4000 sq.m
Variety	PR 126	PR 126
Main Field	• Application of NPK @ 40 kg/, Zinc @ 10 kg, urea @ 48 kg • Seed treatment with Trichoderma @ 10g/ kg seed • Application of Bispyribac Sodium @250 ml/ha • Sprayed Cartap hydrocloride 50% SP@ 600g/ha • Sprayed Neemazal • Sprayed Pymetrozine 50% WG • Applied Hexaconazole 5% EC + Propiconazole 25% EC • Installed pheromone traps for YSB @ 8/ ha	• Application of NPK @ 40 kg, Chelated Zinc @ 2.5 kg and urea 60 kg • Application of Pretilachlor 50 EC @ 1.5 liter/ ha; Nominee gold @ 200 ml/ ha • Applied Cartap Hydrocloride 4.0 GR @ 19kg/ha, Chlorantrniliprole 18.5%(Coragen) @ 150 ml/ha. • Applied Chlorpyrifos 50% + Cypermethrin 5% EC (Hamla) • Buprofezin 25 SP @1000 ml /ha, Pymetrozine 50% WP • Applied Copper oxychloride 50% WP + Streptocycline • Applied Propiconazole 25% EC(Tilt) @ 500 ml/ha
5) Sri Prabhash Sarkar, Chitranjanpur, Dineshpur village, Udhamsingh nagar district, Uttarakhand		
Area	4000 sq.m	4000 sq.m
Variety	PR 130	PR 130
Main Field	• Application of NPK 40 kg, Zinc 10 kg and Urea 48 kg • Application of Bispyribac Sodium 10% SC@ 250 ml/ha • Sprayed Cartap hydrochloride 50% SP @ 600g/ha and Triflumezopyrim 10% SC(Pexalon) @ 94 ml /acre • Applied Hexaconzole 5%EC + Propiconazole 25% EC • Installed pheromone traps for YSB @ 8/ ha • Sprayed Neemazal	• Application of NPK 40 kg, Chelated Zinc @ 2.5 kg and Urea 60 kg, micronutrient granules @ 2 kg/ acre • Applied Pretilachlor @1.5 liter/ha, Nominee gold 200 ml/ha • Application of Chlorantraniliprole 0.4GR (Ferterra) • Applied Chlorantraniliprole 18.5% SC (Coragen) • Applied Fipronil 5% SC and, Triflumezopyrim 10% SC(Pexalon) @ 94 ml /acre • Applied Streptocycline @ 15g/ha + Copper oxycloride @ 500g/ha, Propiconazole 25 EC @ 500ml/ha
6) Sri Prakash Sarkar, Arjunpur, Dineshpur village, Udhamsingh nagar district, Uttarakhand		
Area	4000 sq.m	4000 sq.m
Variety	PR 130	PR 130
Main Field	• Application of NPK 40 kg, Zinc 10 kg and Urea 48 kg • Application of Bispyribac Sodium 10% SC@ 250 ml/ha • Applied Cartap Hydrocloride 50% SP @ 600 g/ha, Pymetrozine 50% WG • Applied Hexaconazole 5% EC + Propiconazole 25% EC • Installed pheromone traps for YSB @ 8/ ha • Sprayed Neemazal	• Application of NPK 40 kg, Chelated Zinc @ 2.5 kg and Urea 60 kg,, micronutrient granules @ 2 kg/ acre • Applied Pretilachlor @ 1.5 L/ ha, Nominee gold 200 ml/ ha • Application of Chlorantraniliprole 0.4GR (Ferterra) • Applied Chlorantraniliprole 18.5% SC (Coragen) • Applied Fipronil 5% SC and Pymetrozine 50% WP • Applied Streptocycline @ 15g/ha + Copper oxycloride @ 500g/ha, Hexaconazole 5% EC

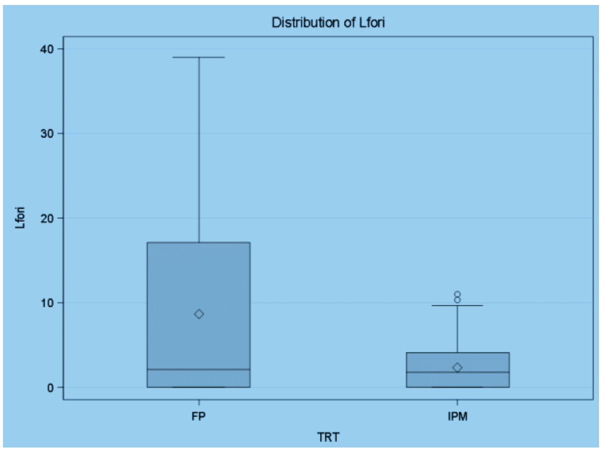
Incidence of stem borer, leaf folder, BPH, WBPH, leaf blast, sheath blight, brown spot was observed in both IPM and FP plots (**Table 2.7.4**). In general, the incidence of insect pests was low in both treatments. However, across the locations, the incidence of dead hearts, leaf folder, BPH and WBPH was significantly low in IPM plots as compared to FP plots (**Figure 2.7.1**). Across the farmers, grain yield was significantly higher in the IPM plot (5755 kg/ ha) as compared to the FP plot (5378 kg/ ha).

Table 2.7.4 Insect Pest incidence in IPMs trial in Zone II (Northern), *Kharif* 202

Treatments			% DH/WE	% LFDL	BPH(No./ hill)	WBPH(No./ hill)	Yield kg/ha
KUL	F1- Sri. Dalsher Singh	IPM	1.7(1.4)b	4.2(2.2)b	2(1.5)b	0.4(1.1)a	4461(67)a
		FP	2.6(1.7)a	20.7(4.5)a	4(2.1)a	0.6(1.2)a	4099(64)b
LSD(0.05,36 df)			**0.22**	**0.13**	**0.30**	**0.19**	**2.57**
KUL	F2 - Sri Pardeep	IPM	1.2(1.2)b	3.4(1.9)b	1(1.1)a	0.2(1.0)a	4433(66)a
		FP	3.1(1.8)a	24.4(4.9)a	2(1.4)a	0.4(1.1)a	4154(65)b
LSD(0.05,36 df)			**0.21**	**0.13**	**0.37**	**0.10**	**1.62**
LDN	F3 - Sri Inderjeet Singh	IPM	3.5(2.0)b	5.4(2.3)a	10(3.2)b	11(3.3)b	7284(85)a
		FP	4.5(2.2)a	5.6(2.3)a	13(3.6)a	14(4.0)a	6992(84)b
LSD(0.05,36 df)			**0.22**	**0.08**	**0.27**	**0.27**	**1.04**
PNT	F4 = Sri Amit Sarkar	IPM	5.3(2.4)b	0.3(0.9)b	14(3.4)b	0.(0.7)a	6277(79)a
		FP	7.4(2.7)a	0.7(1.0)a	25(4.8)a	0.(0.7)a	5794(76)b
LSD(0.05,36 df)			**0.26**	**0.09**	**0.31**	**0.02**	**2.48**
PNT	F5 = Sri Prabhash Sarkar	IPM	4.9(2.2)b	0.8(1.1)a	14(3.6)b	2(1.5)b	5924(77)a
		FP	9.0(3.0)a	0.6(1.0)a	31(5.5)a	4(2.0)a	5534(74)a
LSD(0.05,36 df)			**0.22**	**0.11**	**0.34**	**0.27**	**3.12**
PNT	F6 = Sri Prakash Sarkar	IPM	4.9(2.2)b	0.3(0.9)a	24(4.7)a	1(1.4)a	6148(79)a
		FP	8.6(3.0)a	0.3(0.9)a	22(4.4)a	2(1.5)a	5694(75)a
LSD(0.05,36 df)			**0.26**	**0.07**	**0.38**	**0.16**	**4.06**
Treatments							
T1 = IPM			3.6(1.9)b	2.6(2.1)b	11(2.9)b	3(1.5)b	5755(76)a
T2 = FP			5.8(2.4)a	6.4(2.6)a	16(3.6)a	4(1.7)a	5378(73)b
LSD(0.05,216 df)			**0.09**	**0.07**	**0.13**	**0.08**	**0.81**
DAT							
D1 = 50 DAT			6.0(2.4)a	4.3(2.7)a	9(2.8)c	2(1.5)b	
D2 = 64 DAT			5.3(2.3)a	5.0(2.7)a	24(4.4)a	6(2.1)a	
D3 = 71 DAT			4.3(2.1)b	4.6(2.3)b	14(3.4)b	3(1.6)b	
D4 = 85 DAT			3.8(2.0)b	5.5(2.3)b	7(2.5)d	1(1.4)c	
D5 = PH			4.2(2.1)b	3.0(1.8)c			
LSD(0.05, 216 df)			**0.15**	**0.11**	**0.18**	**0.11**	

Figures in parenthesis are Atkinson's transformed values. Means in a column followed by same letter are not significantly different from each other





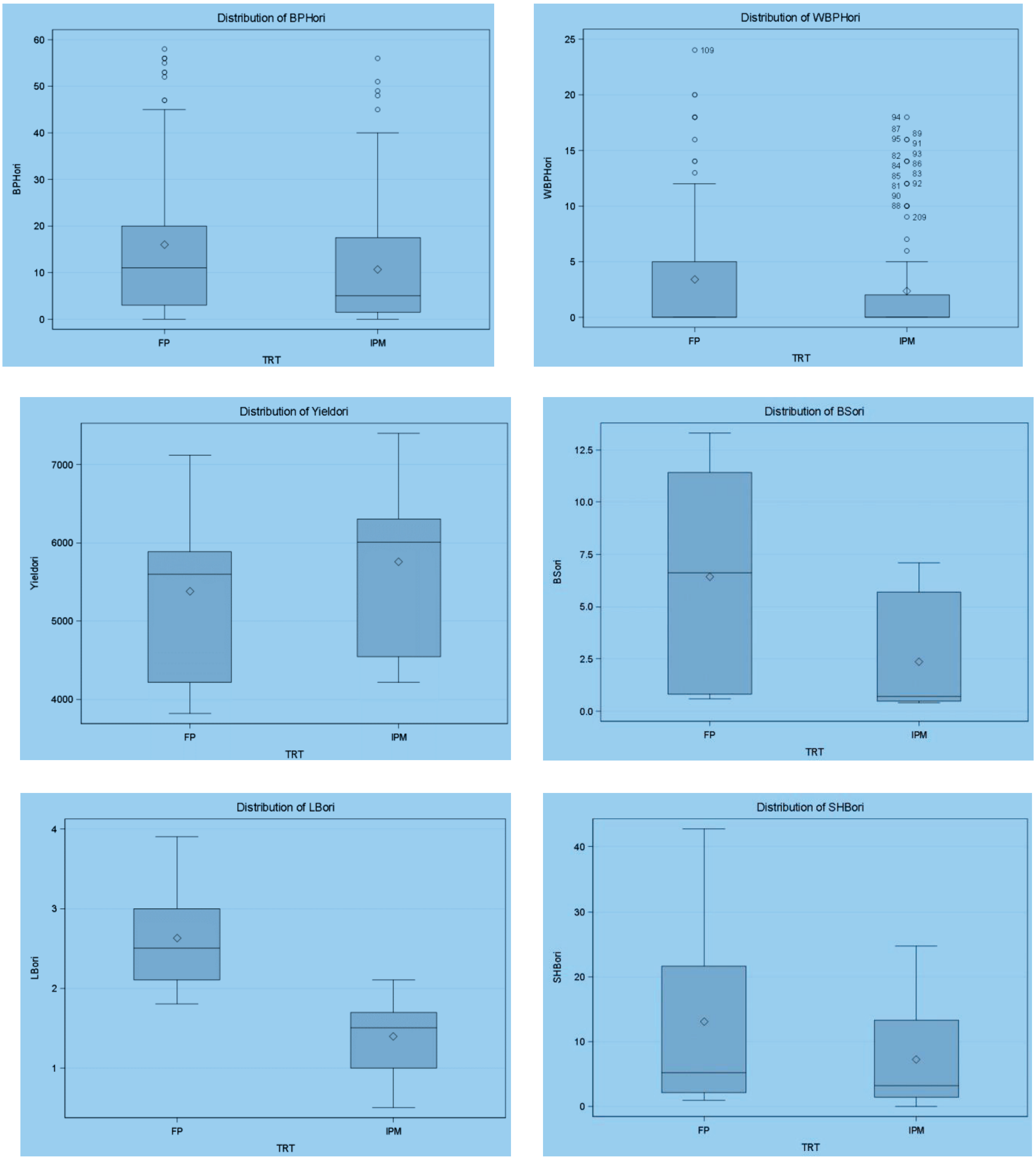


Figure 2.7.1 Box plots of the incidence of dead hearts, leaf folder damage, BPH, WBPH, brown spot, leaf blast, sheath blight and grain yield in IPM and FP plots across locations in Zone II (Northern areas)

At Kaul, the weed population at Active Tillering and Panicle Initiation stage in IPM plots was lower than farmers practice by 40 and 70% respectively. The mean grain yield advantage was 7.2 in IPM adopted plots. At Ludhiana, the weed population at Panicle Initiation stage in IPM plots was lower than farmers practice by 19.2% respectively. The mean grain yield advantage was 1.5 in IPM adopted plots (**Table 2.7.5**).

Table 2.7.5 Weed parameters in Zone II, *Kharif* 2023

Location	Treatments	Weed population (No/m2)	
		Active tillering stage	Panicle initiation stage
KAUL	IPM	1.0(1.0)	0.4(0.9)
	FP	0.6(1.0)	0.1(0.8)
	Exp. mean	1.0	0.8
	CD(0.05)	0.8	0.3
LUDHIANA	IPM		5.3(2.3)
	FP		6.5(2.5)
	Exp. mean		2.4
	CD(0.05)		0.6

At Pantnagar, the trial was evaluated for the management of sheath blight, brown spot, bacterial blight and false smut in three different locations. Data was recorded as disease severity for the all the diseases except false smut, wherein the data was recorded as disease incidence. Spraying of specific fungicide (Hexaconazole 5% EC) for sheath blight disease effectively reduced the disease progression of (377-317 AUDPC units) when compared to Farmers practices (730 to 670 AUDPC units). Spraying of Propiconazole 25% EC at correct stage of the crop effectively reduced the false smut disease incidence (IPM - 22.6 to 13.6 %) as against farmers practice (20.2% to 22.6%). Similarly, adoption of IPM practices reduced the disease progress of brown spot and bacterial blight, as compared to the farmer practices. At Kaul, the trial was conducted for the management of leaf blast, neck blast, bacterial blight and sheath blight in two different locations. Adoption of IPM practices, significantly reduced the progress of the leaf blast (L1= IPM-116; FP-189, L2= IPM-117; FP-159) and sheath blight (L1= IPM-85; FP-104, L2= IPM-58; FP-105) in terms of AUDPC value as compared to the farmer management practices. In case of neck blast disease there was no much variation between the IPM and Farmer practices. At Ludhiana, the trial was conducted for the management of sheath blight, brown spot and false smut at one location. Results revealed that, adoption of IPM practices reduced the false smut disease incidence (**Table 2.7.6**).

Among the IPM farmers, the highest grain yield was reported from the IPM plot (7284 kg/ ha) and was significantly different from the FP plot (6992 kg/ha). Maximum gross returns were obtained at Kaul in Sri Dasher Singh's IPM plot resulting in the highest BC ratio (6.01) followed by the FP plot (5.59). In Zone II, the mean BC ratio was higher in the IPM plot (3.68) as compared to the FP plot (**Table 2.7.7**).

Table2.7.6 AUDPC values based on disease severity (%) of rice diseases in Zone II (Pantnagar, Ludhiana and Kaul), *Kharif* 2023

		DI (%)	AUDPC Values									DI (%)
	Treat-ment	Pantnagar				Kaul				Ludhiana		
		FS	SHB	BS	BB	LB	NB	BB	SHB	SHB	BS	FS
L1	IPM	15.9	354	28	0	116	20	12	85	114	152	18.2
	FP	22.6	728	90	16	189	20	21	104	60	72	20.0
L2	IPM	13.7	377	28	0	117	10	15	58	-	-	
	FP	20.2	730	91	15	159	15	22	105	-	-	
L3	IPM	13.6	317	29	0	-	-	-	-	-	-	
	FP	21.4	670	94	16	-	-	-	-	-	-	

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; AUDPC- Area under disease progress curve

Table 2.7.7 Returns and BC ratio in IPMs trial in Zone II (Northern), *Kharif* 2023

Location	Farmers	Treatments	Yield (q/ ha)	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net returns (Rs.)	BC ratio
KUL	F1- Sri. Dalsher Singh	IPM	44.61	274352	45625	228727	6.01
		FP	40.99	252089	45125	206964	5.59
KUL	F2 - Sri Pardeep	IPM	44.33	265980	53813	212167	4.94
		FP	41.54	249240	50150	199090	4.97
LDN	F3 - Sri Inderjeet Singh	IPM	72.84	150050	56746	93304	2.64
		FP	69.92	144035	60646	83389	2.38
PNT	F4 = Sri Amit Sarkar	IPM	62.77	131817	44468	87349	2.96
		FP	57.94	121674	53140	68534	2.29
PNT	F5 = Sri Prabhash Sarkar	IPM	59.24	124404	47298	77106	2.63
		FP	55.34	116214	55008	61206	2.11
PNT	F6 = Sri Prakash Sarkar	IPM	61.48	129108	44618	84490	2.89
		FP	56.94	119574	52870	66704	2.26
	IPM		**57.55**				**3.68**
	FP		**53.78**				**3.27**

Price of Paddy: F1 = Rs.6150/q; F2 = Rs. 6000/q; F3 = Rs. 2060/q; F4, F5 & F6 = Rs.2100/q

Zone III – Eastern areas

IPM trial was conducted in three farmers' fields at three locations. The details are given below:

S. No	State	Location	Village/district	Farmer Name
1	Odisha	Chiplima	Garmunda village, Sambalpur	Sri. Tarakanta Pradhan
2	Uttar Pradesh	Masodha	Murchpur village, Masodha/ Ayodhya district	Sri Raj Narayan
3	Bihar	Pusa	Muktapur village, Samastipur district	Sri Shankar Prasad

The package of practices followed in both IPM and FP plots are given below:

Practices followed in IPMs trial in Zone III (Eastern areas), *Kharif* 2023

Practices followed in IPMs trial at Chiplima, *Kharif* 2023		
	IPM practices	**Farmers practices**
Area/ variety	2000 sq.m ; Swarna (MTU 7029)	2000 sq.m ; Swarna (MTU 7029)
Nursery	• Seed treatment with Trichoderma @ 10g/kg • Applied fipronil 0.3 G @ 10 kg/ acre, 5 days before transplantation	
Main field	• Transplanted at a spacing of 20 x 15 cm. • Alleyways of 30 cm after every 2 m. • Fertilizers (NPK) applied @ 100:50:50. • Sprayed CM75 @ 1000 g/ ha at 60 DAT for brown spot management • Applied Triflumezopyrim 10% SC @ 94 ml/ acre at 70 DAT	• Fertilizers (NPK) applied 100:50:50 • Applied Cartap hydrochloride 4 G @ 20 kg /ha during transplanting • Sprayed Fipronil 5 SC @ 1250 ml/ ha two times at 30 DAT and 45 DAT • Sprayed Isoprothiolane 40 EC @ 1000 ml/ha at 55 DAT • Sprayed Pymetrozine 50 WP @ 300 g /ha at 75 DAT
Practices followed in IPMs trial at Masodha, *Kharif* 2023		
Area/	5 acres	5 acres
Variety	BPT 5204	BPT 5204
Nursery	• Seed treatment with Trichoderma@10kg/ha. Presoak the seed in water for 12 hrs. Application of FYM	• Only presoak the seed in water for 12 hrs.
Main field	• Application of 100:50:50:10: N: P: K: ZnSo4 and 10 t/ha FYM • Transplanted seedlings at a spacing of 20 x 15 cm. • Alleyways of 30 cm after every 2 m • Applied Pretilachlor 0.5 kg ai/ ha within two days after transplanting the crop. • Installed pheromone traps with 5 mg lure @ 8 traps/ ha for stem borer monitoring. • One spray of Cartap hydrochloride 50 WP @ 400 g / ha at 60 DAT • Need based application of Propiconazole	• Applied 50:50 N: P and 5 t/ha FYM • Applied Nominee gold @ 100 ml/ acre
Practices followed in IPMs trial at Pusa, *Kharif* 2023		
Area	1 acre	1 acre
Variety	Rajendra Mahsuri	Rajendra Mahsuri
Nursery	• Seed treatment with Carbendazim @ 2 g/ kg seed	• Seed treatment with Carbendazim @ 2 g/ kg seed
Main Field	• Transplanting at 20 x 15 cm spacing • Application of RDF • Application of Butachlor @ 1.5 kg ai/ ha after one week after transplanting • Installed pheromone traps for YSB @ 3/ acre • Application of Bispyribac sodium 20 g ai/ ha at 20 DAT • Application of cartap hydrochloride 50 WP @ 600g / ha at 50 DAT	• Transplanting at 20 x 15 cm spacing • Application of RDF • Application of Butachlor @ 1.5 kg ai/ ha after one week after transplanting • Hand weeding at 30 DAT • Application of Padan (cartap hydrochloride) soluble powder @ 2 kg formulation/ha

Low incidence of stem borer, leaf folder and BPH was observed in both IPM and FP plots at all the locations (**Table 2.7.8)**. However, the incidence was significantly low in IPM plots as compared to FP plots across locations (**Figure 2.7.2**).

Table 2.7.8 Insect Pest incidence in IPMs trial in Zone III (Eastern), *Kharif* 2023

Treatments			%DH/WE	%LFDL	%BPH	Yield kg/ha
Location	**Farmer**					
CHP	F1 = Sri Tarakanta Pradhan	IPM	0.8(1.0)b	0.1(0.8)b	8.0(3)b	4410(66)a
		FP	1.4(1.1)a	0.4(1.0)a	22.0(5)a	4200(65)a
LSD (0.05; 28df)			**0.11**	**0.05**	**0.37**	**3.79**
MSD	F2 = Sri Raj Narayn	IPM	3.4(2.0)b	4.0(2.0)b		5444(74)a
		FP	4.7(2.3)a	6.9(2.6)a		3610(60)a
LSD (0.05; 28df)			**0.19**	**0.10**		**1.67**
PUS	F3 = Sri Shankar Prasad	IPM	7.0(2.4)a	1.4(1.1)b		5918(77)a
		FP	7.5(2.6)a	2.3(1.3)a		4686(68)b
LSD (0.05; 28df)			**0.34**	**0.04**		**5.99**
Treatments						
IPM			1.8(5.7)b	2.9(13.8)b	2.0(5)b	5257(72)a
FP			2.4(6.4)a	5.7(16.9)a	6.0(8)a	4162(64)b
LSD (0.05,84)			**0.36**	**0.36**	**0.65**	**1.91**
DAT						
D1 = 29/45 DAT			1.9(5.9)b	10.5(25.2)a		
D2 = 50/60 DAT			1.5(5.5)b	3.9(14.3)b	2.0(5)c	
D3 = 71/75 DAT			2.0(6.0)b	2.4(12.4)c	4.0(6)bc	
D4 = Pre har			2.8(7.0)a	0.5(9.4)d	4.0(7)b	
LSD (0.05,84)			**0.51**	**0.51**	**0.92**	

Figures in parenthesis are Atkinson's transformed values. Means in a column followed by same letter are not significantly different from each other

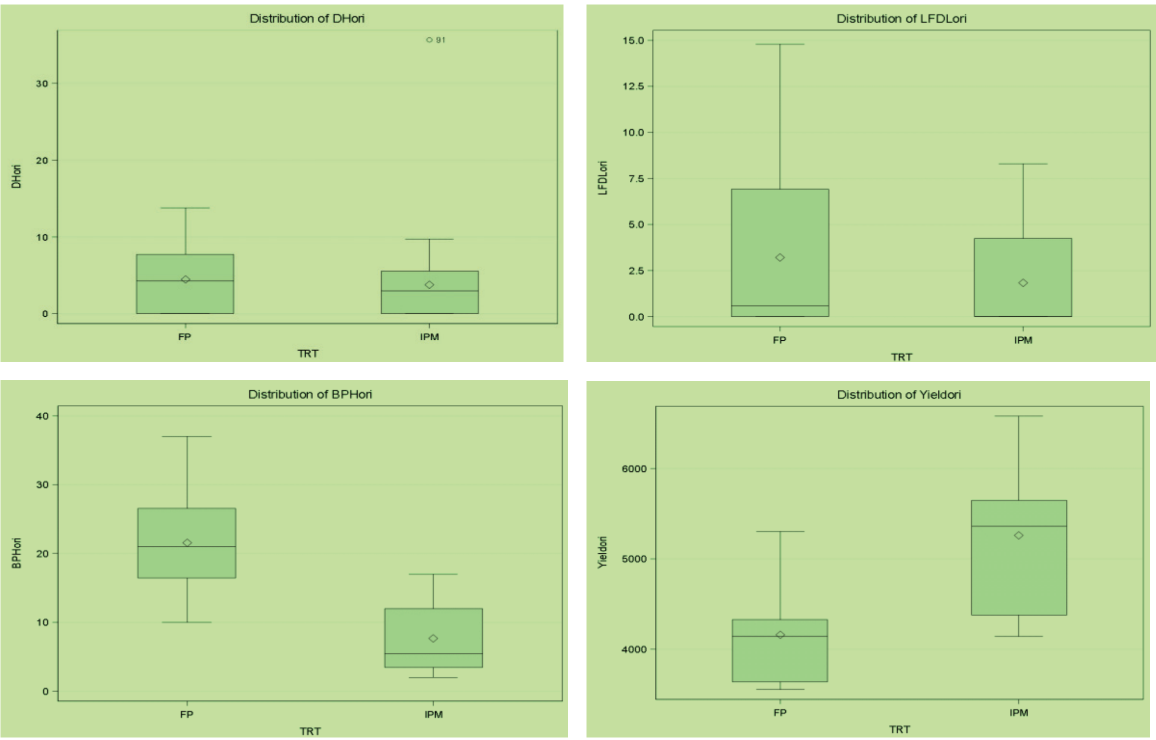


Figure 2.7.2 Box plots of the incidence of dead hearts, leaf folder damage, BPH and grain yield in IPM and FP plots across locations in Zone III (Eastern areas)

In the IPM trial conducted by Chiplima, the data on weed population recorded at Panicle Initiation stage showed significant decrease in weed population by 25.2%. IPM implemented fields, resulted in higher growth, yield attributes and grain yield advantage increase by 22% of the variety Swarna (**Table 2.7.9**). At Masodha, Faizabad, the data on weed population recorded at Active Tillering and Panicle Initiation stage showed significant decrease in weed population by 77.2 and 37.8%, respectively. The dry weed biomass was lower in IPM implemented fields by 77.2 and 35.2 % respectively. IPM implemented fields, resulted in higher growth, yield attributes and grain yield advantage increase by 33.7%. In the IPM field trial conducted, the weed population at Active Tillering and Panicle Initiation stage was lower than farmers practice by 17.1 and 9.7 % respectively. The dry weed biomass also was lower in IPM implemented fields by 18.2 and 13.3% respectively. The mean grain yield advantage was 20.8% in IPM adopted plots.

Table 2.7.9 Weed parameters in Zone III (eastern areas), *Kharif* 2023

Locations	Treatments	Weed population (No/m2)		Weed dry biomass (g/m2)	
		Active tillering stage	Panicle initiation stage	Active tillering stage	Panicle initiation stage
CHIPLIMA	IPM		106.8(10.3)		
	FP		142.8(11.9)		
	Exp. mean		11.2		
	CD(0.05)		0.3		
MASODHA	IPM	3.0(1.9)	6.2(2.6)	0.4	0.9
	FP	13.0(3.7)	9.9(3.2)	1.9	1.4
	Exp. mean	2.8	2.9	1.2	1.2
	CD(0.05)	0.3	0.3	0.3	0.3
PUSA	IPM	11.2(3.4)	12.7(3.6)	13.0	14.9
	FP	13.6(3.8)	14.1(3.8)	15.8	17.2
	Exp. mean	3.6	3.7	14.4	16.0
	CD(0.05)	0.4	0.2	2.0	1.0

At Chiplima, adoption of IPM Practices like seed treatment with *Trichoderma* @10g/kg and spraying of carbendazim + mancozeb reduced the leaf blast disease progress (IPM- 27; FP- 141) as compared to farmer practices. The diseases *viz.*, neck blast and bacterial blight progress was low in the IPM practices adopted field as compared with the farmer practices adopted field (NB = IPM – 177; FP-225, BB = IPM-295, FP-350). Similarly, reduction of false smut incidence (8.0%) was recorded in the IPM practices adopted field as against farmer practices (11.76%). In case of brown spot disease, IPM practice adopted field recorded the AUDPC value of 132 as against 108 in farmer practice adopted field. At Masodha the trial was conducted for the management of leaf blast, neck blast and bacterial blight and the data was recorded in terms of disease severity. Significant reduction in the disease development of leaf blast, neck blast and bacterial blight was recorded. Adoption of IPM practices, completely reduced the disease severity of leaf blast (0) as compared to farmer practices (26%). With respect to neck blast and bacterial blight, the disease severity was reduced from 37.3% to 16.4% and from 36.6 % to 11.1% respectively (**Table 2.7.10**).

Table 2.7.10 AUDPC values based on disease severity (%) of rice diseases at Chiplima and Masodha, *Kharif* 2023

	Treatment	Chiplima					Masodha		
		AUDPC				FS	Disease Severity (%)		
		LB	NB	BS	BB	(DI %)	LB	NB	BB
L1	IPM	27	177	132	295	8.0	0	16.4	11.1
	FP	141	225	108	350	11.8	26.0	37.3	36.6

L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices; LB- Leaf Blast; NB- Neck Blast; BB- Bacterial blight; DI- Disease Incidence; AUPDC- Area under disease progress curve

Grain yield was significantly high in IPM plots (5257 kg/ ha) as compared to FP plots (4165 kg/ ha). BC ratio was high in IPM plots (2.10) due to high grain yield resulting in high gross returns and low cost of cultivation compared to FP plots (**Table 2.7.11**).

Table 2.7.11Returns and BC ratio in IPMs trial in Zone III (Eastern), *Kharif* 2022

Location	Farmer's Name	Treatments	Yield (q/ha)	Gross Returns (Rs.)	Cost of Cultivation (Rs)	Net Returns (Rs.)	BC Ratio
CHP	F1 = Sri Tarakanta Pradhan	IPM	44.10	85554	50540	35014	1.69
		FP	42.00	81480	52940	28540	1.54
MSD	F2 = Sri Raj Narayn	IPM	54.44	117863	62860	55003	1.88
		FP	36.10	78157	60400	17757	1.29
PUS	F3 = Sri Shankar Prasad	IPM	59.18	129190	47283	81907	2.73
		FP	46.86	102295	36865	65430	2.77
		IPM	**52.57**				**2.10**
		FP	**41.65**				**1.87**

Price of paddy at CHP = Rs.1940/q, at MSD= 2165 Rs/ q; at PSA = Rs. 2183/q

Zone IV – North-Eastern areas

Titabar, Assam: In Zone IV, the IPMs trial was conducted at Sri Purna Kanta Baruah's field, Dihingia village, Titabar Mandal, Jorhat district, Assam. Ranjit sub-1 variety was grown in both IPM and FP plots. Practices followed in IPM and farmers' practices are given in the table below:

Practices followed in IPMs trial at Titabar in Zone IV (North Esatern), *Kharif* 2023

	IPM Practices	Farmers Practices
Variety	Ranjit Sub-1	Ranjit Sub-1
Nursery	• Seed treatment with Bavistin @ 2 g/ kg seed	
Main field	• Fertilizer application @ 20, 10, 10 kg NPK/ha • Applied Pretilachlor within a week of transplanting • Applied paddy weeder to lessen weeds • Installed pheromone traps @ 12/ ha for stem borer • Applied Chlorantraniliprole 18.5% SC for stem borer management • Placed tricho cards for stem borer and leaf folder management • Sprayed fresh cowdung solution @200g/L water at mid tillering stage against BLB	• Fertilizer application @ 60,20,40 kg NPK/ha • Manual weeding done two times

The incidence of dead hearts caused by stem borer was significantly high in the FP plot (15.3% DH) compared to the IPM plot (5.0% DH) at 22 DAT and a similar trend was observed at 36 DAT (**Table 2.7.12)**. The incidence of white ears was significantly lower in the IPM plot (3.5% WE) than in the FP plot (8.9% WE).

Similarly, gall midge incidence (3.2% SS) and leaf folder incidence (5.5% LFDL) were low in IPM plots as against the FP plot.

Table 2.7.12 Insect pest incidence in IPMs trial at Titabar in Zone IV (North Eastern), *Kharif 2023*

Treatments	% DH		% WE	% SS	%LFDL	% WMDL
	22 DAT	36 DAT	Pre har	36 DAT	36 DAT	43 DAT
IPM	5.0 ± 2.1b	7.1 ± 2.3b	3.5 ± 0.9b	3.2 ± 1.3b	5.5 ± 1.7b	2.7 ± 1.1a
FP	15.3 ± 6.3a	10.8 ± 1.1a	8.9 ± 0.9a	8.2 ± 0.9a	9.1 ± 1.1a	3.7 ± 0.6a

Figures in parenthesis are Atkinson's transformed values. Means in a column followed by same letter are not significantly different from each other

Weed population and biomass were reported for Panicle Initiation stage only. A Significant reduction in weed population (49.5%) and dry weed biomass (45.1%) in IPM fields was recorded. The grain yield advantage of 20.6 % was recorded in IPM adopted fields. Grain yield was significantly high in the IPM plot (4990 kg/ha) resulting in higher gross returns and a high BC ratio (2.44) compared to FP plot (**Table 2.7.13**).

Table 2.7.13 Weed parameters, Grain yield and BC ratio in IPMs trial at Titabar, *Kharif* 2023

Treatments	Weed population (No/m2)	Weed dry biomass (g/m2)	Yield (Kg/ha)	Gross Returns (Rs.)	Cost of cultivation (Rs.)	Net Returns (Rs.)	BC ratio
IPM	33.8(5.8)	17.3	4990 ± 4a	104790	43000	61790	2.44
FP	67.0(8.1)	31.5	3420 ± 51b	71820	37000	34820	1.94

Price of Paddy = Rs.2100/q

Zone V – Central areas

Jagdalpur, Chattisgarh: IPMs trial was conducted in three farmer's fields in this zone at only one location. It is conducted in Sri Bhola Ram Sethiya's field, Sri Lakshminath's field and Sri Damodar's field in Tandpal village, Bastar district. Practices followed in both IPM and FP plots are given in the table below:

Practices followed in IPMs trial at Zone V (Central), *Kharif* 2023

Practices followed by three farmers at Jagdalpur		
	IPM Practices	Farmers Practices
Area	1 acre each farmer	1 acre each farmer
Variety	Bamleshwari	Bamleshwari
Nursery	• Application of 5 kg N, 3 kg P, 1.2 kg K / 400m^{2}nursery	• Application of 2 kg N, 1 kg P / 400m^2 nursery
Main field	• Application of 35 kg N, 23 kg P, and 15 kg K per acre • Seedlings transplanted at a spacing of 20/15 cm; Left alleyways of 30 cm after 10 rows. • Applied Pyrazosulfuron ethyl 10 WP 500gm./ha • Nitrogen top dressing at 45 DAT	• Application of 23 kg N, 12 kg P, and 15 kg K per acre • Hand weeding once

The incidence of dead hearts caused by stem borer is significantly higher in Sri Damodar's FP plot (13% DH) compared to the IPM plot (**Table 2.7.14**). Similarly, gall midge damage was significantly higher in the FP plot (12.7% SS) than in the IPM plot (1.9% SS). Low incidence of leaf folder (*% LFDL), whorl maggot (<7% WMDL), thrips (<9% THDL) was observed in both the treatments across the farmers' fields.

Table 2.7.14 Insect Pest incidence in IPMs trial in Zone V (Central), *Kharif* 2023

Location	Farmer Name	Treat	% DH/WE	% SS	% LFDL	% WMDL	%THDL	Yield kg/ha
JDP	F1 = Sri Bhola Ram Sethiya	IPM	2.9(1.7)b	3.5(1.8)b	4.0(2.1)b	4.1(2.1)b	3.7(2.0)b	4648(68)a
		FP	6.3(2.4)a	5.8(2.3)a	7.8(2.8)a	6.8(2.6)a	8.5(3.0)a	3944(63)b
LSD (0.05, 44df)			**0.38**	**0.53**	**0.21**	**0.3**	**0.29**	**2.08**
JDP	F2 = Sri Lakshminath	IPM	4.7(2.2)b	7.2(2.6)a	1.9(1.5)b	3.6(2.0)b	2.9(1.8)b	4573(68)a
		FP	8.1(2.8)a	7.8(2.8)a	6.8(2.7)a	6.5(2.6)a	5.0(2.3)a	3720(61)b
LSD (0.05,44 df)			**0.38**	**0.37**	**0.2**	**0.29**	**0.23**	2.42
JDP	F3 = Sri Damodar	IPM	4.1(1.9)b	1.9(1.4)b	1.7(1.4)b	1.1(1.2)b	1.8(1.5)b	4520(67)a
		FP	13.0(3.5)a	12.7(3.5)a	4.4(2.2)a	6.3(2.5)a	7.7(2.8)a	3812(62)b
LSD (0.05,44 df)			**0.49**	**0.41**	**0.23**	**0.28**	**0.23**	**2.42**
Treatments								
T1 = IPM			1.1(2.0)b	4.2(1.9)b	2.5(1.7)b	2.9(1.8)b	2.8(1.8)b	4580(68)a
T2 = FP			2.4(2.9)a	8.8(2.9)a	6.3(2.6)a	6.5(2.6)a	7.1(2.7)a	3825(62)b
LSD (0.05,264)			**0.24**	**0.25**	**0.12**	**0.16**	**0.14**	**1.05**
DAT								
D1 = 30 DAT			0.7(1.5)d			2.8(1.7)c		
D2 = 45 DAT			1.4(2.2)c	7.0(2.6)b	2.9(1.8)c	5.0(2.3)b	4.0(2.0)b	
D3 = 60 DAT			1.8(2.5)bc	9.6(3.0)a	3.7(2.0)b	6.3(2.5)a	5.5(2.3)a	
D4 =75 DAT			2.1(2.6)b	6.9(2.5)b	5.2(2.3)a		5.4(2.3)a	
D5 = 90 DAT			1.9(2.6)b	2.5(1.5)c	5.8(2.4)a			
D6 = Pre har			2.6(3.1)a					
LSD (0.05,264 df)			**0.41**	**0.35**	**0.17**	**0.2**	**0.17**	

Figures in parenthesis are Atkinson's transformed values. Means in a column followed by same letter are not significantly different from each other

At this location, the weed population recorded at Active Tillering and Panicle Initiation stages, was lower than farmers practice by 40.7 and 36.4% respectively. The mean grain yield advantage was 18.8% in IPM adopted plots (**Table 2.7.15**).

Incidence of leaf blast, neck blast, sheath blight and brown spot was recorded in both IPM and FP plots at this location. With respect to leaf blast and neck blast, in the IPM field, the disease progress in terms of AUDPC values were reduced from 412 to 164 and from 248 to 167, respectively. Similarly, sheath blight and brown spot diseases were managed using the IPM practices wherein the disease progress was reduced from 421 to 173 and from 125 to 78, respectively. Similar trend was also observed in case of false smut disease incidence, wherein the disease was nil in the IPM practices adopted field as compared to the farmer practices (56.7%) (**Table 2.7.15**)

Table 2.7.15 Weed population, AUDPC values of rice diseases at Zone V (Jagdalpur), *Kharif* 2023

Location	Treatments	Weed population		AUDPC Values				False smut
		Active tillering stage	Panicle initiation stage	Leaf Blast	Neck blast	Sheath blight	Brown spot	(DI%)
L1	IPM	3.4(1.9)	7.5(2.8)	164	167	173	78	0
	FP	5.7(2.5)	11.7(3.5)	412	248	421	125	56.7

L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices; AUDPC- Area under disease progress curve

Grain yield was significantly high in IPM plots at all three farmers' fields as compared to FP plots (**Table 2.7.16**). Across the farmers, the average grain yield was 4580 kg/ ha in the IPM plot as against 3725kg/ ha in the FP plot. Higher grain yield resulted in higher gross returns and higher BC ratio in IPM fields compared to FP fields.

Table 2.7.16 Returns and BC ratio in IPMs trial at Zone V (Central), *kharif* 2023

Location	Name of the Farmer	Treatments	Yield (q/ha)	Gross Returns (Rs.)	Cost of Cultivation (Rs.)	Net Returns (Rs.)	BC ratio
JDP	F1 = Bhola Ram Sethiya	IPM	46.48	97608	20750	76858	4.70
		FP	39.44	82824	23750	59074	3.49
JDP	F2 = Sri Lakshminath	IPM	45.73	96033	20750	75283	4.63
		FP	37.2	78120	23750	54370	3.29
JDP	F3 = Sri Damodar	IPM	45.2	94920	20750	74170	4.57
		FP	35.12	73752	23750	50002	3.11
		IPM	**45.80**				**4.64**
		FP	**37.25**				**3.29**

Price of Paddy = F1, F2 & F3 = Rs. 2100/q

Zone VI – Western areas

IPM trial was conducted in seven farmers' fields at 3 locations in this zone. The details of farmers and villages are given below:

S. No	Location	State	Village, district	Farmer Name
1	Karjat	Maharashtra	Kirawali, Raigad	F1- Sri Prabhakar Badhekar
2	Karjat	Maharashtra	Vadap, Raigad	F2 - Sri Param Patil
3	Karjat	Maharashtra	Wanjale, Raigad	F3- Sri Ravindra Thakare
4	Navasari	Gujarat	Abrama, Navsari	F4 = Sri Bhanubhai Patel
5	Nawagam	Gujarat	Kathwada, Kheda	F5 - Sri Vipulbhai Jayantibhai Bharwad
6	Nawagam	Gujarat	Kathwada/ Kheda	F6 - Sri Rakeshbhai Ramsangbhai Chunara
7	Nawagam	Gujarat	Nawagam farm	F7 = NWG farm

The package of practices followed in IPM and FP plots are given in the following table:

Package of practices followed in IPMs trial in Zone VI (Western), *Kharif* 2023		
Practices followed by three farmers in IPMs trial at Karjat, *Kharif* 2023		
	IPM practices	**Farmers practices**
Area	1 acre	1 acre
Varieties	F1- Sri Prabhakar Badhekar - Karjat 7 F2 - Sri Param Patil - Karjat 7 Sri Ravindra Thakare – Karjat 7	
Nursery	Seed treatment with carbendazim @ 10 g/ 10 kg seed Raised bed 3x1m treated with rice husk (hull) ash @3kg/bed	Land burnt with waste materials
Main field	• Deep ploughing • Application of FYM 4 T, Suphala 125 Kg, Urea 44 Kg • 2-3 seedlings transplanted at a spacing 20 x15 cm. • Alleyways of 40cm left after every 10 rows • Bispyribasodium 250ml/ha (Nomini gold). • 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)	• Deep ploughing • Application of FYM 2 T, Urea 50 kg, Suphala 50 kg • 4-5 seedlings transplanted randomly • Hand weeding once • Phorate 10 kg/ha (two applications)
Practices followed by three farmers in IPMs trial at Nawagam, *Kharif* 2023		
Area	1250 sq.m	1250 sq.m
Variety	Gurjari	Gurjari

Farmers	F5 - Sri Sri Vipulbhai Jayantibhai Bharwad F6 - Sri Rakeshbhai Ramsangbhai Chunara F7 – NWG farm	
Main field	• Application of 80 kg urea, 54 kg DAP and 20 kg Zinc sulphate • 2-3 seedlings transplanted at a spacing 20 x15 cm. • Alleyways of 40cm left after every 10 rows • Bispyribasodium 10% SC @ 0.4 ml/ liter water (Nomini gold). • One-hand weeding • Applied Neemazal @ 3 ml/ liter water • Use of bird perches in the field • Sprayed Chlorantraniliprole 18.5 SC @ 150 ml/ ha • Applied Carbendazim + mancozeb @ 2-2.5 g/lit • Applied Pymetrozine 50 WP @ 6.0g/10 L water	• Application of 200 kg urea, 80 kg DAP and 20 kg Zinc sulphate • 4-5 seedlings transplanted randomly • Applied Pendimethalin 30% EC @ 50 ml/ 10liter water • Hand weeding once • Applied Chlorantraniliprole 0.4 GR @ 10 kg/ha • Applied Cartap hydrochloride 4 G @ 20 kg/ha

Incidence of stem borer and leaf folder was observed across locations in both IPM and FP plots (**Table 2.7.17**). However, WBPH was observed only at Nawagam in all three farmers' fields. Though the incidence of dead hearts and leaf folder damage was low in both plots, there are significant differences between the treatments. The incidence of WBPH was significantly high in the IPM field (22/hill) as compared to the FP plot (16/hill). Across locations, incidence of pests was significantly low in IPM plot as compared to FP plot (**Figure 2.7.3)**.

At Navsari, IPM trial conducted showed significant reduction in weed population 59.8 and 48.0% and dry weed biomass 58.5 and 42.6% at Active Tillering and Panicle Initiation stages. Significant improvement in grain yield advantage was noticed with 6.5% in IPM adopted fields (**Table 2.7.18**). At Nawagam, IPM trial conducted showed significant reduction in weed population by 39.8 and 47.0%, and dry weed biomass by 72.7 and 30.5% at Active Tillering and Panicle Initiation stages respectively. The grain yield advantage was 11.5% in IPM adopted fields. At Vadagaon, weed population at Active Tillering and Panicle Initiation stages was lower than farmers practice by 76.9 and 69.2% and weed dry biomass by 76.4 and 69.9% respectively. The mean grain yield advantage was 45.1 % in IPM adopted plots.

Table 2.7.17 Insect Pest incidence in IPMs trial in Zone VI (Western), *Kharif* 2023

Treatments			%DH/WE	% LFDL	WBPH	Yield kg/ha
KJT	F1- Sri Prabhakar Badhekar	IPM	3.2(1.8)b	3.1(1.9)a		4616(68)a
		FP	7.6(2.7)a	3.2(1.8)a		3900(62)b
LSD (0.05, 36df)			**0.39**	**0.23**		**1.84**
KJT	F2 - Sri Param Patil	IPM	3.6(1.9)b	2.3(1.6)b		4540(67)a
		FP	7.4(2.7)a	4.0(2.1)a		3776(62)b
LSD (0.05, 36df)			**0.38**	**0.32**		**2.39**
KJT	F3- Sri Ravindra Thakare	IPM	7.5(2.7)a	1.6(1.3)b		4504(67)a
		FP	7.5(2.7)a	4.8(2.2)a		3824(62)b
LSD (0.05, 36df)			**0.34**	**0.27**		**1.04**
NVS	F4- Sri Bhanubhai Patel	IPM	2.4(1.5)b	2.2(1.6)a		4464(67)a
		FP	5.8(2.3)a	3.0(1.8)a		3832(62)b
LSD (0.05, 36df)			**0.45**	**0.42**		**2.83**
NWG	F5 - Sri Vipulbhai Jayantibhai Bharwad	IPM	3.5(1.9)b	3.0(1.7)b	14.0(4)b	5660(75)a
		FP	5.3(2.2)a	4.6(2.1)a	23.0(5)a	4740(69)b

LSD (0.05, 36df)			**0.12**	**0.22**	**0.39**	**4.06**
NWG	F6 - Sri Rakeshbhai Ramsangbhai Chunara	IPM	4.0(2.0)b	3.3(1.8)b	16.0(4)b	5780(76)a
		FP	5.6(2.2)a	4.8(2.2)a	23.0(4)a	4544(67)a
LSD (0.05, 36df)			**0.11**	**0.21**	**0.24**	**10.41**
NWG	F7 - NWG farm	IPM	4.4(2.0)b	3.3(1.8)b	17.0(4)b	6028(78)a
		FP	5.1(2.2)a	4.5(2.1)a	20.0(4)a	4792(69)b
LSD (0.05, 36df)			**0.12**	**0.19**	**0.22**	**6.89**
Treatments						
T1 = IPM			2.3(5.8)b	2.7(5.3)b	16.0(9)b	5085(48)a
T2 = FP			3.4(6.9)a	4.1(6.4)a	22.0(10)a	4201(44)b
LSD (0.05,252)			**0.21**	**0.27**	**0.36**	**0.49**
DAT						
D1 = 29 DAT			1.6(5.1)d	2.1(4.7)c	5.0(5)c	
D2 = 36 DAT			0.9(3.5)e			
D3 = 50 DAT			2.6(6.4)c	2.8(5.4)b	29.0(13)b	
D4 = 71 DAT			4.0(7.9)b	5.3(7.3)a	37.0(15)a	
D5 = 85 DAT			5.1(8.7)a			
LSD (0.05,252)			**0.33**	**0.33**	**0.51**	

Figures in parenthesis are Atkinson's transformed values. Means in a column followed by same letter are not significantly different from each other

In this zone, the trial was conducted at Nawagam at 3 locations for the management of sheath rot. At all the three locations, spraying of carbendazim 12% + mancozeb 63 % effectively reduced the disease progress as compared to farmer practices, wherein no fungicide spray was taken up. At Navsari, the trial was conducted at one location on diseases *viz.*, sheath blight and brown spot. In the IPM field, application of hexaconazole 5 EC (2 ml/lit) at 60 DAT effectively reduced the sheath blight disease development (AUDPC value 416) as compared to farmer practice (AUDPC value 852). Similarly, AUDPC value of brown spot was reduced from 930 to 626 due to adoption of IPM practices (**Table 2.7.19**).

Table 2.7.18 Weed parameters in Zone VI (western areas), *Kharif* 2023

Location	Treatments	Weed population (No./m2)		Weed dry biomass (g/m2)	
		Active tillering stage	Panicle initiation stage	Active tillering stage	Panicle initiation stage
NAVSARI	**IPM**	7.0(2.7)	10.6(3.3)	8.8	13.7
	FP	17.4(4.2)	20.4(4.6)	21.3	24.2
	Exp. mean	3.5	3.9	15.1	18.9
	CD(0.05)	0.4	0.3	2.7	3.5
NAWAGAM	**IPM**	78.4(8.6)	81.5(9.0)	33.7	48.9
	FP	130.2(11.3)	153.7(12.3)	121.7	70.4
	Exp. mean	10.0	10.7	77.7	59.7
	CD(0.05)	1.3	1.1	111.3	14.5
VADAGOAN	**IPM**	11.9(3.5)	18.9(4.4)	21.7	31.0
	FP	51.5(7.2)	61.5(7.8)	91.9	102.9
	Exp. mean	5.4	6.1	56.8	66.9
	CD(0.05)	0.3	0.2	6.3	6.0

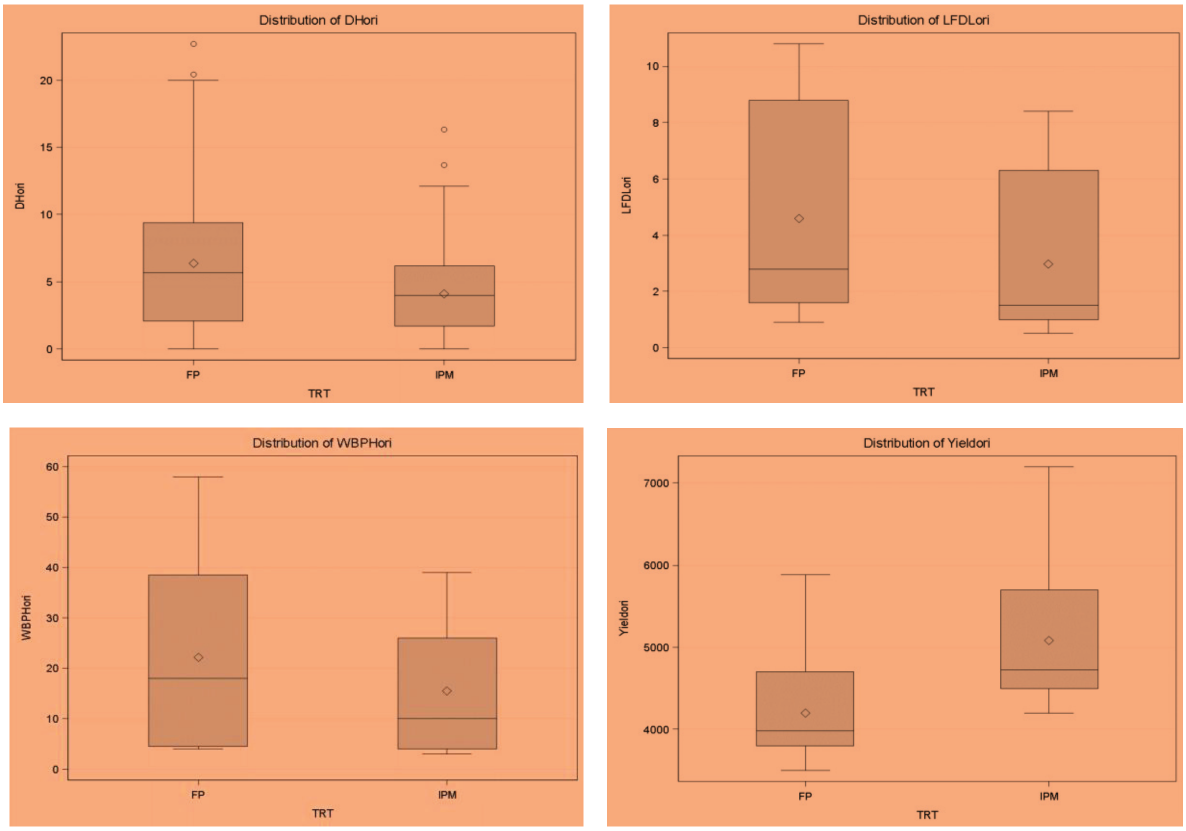


Figure 2.7.3 Box plots of the incidence of dead hearts, leaf folder damage, WBPH and grain yield in IPM and FP plots across locations in Zone VI (Western areas)

Table 2.7.19 AUDPC values of rice diseases recorded at Zone VI, *Kharif* 2023

Location	Treatment	AUDPC Values		
		Nawagam	Navsari	
		Sheath rot	Sheath blight	Brown spot
L1	IPM	563	416	626
	FP	705	852	930
L2	IPM	416	-	-
	FP	539	-	-
L3	IPM	404	-	-
	FP	574	-	-

L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices; AUDPC- Area under disease progress curve

Grain yield was significantly higher in IPM plots compared to FP plots across the locations. The average grain yield of 5085 kg/ ha was recorded in IPM treatment as compared to farmers' practices (4201 kg/ ha). This high grain yield resulted in high gross returns and a high BC ratio in IPM plots (2.49) as compared to FP plots (2.28) across locations (**Table 2.7.20)**.

Table 2.7.20 Returns and BC ratio in IPMs trial at Zone VI (Western), *Kharif* 2023

Location	Farmers	Treatments	Yield (q/ ha)	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net returns (Rs.)	BC ratio
KJT	F1- Sri Prabhakar Badhekar	IPM	46.16	100767	43436	57331	2.32
		FP	39.00	85137	37455	47682	2.27
KJT	F2 - Sri Param Patil	IPM	45.40	99108	43436	55672	2.28
		FP	37.76	82430	37455	44975	2.20
KJT	F3- Sri Ravindra Thakare	IPM	45.04	98322	43436	54886	2.26
		FP	38.24	83478	37455	46023	2.23
NVS	F4- Sri Bhanubhai Patel	IPM	44.64	89280	50400	38880	1.77
		FP	38.32	76640	42600	34040	1.80
NWG	F5 - Sri Vipulbhai Jayantibhai Bharwad	IPM	56.60	123388	43144	80244	2.86
		FP	47.40	103332	40256	63076	2.57
NWG	F6 - Sri Rakeshbhai Ramsangbhai Chunara	IPM	57.80	126004	43147	82857	2.92
		FP	45.44	99059	40554	58505	2.44
NWG	F7 - NWG farm	IPM	60.28	131410	43147	88263	3.05
		FP	47.92	104466	42262	62204	2.47
		IPM	**50.85**				**2.49**
		FP	**42.01**				**2.28**

Price of Paddy = F1, F2, F3 = Rs. 2183/q; F4 = Rs. 2000/q; F5, F6 & F7 = Rs. 2180/q

Zone VII – Southern areas

IPMs trial was conducted at 14 farmers' fields in 5 locations during *Kharif* 2023 and in three farmer's field at two locations during *Rabi* 2022-23. The details of farmers and villages are given below:

Zone VII				
S. No	**Location**	**State**	**Village, district**	**Farmer Name**
1	Mandya	Karnataka	Mallanayakanakatte, Mandya	F1 – Sri Puttaswamy
2	Mandya	Karnataka	Bilaguli, Mandya	F2 - Sri Annabasavaraju
3	Mandya	Karnataka	Ganadalu, Mandya	F3 – Sri Chikkonu
4	Aduthurai	Tamil Nadu	Thiruneelakudi, Thanjavur	F4- Smt Revathi
5	Aduthurai	Tamil Nadu	Melamaruthuvakudi, Thanjavur	F5 - Sri R Ramakrishnan
6	Aduthurai	Tamil Nadu	Thiruvaduthurai, Mayiladuthurai	F6- Sri Sekar
7	Bapatla	Andhra Pradesh	Yajali, Karlapalem	F7 – Sri Movva Krishnam Raju
8	Bapatla	Andhra Pradesh	Jammulapalem, Bapatla	F8 – Sri Boyina Venkaiah
9	Gangavathi	Karnataka	Sharanabasaveshwar camp, Koppal	F9 = Sri Hanumanthappa
10	Gangavathi	Karnataka	Hosalli village, Gangavathi	F10 = Sri Basavaraj
11	Rajendranagar	Telangana	Sajjanpally, Ranga Reddy	F11 = Sri E Ashok
12	Rajendranagar	Telangana	Sajjanpally, Ranga Reddy	F12 = Sri V.Ravinder
13	Rajendranagar	Telangana	Sajjanpally, Ranga Reddy	F13 = Sri E Narayana
14	Maruteru	Andhra Pradesh	Vadali, Penugonda mandal	F14 – Sri T Jogeswara Rao
15	Maruteru	Andhra Pradesh	Vadali, Penugonda mandal	F15 – Sri N Srinivasa Rao
16	Pattambi	Kerala	Kondurkara, Palakkad	F16 – Sri Ummer

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 IPMs trial in Zone VII (Southern), *Kharif* 2023

Practices followed in IPMs trial at Aduthurai, *Kharif* 2023		
	IPM practices	**Farmers practices**
Area/ variety	1 ha; TPS5, ADT 51	1 ha; TPS5, ADT 51
Nursery	• Seed treatment with carbendazim @ 2g / kg seed	
Main field	• Transplanting the seedlings at a spacing of 20 x 15 cm. • Leaving alleyways of 30 cm after every 2 m or 10 rows. • Fertilizers applied as per local recommended fertilizer dose. • Application of Butachlor 1.5 kg a.i./ ha within one week after transplanting the crop. • At 15 DAT, installed pheromone traps with 5 mg lure @ 8 traps/ha for stem borer monitoring • One spray of Cartap hydrochloride 50 WP @ 600 g /ha at 60 DAT • Application of Propiconazole	• Five rounds of insecticides followed due to gall midge, stem borer, leaf folder and BPH incidence. • Thiamethoxam 100 g/ha at 25 DAT for thrips • Chlorantraniliprole 18.5 SC @ 150 ml/ha at 45 DAT for stem borer and leaf folder • Profenophos 20 EC @ 1000ml/ha at 70 DAT for stem borer and leaf folder • Applied Cartap hydrochloride 10kg/ha • Sprayed Copper oxy chloride, Mancozeb+ carbendazim (saaf), Propiconozole
Practices followed in IPMs trial at Gangavathi, *Kharif* 2023		
Sri Hanumanthappa, Bapireddy camp		
Area	1 acre	1 acre
Variety	BPT 5204	BPT 5204
Nursery	• Seed treatment with Trichoderma • Applied Fipronil 0.3G	Sprayed Chlorpyriphos 20 EC @ 2 ml/liter and Fipronil 5SC @ 2 ml/l
Main field	• Fertilizer application @ 60:30:30 kg NPK /ha • Forming alleyways of 30 cm after every 2 m • Grown cowpea on bunds • Installation of pheromone traps @ 8 traps/ ha • Fipronil 0.6G @ 4 kg/ acre • Trichogramma cards 4 releases @ 40,000/ acre • Followed alternate wetting and drying • Sprayed Metarhizium @ 3 g/ liter water • Application of Flupyrimin 2% GR @ 3 kg/ acre	• Fertilizer application @ 120:60:60 kg NPK /ha • Application of weedicide, Butachlor @ 400 ml/ac • Application of Ferterra @ 4 kg at 25 DAT • Sprayed Chlorpyriphos 20 EC @ 2ml / liter • Application of Triflumezopyrim @ 94 ml / acre at 60 DAT • Sprayed Lamda cyahalothrin @ 1 ml/l • Sprayed Thiamethoxam @ 0.5g/lit
Sri Basavaraj Hosalli		
Variety	BPT 5204	BPT 5204
Nursery	Seed treatment with Thiamethoxam 25 WG @ 4 g/ kg seed	Sprayed Chlorpyriphos 20 EC @ 2 ml/liter and Carbosulfan 25 EC @ 2 ml/ liter
Main field	• Forming alleyways of 30 cm after every 2 m • Grown marigold on bunds • Installation of pheromone traps @ 8 traps/ ha • Trichogramma cards 4 releases @ 40,000/ acre • Chlorantraniliprole 0.4G @ 4 kg/ acre • Application of Triflumezopyrim @ 94 ml / acre	• Applied granules, Chlorantraniliprole + Thiamethoxam @ 4 kg/ acre • Sprayed Chlorpyriphos 20 EC @ 2ml / liter • Applied Fipronil 0.3G @ 7.5 kg/ acre • Applied Pymetrozine @ 0.6g/liter • Spraying Imidachloprid @ 0.5 ml/l
Practices followed in IPMs trial at Mandya, *Kharif* 2023		
Sri Chikkonu, Ganadalu village, Mandya district, Karnataka		
Area	1 acre	1 acre
Variety	MSN 99	MSN 99
Nursery	• Seed treatment with Carbandezim @ 2g / kg seed	
Main field	• Urea 45 kg/ acre, SSP 125 kg/ acre, MOP 35 kg/ acre, Top dressing 45 kg urea • Transplanting with 20 x 15cm spacing • Forming alleyways of 30 cm at every 2 m • Londax power @ 4kg/ac - herbicide at 3 DAT + one hand weeding • Installation of pheromone traps 5 mg lure for monitoring stem borer @ 8 traps / ha • Application of Fipronil 5SC @ 1.5ml/liter water	• Urea 50 kg/ acre, 10:26:26 complex fertilizer 100 kg/ ac, MOP 25 kg/ acre • Random transplanting • Applied Pretilachlor 50 EC @ 400ml/ acre + two hand weedings • Fipronil 0.3G @ 10 kg/acre • Flubendiamide 48%SC @ 0.1 ml/liter • Tebuconazole @ 0.4 g/ liter • Buprofezin 25 EC @ 1.4 ml/ liter

	• Zinc sulphate @ 8 kg/ acre • Tricyclazole 75WP @ 0.6g/lit • Followed alternate wetting and drying	• Continuous irrigation
Sri Annabasavaraju, Bilaguli village, Mandya district, Karnataka		
Area	1 acre	1 acre
Variety	MSN 99	MSN 99
Nursery	• Seed treatment with Carbandezim @ 2g / kg seed	
Main field	• Urea 45 kg/ acre, SSP 125 kg/ acre, MOP 35 kg/ acre, Top dressing 45 kg urea • Transplanting with 20 x 15cm spacing • Forming alleyways of 30 cm at every 2 m • Londax power @ 4kg/ac - herbicide at 3 DAT + one hand weeding • Installation of pheromone traps for monitoring stem borer 5 mg lure @ 8 traps / ha • Application of Fipronil 0.3G @ 10 kg/acre • Sprayed Tricyclazole 75 WP @ 0.6g/ liter water • Zinc sulphate @ 8 kg/ acre • Alternate wetting and drying	• Urea 100 kg/acre, 20:20:0:13 @ 50 kg/acre, 10:26:26 @ 50 kg/acre • Randomly transplanted • Butachlor @ 400 ml/ acre + two hand weedings • Chlorantraniliprole 0.4 GR @ 4kgl/acre • Cartap hydrochloride 50SP @ 2gm/l (400g/ acre) • Azoxystrobin + Difenconazole (amistar top) @1ml/lit • Imidacloprid17.8SL@0.3ml/lit • Continuous irrigation
Sri Puttaswamy, Mallanayakanakatte village, Mandya district Karnataka		
Area	1 acre	1 acre
Variety	RNR 15048	RNR 15048
Nursery	• Seed treatment with Carbandezim @ 2g / kg seed	
Main field	• Urea 45 kg/ acre, SSP 125 kg/ acre, MOP 35 kg/ acre, Top dressing 45 kg urea • Transplanting with 20 x 15cm spacing • Forming alleyways of 30 cm at every 2m row • Londax power @ 4kg/ac - herbicide at 3 DAT + one hand weeding • Installation of pheromone traps for monitoring stem borer 5 mg lure @ 8 traps / ha • Application of Chlorantraniliprole 0.4G @ 4 kg/ acre • Sprayed Tricyclazole 75 WP @ 0.6g/ liter water • Alternate wetting and drying was followed	• Randomly transplanted • Urea 50 kg/ acre, 10:26:26 complex fertilizer 100 kg/ ac, MOP 25 kg/ acre • Pretilachlor 50EC (Refit) @400ml/acre + 2 hand weedings • Carbofuran 4G @ 8 kg/ acre • Chlorantraniliprole 18.5SC (Coragen) @ 60ml/acre • Fipronil 0.3G@10kg/acre • Tebuconozole @0.4gm/lit • Dinotefuran 20% SG @ 250g/ ha at 70 DAT • Continuous irrigation
Practices followed in IPMs trial at Bapatla, Kharif 2023		
Sri Movva Krishnam Raju, Yajali village, Karlapalem mandal, Andhra Pradesh		
Area	• 2000 sq.m	• 2000 sq.m
Variety	• BPT 5204	• BPT 5204
Nursery	• Seed treatment with Carbendazim @ 10g/ kg seed • Application of Carbofuran granules @ 800g/ 5 cent	
Main Field	• Formation of alleyways of 30 am for every 2 m • NPK @ 90-60-40 kg/ ha • Bis-pyribac sodium@ 250 ml/ha at 15 DAT and All-mix @ 20 g/acre at 25 DAT • Installed pheromone traps @ 8 traps/ ha for stem borer monitoring. • Release of egg parasitoid, T. Chilonis @ 60000/acre from 45 DAT 3 times in 15 days interval • One spray of chlorantraniliprole @ 0.3 ml/l at 60 DAT • Spraying of Hexaconazole against sheath blight • Spraying of tricyclazole @ 0.6 g/l against leaf blast	• Formation of alleyways of 30 am for every 2 m • NPK @ 120-80-40 kg/ ha • Application of Londax power @10kg/ha within one week after transplantation+one manual weeding • Application of dinotefuran, pymetrozine and triflumezopyrim against brown planthoppers • Application of ferterra granules and cartap hydrochloride granules spraying of acephate @ 3 g/l against stem borer • Spraying of Indoxacarb for leaf folder, stem borer & Profenophos for leaf & panicle mite • Spraying of tricyclazole and isoprothiolane against leaf blast • Spraying of hexaconazole and azoxystrobin +difenconazole (amistar top) against sheath blight
Sri Boyina Venkaiah, Jammulapalem, Bapatla mandal, Andhra Pradesh		
Area	• 2000 sq.m	• 2000 sq.m

Variety	• BPT 2595	• BPT 2595
Nursery	• Seed treatment with Carbendazim @ 10g/ kg seed • Application of Carbofuran granules @ 800g/ 5 cent	
Main field	• Formation of alleyways of 30 am for every 2 m • NPK @ 90-60-40 kg/ ha • Bis-pyribac sodium@ 250 ml/ha at 15 DAT and All-mix @ 20 g/acre at 25 DAT • Installed pheromone traps @ 8 traps/ ha for stem borer monitoring. • Release of egg parasitoid, T. Chilonis @ 60000/acre from 45 DAT 3 times in 15 days interval • One spray of chlorantraniliprole @ 0.3 ml/l at 60 DAT • Spraying of Hexaconazole against sheath blight • Spraying of tricyclazole @ 0.6 g/l against leaf blast	• Formation of alleyways of 30 am for every 2 m • NPK @ 120-80-40 kg/ ha • Application of Londax power @10kg/ha within one week after transplantation+one manual weeding • Application of dinotefuran, pymetrozine and triflumezopyrim against brown planthoppers • Application of ferterra granules and cartap hydrochloride granules spraying of acephate @ 3 g/l against stem borer • Spraying of Indoxacarb for leaf folder, stem borer & Profenophos for leaf & panicle mite • Spraying of tricyclazole and isoprothiolane against leaf blast • Spraying of hexaconazole and azoxystrobin +difenconazole (amistar top) against sheath blight
Practices followed in IPMs trial at Rajendranagar, *Kharif* 2023		
Variety	BPT 5204	BPT 5204
Nursery	• Applied 4.4 kg urea, 6.25 kg SSP and 1.75 kg MOP • Seed treatment with Trichoderma viridae @ 10 g/ kg seed	• Application of 6 kg urea, 8 kg SSP and 3 kg MOP
Main field	• Applied 80 kg N,90 kg P and 15 kg K • Adopted alleyways • Applied weedicide Cyhalofop butyl + Penoxulam (Vivaya) @ 1000ml/acre + one hand weeding • Applied Chlorantraniliprole @0.4G @ 4 kg/ acre • Applied Chlorantraniliprole @ 60ml/acre at PI to booting & Propiconazole @ 200ml/acre for Grain discolouration and sheath rot.	• Application of 120 kg N, 80 kg P and 20 kg K. • Applied weedicide: Bensulfuron Methyl + Pretilachlor (Londax Power T) @ 4kg/acre at 3-5 DAT • Sprayed Chlorpyriphos @ 2.5 ml/ liter water • Hand weeding • Sprayed Cartap hydrochloride 50SP @ 2g/l (400g/ acre) • Sprayed Tebuconazole + trixystrobin (Nativo) @ 80g/acre
Practices followed in IPMs trial at Maruteru, Rabi 2022- 23		
Sri T Jogeswara Rao, Vadali village, Penugonda mandal, Andhra Pradesh **Sri N Srinivasa Rao, Vadali 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	• Application of carbofuran 3 G @ 800 g/5 cents of nursery before 7 days 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 sand/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	• Bengal method of transplantation (average spacing of 28x28 cm spacing) • 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 3 G 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.

	• 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.	
Practices followed in IPMs trial at Pattambi, Rabi 2022- 2023		
Area	• 4000 sq.m	• 4000 sq.m
Variety	• Mattatriveni	• Mattatriveni
Nursery	• Seed treatment with Pseudomonas flourescens @ 10 g/ kg seed • Seedling dip with Pseudomonas @ 20 g / litre of water	
Main field	• NPK @ 70:35:35 kg/ha • Three Sprays with Eco-neem 1 %at 20, 45 and 65 and cartaphydrochlorie 4%G @ 1000g a.i/ha at 80 DAT • *Trichogramma japonicum* for stem borer and *T.chilonis* for leaf folder six releases each at weekly intervals • Pheromone mass trapping done with 8 traps/ acre	• 90 Kg Factomphos,80 Kg Urea, 35Kg potash • Spray with Chlorantanilipole, flubendiamide, lambdacyhalothrin and streptocycline at 30, 60, 75 and at 95 DAT

Incidence of stem borer, gall midge, leaf folder, caseworm and BPH was observed in various farmers' fields in both IPM and FP plots **(Table 2.7.21)**. At Aduthurai, stem borer incidence was significantly high in all three farmers' practices (30.0 – 42.3% DH) than in IPM plots (12.5-13.3% DH). Similarly gall midge incidence was also significantly high in FP plots (18.0-34.0% SS) as compared to IPM plots (7.1-17.5% SS). Leaf folder incidence was significantly low in IPM plots (6.5 – 18.2% LFDL) compared to FP plots (19.2-22.4% LFDL). BPH incidence was significantly high in IPM plots (49.0-53.0/hill) as compared to FP plots (10.0/hill) in both the farmer's fields at Gangavathi while the incidence was at par in both the treatments at Sri E Narayan's field at Ranga reddy district. BPH incidence was significantly high in FP plots (32.0-36.0/hill) than in IPM plots (24.0-26.0/hill) in both the farmers' fields at Maruteru. Low incidence of caseworm was observed at both Mandya and Pattambi locations in various farmers' fields.

Table 2.7.21 Insect Pest incidence in IPMs trial in Zone VII (Southern), *Kharif* 2023

Location	Farmer Name	Treatments	%DH/WE	% SS	% LFDL	%CWDL	BPH	Yield kg/ha
MND	F1 = Sri Puttaswamy	IPM	5.1(2.1)b		1.5(1.3)b	0.9(1.1)b	2(2)b	5172(72)a
		FP	12.3(3.3)a		3.1(1.8)a	2.2(1.6)a	5(2)a	4572(67)a
LSD (0.05,28)			**0.75**		**0.30**	**0.21**	**0.34**	**11.43**
MND	F2 = Sri Annabasavaraju	IPM	6.8(2.5)b		2.3(1.6)b	1.5(1.3)b	3(2)b	5796(76)a
		FP	14.9(3.7)a		8.2(2.5)a	4.8(2.2)a	11(3)	5156(72)a
LSD (0.05,28)			**0.64**		**0.68**	**0.26**	**0.35**	**13.50**
MND	F3 = Sri Chikkonu	IPM	5.3(2.2)b		2.4(1.6)b	1.8(1.4)b	3(2)b	7336(85)a
		FP	11.4(3.3)a		4.3(2.1)a	4.6(2.2)a	11(3)a	6096(78)a
LSD (0.05,28)			**0.55**		**0.34**	**0.29**	**0.39**	**15.12**
ADT	F4 = Sri Revathi	IPM	12.5(3.0)b	17.5(3.9)b	8.9(2.4)b		0(1)b	6440(80)a
		FP	42.3(6.1)a	34.0(5.6)a	22.4(4.2)a		9(3)a	5400(73)b
LSD (0.05,28)			**1.37**	**0.92**	**0.43**		**0.37**	**0.88**
ADT	F5 = Sri Ramakrishna	IPM	13.2(3.3)b	7.1(2.5)b	6.5(2.2)b		1(1)b	
		FP	30.0(5.1)a	20.4(4.3)a	19.8(3.9)a		11(3)a	
LSD (0.05,28)			**1.17**	**0.88**	**0.63**		**0.34**	
ADT	F6 = Sri Sekhar	IPM	13.3(3.3)b	8.4(2.8)b	18.2(3.6)a		5(2)b	
		FP	38.1(5.9)a	18.0(4.0)a	19.2(3.8)a		15(4)a	
LSD (0.05,28)			**1.08**	**0.79**	**0.58**		**0.54**	
BPT		IPM	1.9(1.5)b	9.8(2.9)a	1.9(1.5)a		8(3)a	6625(81)a

	F7 = Sri Movva Krishnam Raju	FP	3.8(1.9)a	5.2(2.2)b	1.9(1.5)a		9(3)a	6812(82)a
LSD (0.05,28)			**0.12**	**0.15**	**0.06**		**0.21**	**3.29**
BPT	F8 = Sri Boyina Venkaiah	IPM	3.7(1.9)b	7.0(2.7)b	1.6(1.4)b		5(2)b	7050(84)a
		FP	5.0(2.2)a	11.9(3.4)a	2.0(1.5)a		7(2)a	7225(85)a
LSD (0.05,28)			**0.10**	**0.12**	**0.06**		**0.15**	**5.07**
GNV	F9 = Sri Hanumanthappa	IPM	4.8(2.2)a	16.2(4.1)a	3.9(2.0)a		49(7)a	6228(79)a
		FP	1.6(1.4)b	5.0(2.3)b	1.7(1.5)b		10(3)b	5978(77)a
LSD (0.05,28)			**0.24**	**0.28**	**0.17**		**0.28**	**2.42**
GNV	F10 = Sri Basavaraj	IPM	8.5(3.0)a	16.7(4.1)a	4.9(2.3)a		53(7)a	6269(79)a
		FP	1.8(1.5)b	7.4(2.8)b	0.7(1.1)b		10(3)b	6001(78)a
LSD (0.05,28)			**0.22**	**0.29**	**0.12**		**0.28**	**3.56**
RNR	F11 = Sri E Ashok	IPM	0.7(1.0)b		0.4(0.9)a		0(1)b	7829(88)a
		FP	2.2(1.3)a		0.0(0.7)b		19(3)a	7364(86)a
LSD (0.05,28)			**0.15**		**0.12**		**0.44**	**9.01**
RNR	F12 = Sri V.Ravinder	IPM	0.0(0.7)b		0.2(0.8)b		15(3)b	6450(80)a
		FP	1.9(1.3)a		0.7(1.0)a		29(3)a	6222(79)a
LSD (0.05,28)			**0.18**		**0.14**		**0.33**	**3.79**
RNR	F13 = Sri E Narayana	IPM	1.0(1.0)a		2.6(1.3)a		55(4)a	6486(81)a
		FP	1.8(1.2)a		0.7(1.0)b		51(4)a	5993(77)b
LSD (0.05,28)			**0.22**		**0.19**		**0.74**	**2.04**
MTU	F14 = Sri T Jogeswara Rao	IPM	2.3(1.4)a	0.6(0.9)a			24(4)b	9000(95)a
		FP	2.5(1.4)a	0.7(1.0)a			32(5)a	9550(97)a
LSD (0.05,28)			**0.29**	**0.26**			**0.34**	**4.51**
MTU	F15 = Sri N Srinivasa Rao	IPM	2.0(1.4)a	0.5(0.9)a			26(4)b	9100(95)b
		FP	2.7(1.5)a	0.6(0.9)a			36(5)a	9750(99)a
LSD (0.05,28)			**0.29**	**0.23**			**0.50**	**1.04**
PTB	F16 = Sri Ummer	IPM	6.6(2.3)b	6.0(2.2)a	3.0(1.7)b	0.9(1.0)a		6533(81)a
		FP	9.3(2.9)a	7.4(2.6)a	3.5(1.8)a	0.6(1.0)a		5065(71)b
LSD (0.05,28)			**0.45**	**0.44**	**0.12**	**0.17**		**5.99**
Treatments								
T1 = IPM			1.7(4.2)b	2.9(6.0)a	2.5(6.4)a	1.0(3.5)b	3(6)b	6880(50)a
T2 = FP			2.4(4.8)a	2.7(5.8)b	2.5(6.4)a	2.3(4.8)a	3(6)a	6513(49)b
LSD (0.05,448)			**0.16**	**0.20**	**0.17**	**0.31**	**0.16**	**0.34**
DAT								
D1 = 36 DAT			2.0(4.6)ab	2.8(6.2)b	2.1(5.9)c	1.4(4.0)b		
D2 = 50 DAT			2.2(4.6)a	2.8(6.0)b	3.1(7.1)b	1.4(3.9)b		
D3 = 71 DAT			1.9(4.4)b	3.2(6.5)a	3.4(7.8)a		4(8)a	
D4 = Pre har			2.1(4.5)ab				2(4)d	
LSD (0.05,448)			**0.22**	**0.28**	**0.24**	**0.44**	**0.23**	

Figures in parenthesis are Atkinson's transformed values. Means in a column followed by same letter are not significantly different from each other

Across locations, IPM plots showed significantly low stem borer, leaf folder, caseworm and BPH damage as compared to FP plots (**Figure 2.7.4**).

At Aduthurai, weed population at Active Tillering and Panicle Initiation stages was lower than farmers practice by 60.4 and 61.3% respectively. The weed dry biomass at Active Tillering and Panicle Initiation stages in IPM plots was lower than farmers practice by 17.9 and 43.4% respectively and contributed to the mean grain yield advantage of 16.1 % in IPM adopted plots (**Table 2.7.22**). At Gangavathi, weed population at Active Tillering and Panicle Initiation stages in IPM plots was lower than farmers practice by 53.4 and 57.5%, respectively and the weed dry biomass was lower than farmers practice by 26.3 and 47.3%. The mean grain yield advantage of 10.7% was recorded in IPM adopted plots. At Mandya, weed population at Active Tillering and Panicle Initiation stages in IPM plots was lower than farmers practice by 80.4 and 68.2% respectively. The weed dry biomass at active tillering and panicle initiation stages in IPM plots was lower by 80.1 and

89.7% respectively and contributed to the mean grain yield advantage of 16.9 %. At Puducherry, the weed population at Active Tillering and Panicle Initiation stages in IPM plots was lower than farmers practice by 48.8 and 52.7% respectively with lower weed biomass in IPM implemented fields by 43.2 and 52.3%. The mean grain yield advantage was14.3% in IPM adopted plots

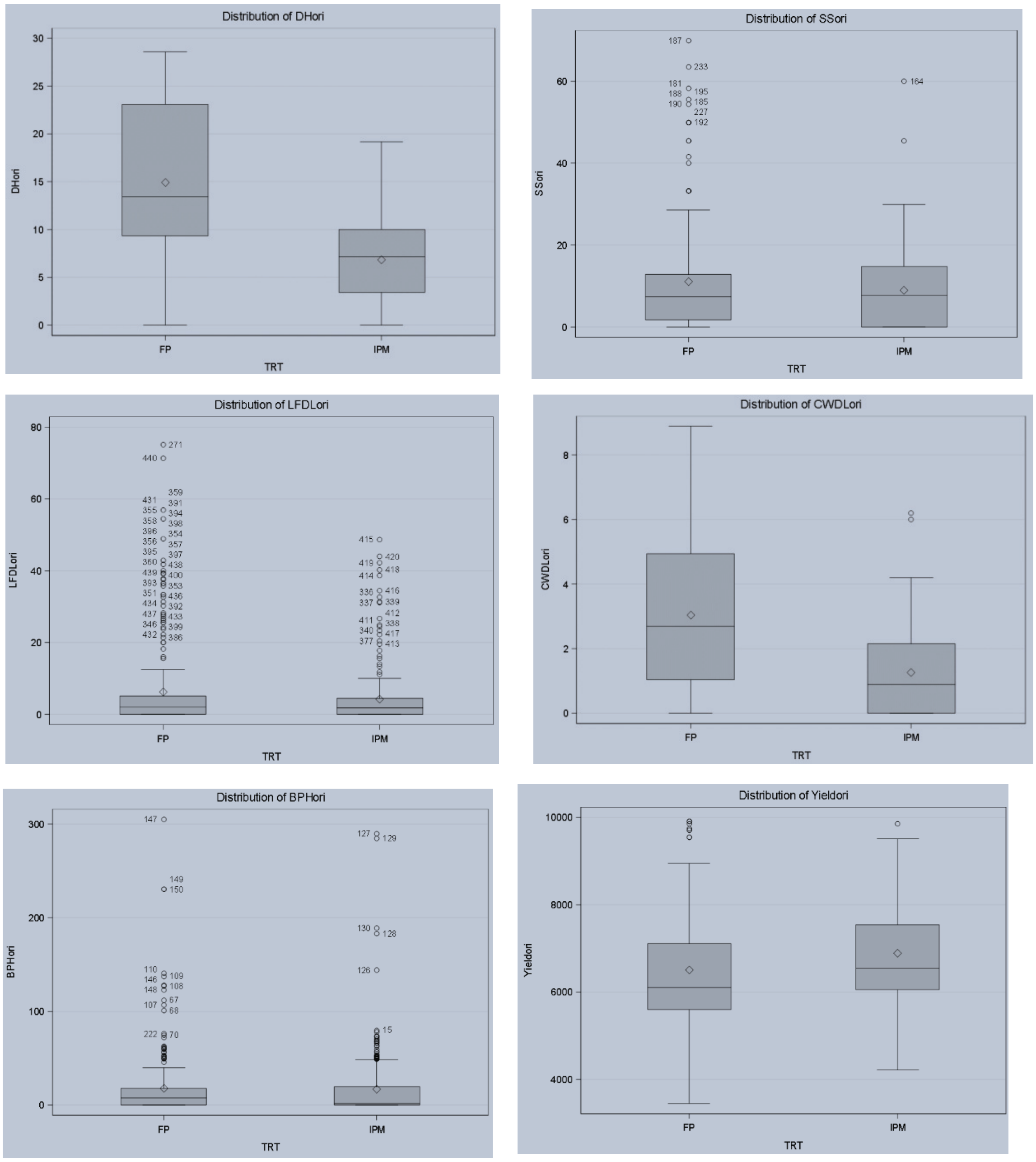


Figure 2.7.4 Box plots of the incidence of dead hearts, gall midge, leaf folder, Caseworm, BPH and grain yield in IPM and FP plots across locations in Zone VII (Southern areas)

At Aduthurai, the trial was conducted for the management of false smut and bacterial blight. Adoption of IPM practices reduced the disease progress of false smut and bacterial blight. AUDPC values of bacterial blight disease was significantly low compared to farmer practices (L1 = IPM - 88; FP-288; L2 = IPM – 78; FP – 229; L3 = IPM – 105; FP – 295). In case of false smut disease, application of IPM practices were effective at all the three locations, wherein the AUDPC values ranged from 22 to 27 in the IPM field as against 89 to 124 in the farmer practices.

Table 2.7.22 Weed parameters in Zone VII (Southern areas), *Kharif* 2023

Location	Treatments	Weed population (No/m2)		Weed dry biomass (g/m2)	
		Active tillering stage	Panicle initiation stage	Active tillering stage	Panicle initiation stage
ADUTHURAI	IPM	7.2(2.8)	8.6(3.0)	9.1	7.2
	FP	18.2(4.2)	22.2(4.7)	11.1	13.0
	Exp. mean	3.5	3.9	10.1	10.1
	CD(0.05)	1.1	0.4	2.8	3.2
GANGAVATHI	IPM	212.0(14.6)	233.4(15.3)	1548.2	1164.1
	FP	455.2(21.3)	549.6(23.4)	2101.0	2209.4
	Exp. mean	18.0	19.4	1824.6	1686.8
	CD(0.05)	0.8	0.8	281.4	254.2
MANDYA	IPM	3.4(1.9)	9.4(3.1)	1.6	7.4
	FP	17.4(4.2)	29.6(5.4)	7.8	72.0
	Exp. mean	3.1	4.3	4.7	39.7
	CD(0.05)	0.5	0.9	1.4	71.1
PUDUCHERRY	IPM	52.5(7.3)	36.7(6.1)	32.6	22.4
	FP	102.5(10.1)	77.5(8.8)	57.4	47.4
	Exp. mean	8.7	7.5	45.0	34.9
	CD(0.05)	0.3	0.1	1.5	2.9

At Mandya, the IPM practices were evaluated only against leaf blast wherein the disease progress values reduced significantly as compared to farmer practices (L1= IPM-90, FP-234; L2 = IPM-94, FP-227; IPM-63, FP-165). At Rajendranagar, the trial was conducted for the management of neck blast in three locations and brown spot in one location. Application of IPM practices *viz.,* seed treatment with *Trichoderma viride* @ 10 g per kg seed, application of carbendazim 25% + mancozeb 50% WS @ 100 g per acre, spraying of carbendazim + mancozeb @ 500 g per acre at PI to booting stage effectively reduced the percentage disease severity of neck blast (L1 = IPM - 0.9%; FP-5.9%. L2 = IPM - 0.1%; FP -3.9%; L3 = IPM - 4.0%; FP-7.7%) and brown spot (L1 = IPM – 16.8%; FP – 52.2%) disease progress in the IPM practices as compared to the farmer practices adopted field (**Table 2.1.23**).

At Gangavathi, adoption of IPM practices reduced the disease progress of leaf blast (IPM-16, FP-30), Neck blast (IPM-16, FP-30), brown spot (IPM-434, FP-545) and false smut (IPM-6.4, FP-11.02%) as compared to the farmer practices. In case of bacterial blight and sheath blight diseases, though diseases progress was reduced, the difference in the AUDPC values between the IPM and FP practices was low as compared to other diseases (**Table 2.1.24)**.

Grain yield in IPM plots was relatively high as compared to FP plots. However, high gross returns along with the low cost of cultivation in IPM practices resulted in a superior BC ratio (2.88) compared to FP plots (2.31), at all the locations (**Table 2.7.25**).

Table 2.7.23 AUDPC values of rice diseases at Aduthurai, Mandya, Rajendranagar, *Kharif* '2023

Location	Treatment	AUDPC Values			DS (%)	
		Aduthurai		Mandya	RNR	
		FS	BB	LB	NB	BS
L1	IPM	22	88	90	0.9	16.8
	FP	124	288	234	5.9	52.2
L2	IPM	24	78	94	0.1	-
	FP	89	229	227	3.9	-
L3	IPM	27	105	63	4.0	-
	FP	105	295	165	7.7	-

L= Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices; AUDPC- Area under disease progress curve

Table 2.7.24 AUDPC values based on disease severity (%) of rice diseases at Gangavathi, *Kharif* 2023

Location	Treatment	AUDPC Values					(DI %)
		LB	NB	BB	SHB	BS	FS
L1	IPM	16	84	431	1010	434	6.4
	FP	30	111	501	1180	545	11.02

L- Location; LB- Leaf Blast; NB- Neck Blast; BB- Bacterial blight; SHB- Sheath Blight; BS- Brown spot; FS- False smut; DI- Disease Incidence

Table 2.7.25 Returns and BC ratio in IPMs trial at Zone VII (Southern), *Kharif* 2023

Location	Name of the Farmer	Treatments	Yield (q/ ha)	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net returns (Rs.)	BC ratio
MND	F1 = Sri Puttaswamy	IPM	51.72	134472	57750	76722	2.33
		FP	45.72	118872	65500	53372	1.81
MND	F2 = Sri Annabasavaraju	IPM	57.96	139104	58375	80729	2.38
		FP	51.56	123744	66625	57119	1.86
MND	F3 = Sri Chikkonu	IPM	73.36	209076	59250	149826	3.53
		FP	60.96	173736	68500	105236	2.54
ADT	F4 = Sri Revathi F5 = Sri Ramakrishna F6 = Sri Sekhar	IPM	64.40	199640	84063	115577	2.37
		FP	54.00	167400	112250	55150	1.49
BPT	F7 = Sri Movva Krishnam Raju	IPM	66.25	139125	58725	80400	2.37
		FP	68.12	143052	65575	77477	2.18
BPT	F8 = Sri Boyina Venkaiah	IPM	70.50	148050	62325	85725	2.38
		FP	72.25	151725	69975	81750	2.17
GNV	F9 = Sri Hanumanthappa	IPM	62.69	156725	52062	104663	3.01
		FP	59.78	149450	60496	88954	2.47
GNV	F10 = Sri Basavaraj	IPM	62.69	156725	52104	104621	3.01
		FP	60.01	150025	60530	89495	2.48
RNR	F11 = Sri E Ashok F12 = Sri V.Ravinder F13 = Sri E Narayana	IPM	78.29	195725	56628	139097	3.46
		FP	73.65	184125	64000	120125	2.88
MTU	F14 = Sri T Jogeswara Rao	IPM	90.00	183600	56500	127100	3.25
		FP	95.50	194820	64500	130320	3.02
MTU	F15 = Sri N Srinivasa Rao	IPM	91.00	185640	57000	128640	3.26
		FP	97.50	198900	64500	134400	3.08
PTB	F16 = Sri Ummer	IPM	65.33	182924	57575	125349	3.18
		FP	50.65	141820	81588	60232	1.74
		IPM	**69.52**				**2.88**
		FP	**65.81**				**2.31**

Price of Paddy: F1= Rs. 2600/q; F2 = Rs.2400/q; F3 = Rs.2850/q; F4, F5 & F6= Rs. 3100/q; F7 & F8 = Rs. 2100/q; F9 & F10 = Rs.2500/q; F11, F12, F13 = Rs. 2203/q; F14 & F15 = Rs.2040/q; F16 = Rs.2800/q

Species wise weed data was reported by 5 locations *viz.*, Mandya, Malan, Navasari, Titabar and Vadagaon. The weed flora reported in the test locations included **Grasses:** *Cynodon dactylon, Dactylactenium aegyptium, Echinochloa colona, Echinochloa crusgalli, Hymenachne spp, Leptochloa chinensis, Panicum repens and Panicum tripheron.* **Sedges:** *Cyperus difformis, Cyperus iria, Cyperus rotundus, Cyperus procerus, Eleocharis spp, Scirpus spp and Fimbristylis miliacea.*

BLW: *Ammania baccifera, Spilanthes acmella, Alternanthera spp, Alternanthera philxeroides, Bergia capensis, Eclipta alba, Eclipta prostrata, Ludwigia parviflora, Monochoria vaginalis, Glinus oppositifolius, Monochoria spp, Rotala densiflora, Sphenoclea zeylanica and Marsilea quadrifolia.*

Overall, stem borer and leaf folder incidence was observed in all the zones while gall midge incidence was observed only at Zone IV, Zone V and Zone VII (**Table 2.7.26**). Whorl maggot incidence was observed in Zone IV and Zone V whereas caseworm incidence was noticed only in Zone VII. Similarly, Thrips incidence was recorded only in Zone V. Sucking pests like BPH incidence was observed in four zones, viz., Zone, I, Ii, III and VII while WBPH incidence was reported from two zones, Zone II and Zone VI.

Table 2.7.26 Incidence of various insect pests in different treatments at various zones

Zones	Treatments	% DH/WE	% SS	% LFDL	% WMDL	% CWDL	% THDL	BPH	WBPH	Yield (kg/ha)	BC ratio
Zone I	IPM	20.6		21.6				6		3600	3.1
	FP	36.4		12.9				7		1800	2.04
Zone II	IPM	3.6		2.6				11	3	5755	3.68
	FP	5.8		6.4				16	4	5378	3.27
Zone III	IPM	1.8		2.9				6		5257	2.1
	FP	2.4		5.7				6		4162	1.87
Zone IV	IPM	5	3.2	5.5	2.7					4990	2.44
	FP	15.3	8.2	9.1	3.7					3420	1.94
Zone V	IPM	1.1	4.2	2.5	2.9		2.8			4580	4.64
	FP	2.4	8.8	6.3	6.5		7.1			3825	3.29
Zone VI	IPM	2.3		2.7					16	5085	2.49
	FP	3.4		4.1					22	4201	2.28
Zone VII	IPM	1.7	2.9	2.5		1		3		6952	2.88
	FP	2.4	2.7	2.5		2.3		3		6581	2.31

Integrated Pest Management special (IPMs) trial was conducted with zone-wise practices at 18 locations during Kharif 2023 and two locations during Rabi 2022-23 in 41 farmers' fields. In Zone I (Hilly areas), dead hearts caused by black beetle was predominant in both IPM (36.4%) and FP plots (20.6%) followed by leaf folder in FP plots (19.4%). Grasshopper damage was significantly high in FP plots (23.5%GHDL) as compared to IPM plots (19.6% GHDL). In Zone II (Northern areas), low incidence of stem borer, leaf folder, BPH, and WBPH was observed. However, leaf folder incidence (24.4%LFDL) was higher in FP plots at Kaul. In Zone III (Eastern areas), low incidence of stem borer, leaf folder and BPH was observed. In Zone IV (North Eastern areas), dead heart damage caused by stem borer was significantly low in IPM plot (5.0%DH) compared to FP plot (15.3% DH).

In Zone V (Central areas), a high incidence of gall midge was observed in FP plot (12.7% SS) compared to IPM plots (1.9% SS) at Jagdalpur. However, the incidence of stem borer, leaf folder, whorl maggot and thrips was low. In Zone VI (Western areas), WBPH incidence was low in IPM plots (14-17/hill) as compared to IPM plots (20-23/hill) at Nawagam. The incidence of stem borer and leaf folder was *low in both IPM and FP plots across locations. In Zone VII (Southern areas), stem borer incidence was high in FP plots at Aduthurai (30.0-42.3% DH) compared to IPM plots (12.5-13.3% DH). Similarly, gall midge and leaf folder incidence were high in FP plots and low in IPM plots in all three farmers' fields at Aduthurai. BPH incidence was significantly high in IPM plots as compared to FP plots in all the farmer's fields at Gangavathi and Maruteru.*

. Weed population and weed dry biomass were significantly low in IPM plots as compared to FP plots across the locations. IPM implemented plots resulted in mean grain yield advantage of 49.1%, 4.4%, 25.5%, 20.7%, 18.8%,21.0% and 14.5%, respectively in Zone-I, II, III, IV, V, VI and VII over the farmer practices. In IPM adopted fields, the mean weed population reduction over the Zones ranged from 4.7% in Zone-I (Hills) to 80.5% in Zone-VII (Southern) at Active Tillering stage and from 9.7 % in Zone-III (Eastern) to 69.2% in Zone-VI (Western) at Panicle Initiation stage. The dry weed biomass reported from 10 locations showed that at both Active Tillering and Panicle Initiation stages, it was significantly reduced by 18.2% in Zone III (Eastern) to 80.1% in Zone-VII (Southern); 13.3% in Zone III (Eastern) to 89.7% in Zone-VII (Southern) respectively.

Adoption of IPM practices effectively reduced the disease progression of leaf blast, neck blast, bacterial blight, sheath blight, and brown spot in Zone II (Northern areas), leaf blast, neck blast, bacterial blight and false smut in Zone III (Eastern areas). There was significant reduction in the disease development of leaf blast, neck blast and sheath blight in Zone V (central areas), sheath rot, sheath blight and brown spot in Zone VI (Western areas), bacterial blight, false smut, leaf blast and neck blast in Zone VII (Southern areas) due to the adoption of IPM practices

Grain yields were significantly high in IPM-implemented plots resulting in high gross returns. Overall, BC ratios of IPM plots were superior to that of FP mainly due to better yields, lower input costs, and better returns.

2.8 Population Dynamics of Inscect pests

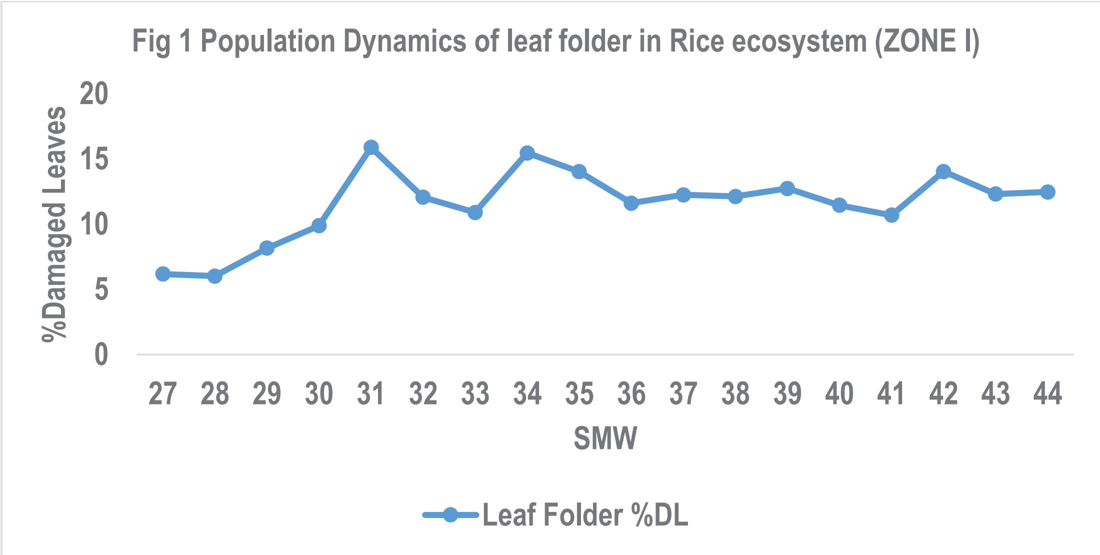
a. Population dynamics of insect pests and natural enemies in rice ecosystem (PDPNE)

Knowledge on population dynamics of insect pests in relation to changes in weather parameters, crop phenology, growing season and cropping systems is vital for designing ecologically sound and economically viable pest management strategies. Further, knowledge on population dynamics of insect pests at a given location is also essential for implementing location specific IPM strategies and precision agriculture technologies. In India, rice is grown in different agro climatic zones under diverse cropping systems. The population dynamics of major as well as minor insect pests vary under such diverse cropping systems and geographical locations. Abiotic factors like temperature, humidity, sunshine hours, rainfall etc., and biotic factors like natural enemies such as parasitoids and predators significantly influence the population dynamics of insect pests. Concerted efforts are being made to monitor the population dynamics of insect pests at different locations across the country to understand the short and long-term changes in the pest scenario.

The weekly insect pest data was collected from 26 locations *viz.*, KHD (Zone I);PNT, NDL and LDN (Zone II), CHP, CHN, MSD, PUS and GGT (Zone III); TTB (Zone IV); RPR and JDP (Zone V); NVS and KJT (Zone VI); ADT, RNR, WGL, BPT, NLR, RGL, MTU, MNC, GNV, MND, CBT (Zone VII) along with the corresponding data on macro weather parameters. The weekly cumulative abundance of different insect pests, weekly averages of rainfall, maximum temperature (max. temp.), minimum temperature (min. temp.), morning relative humidity (RH mor), evening (RH eve) and sun shine hours (SSH) are computed from the daily data and are presented with reference to the standard weeks. All the observations in a zone are averaged and means are calculated. The summary of observations and general trends are presented here.

Zone 1:

In Zone-I at Khudwani, the incidence of leaf folder was recorded with highest leaf damage of 15.89 % during 31st SMW, while the lowest leaf damage was recorded during 28th SMW (6.08 %). Mean leaf folder incidence was 11.57 % over all the standard meteorological weeks (Fig 1). The correlation between the incidence of leaf folder damage and the weather parameters *viz.*, maximum temperature (-0.04), minimum temperature (-0.21), rainfall (-0.37) and evening relative humidity (-0.10) was negative and non-significant, whereas LFDL has no correlation with morning relative humidity (Fig 2). All the weather parameters have non-significant negative correlation on the incidence of leaf folder.



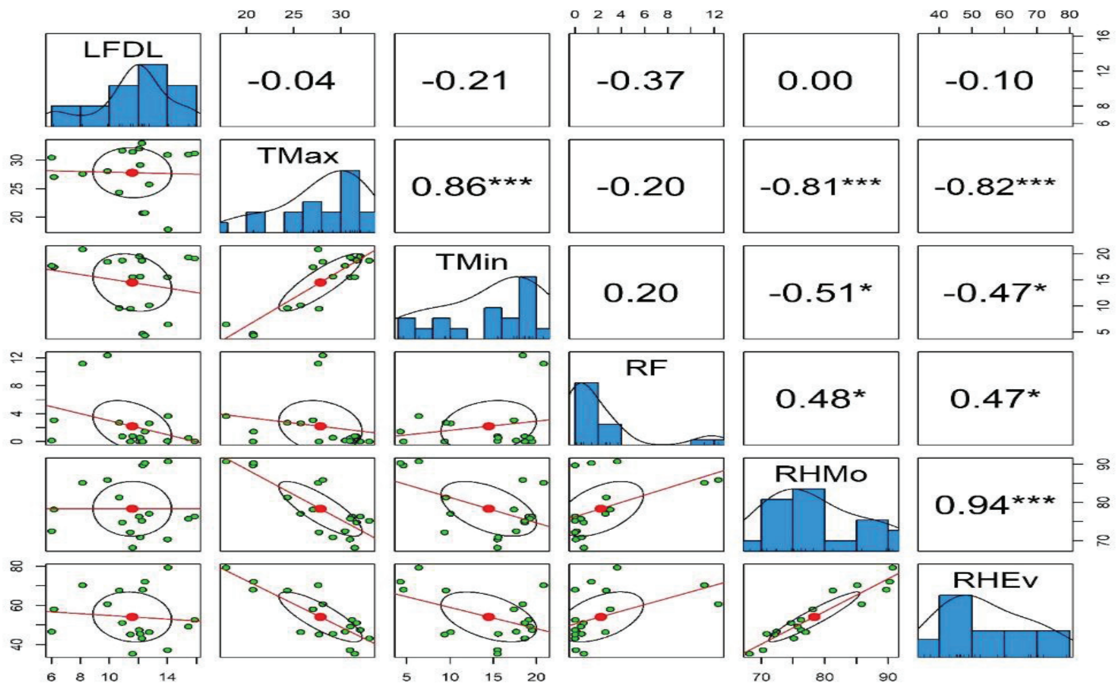


Fig 2. Correlation matrix - field incidence of leaf folder & weather parameters at Khudwani in Zone-I, *Kharif*, 2023

Zone II:

In Zone-II, several pests were recorded *viz*., stem borer, leaf folder, whorl maggot, rice hispa and brown planthopper with their incidence starting from 32 SMW (33 SMW for BPH). The Peak dead heart incidence (12.0%) was recorded during 36th to 39th SMW and lowest incidence was recorded during 32nd week (1.00 %). Leaf folder incidence was lowest (0.65% LFDL) during 42nd SMW and highest (9.22 % LFDL) during 39th SMW. The incidence of whorl maggot was low (0.02% WMDL during 38th SMW) as compared to all other pests and its incidence was at peak during 34th SMW. Rice hispa and planthoppers were also recorded in this zone. The highest incidence of rice hispa *i.e.*, 4.08 % HDL and planthoppers (5.44 hoppers per hill) was observed during 42nd and 39th SMW, respectively. Stem borer white ears were recorded during the late season, *i.e.*, from 41st to 44th SMW, with maximum incidence (19.41%) during 44th SMW (Fig 3a, 3b and 3c). In Zone-II, the relationship between the field incidence of rice insect pests at weekly intervals and the weather parameters, *i.e.*, maximum temperature, minimum temperature, relative humidity morning, relative humidity evening and rainfall was estimated using Pearson correlation coefficients. There was a positive correlation between stem borer dead hearts (SBDH) and weather parameters such as maximum temperature (0.49), minimum temperature (0.33), evening relative humidity (0.29), sunshine hours (0.08) and evaporation (0.37), whereas morning relative humidity (-0.13) and rainfall (-0.12) are negatively correlated with SBDH. The leaf folder damage (LFDL) has positive correlation with the weather parameters like maximum temperature (0.44), minimum temperature (0.09), evening relative humidity (0.06), sunshine hours (0.29) and evaporation (0.22) whereas it has negative correlation with morning relative humidity (-0.07) and rainfall (-0.13). The whorl maggot incidence (WMDL) recoreded positive correlation with maximum temperature (0.32), minimum temperature (0.54), morning relative humidity (0.39), evening relative humidity (0.22), rainfall (0.14) and evaporation (0.48) except sunshine hours (-0.05) which recorded negative correlation. Hispa incidence is positively correlated with all the weather parameters like maximum temperature (0.06), minimum temperature (0.25), morning relative humidity (0.20), evening relative humidity (0.10), rainfall (0.06), sunshine hours (0.01) and evaporation (0.31). The brown planthopper has positive correlation with maximum temperature (0.27), sunshine hours (0.35) and evaporation (0.07) whereas, it has negative correlation with minimum temperature (-0.32), morning relative humidity (-0.39), evening relative humidity (-0.35) and rainfall (-0.18) (Fig 3).

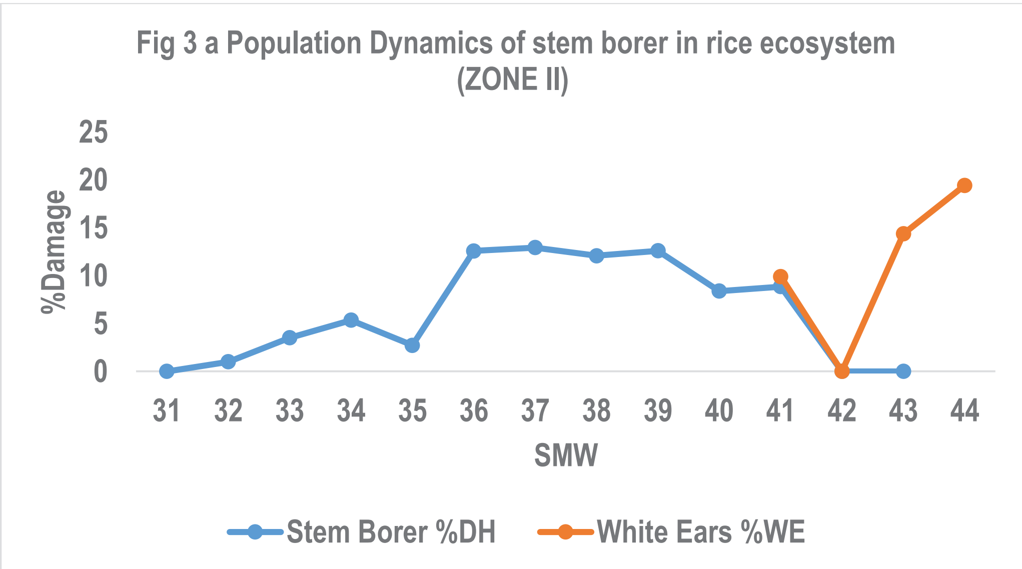


Fig 3 a Population Dynamics of stem borer in rice ecosystem (ZONE II)

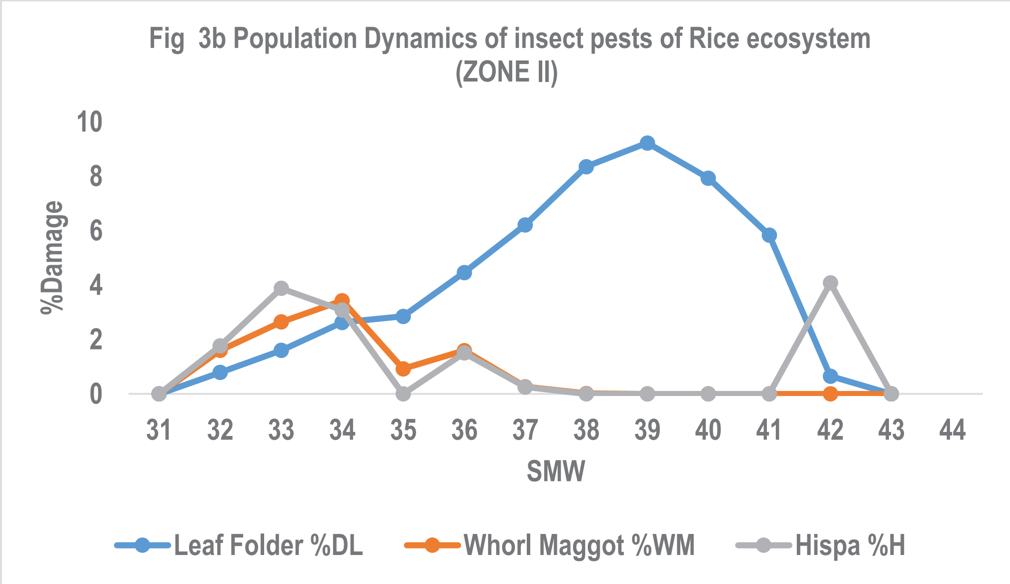


Fig 3b Population Dynamics of insect pests of Rice ecosystem (ZONE II)

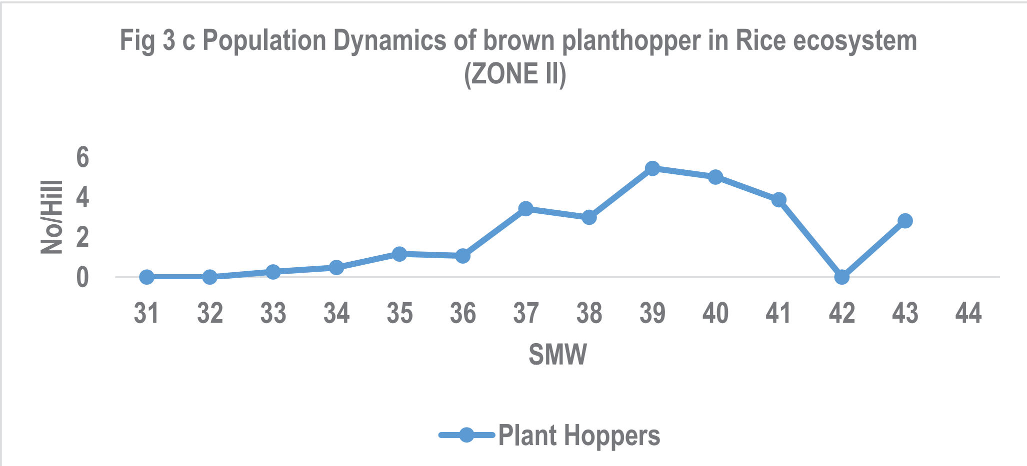


Fig 3 c Population Dynamics of brown planthopper in Rice ecosystem (ZONE II)

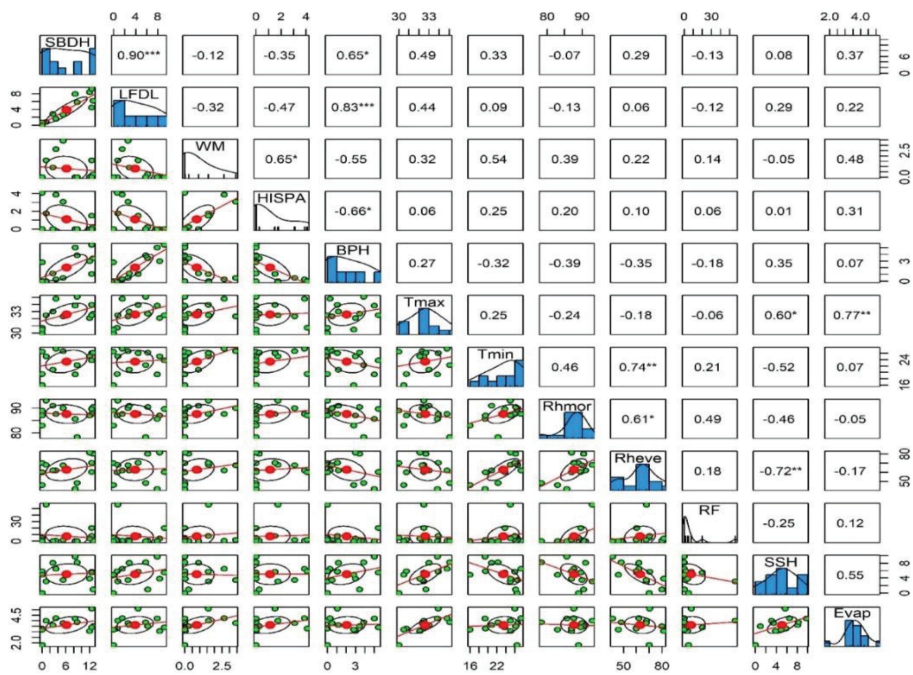
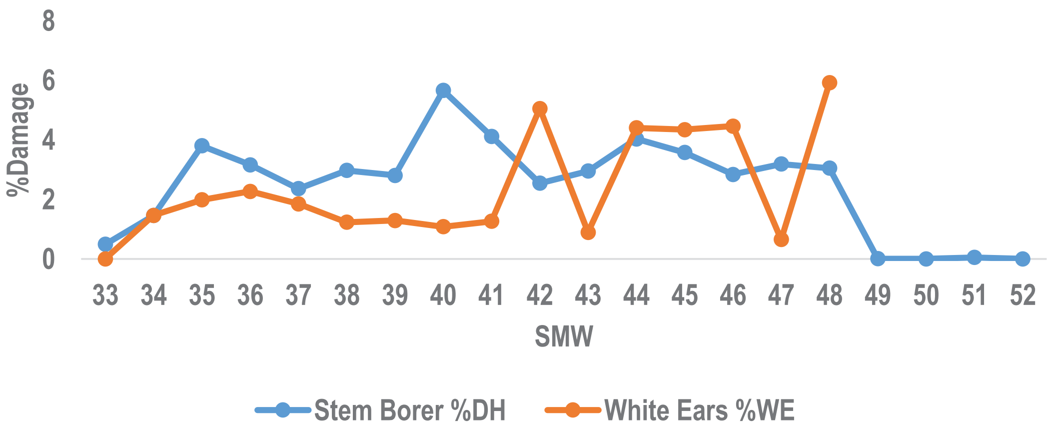


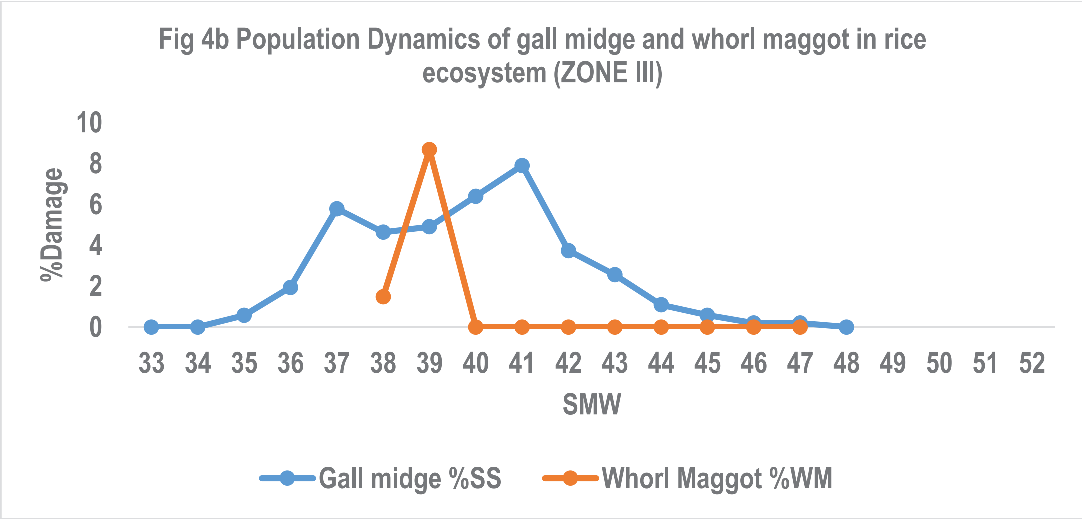
Fig: 3 Correlation matrix - field incidence of stem borer, leaf folder, whorl maggot, hispa, BPH & weather parameters in Zone-II, *Kharif,* 2023

Zone III

In Zone – III, gall midge incidence was recorded during 36th to 47th SMW, with lowest silver shoots (0.20%) during 46th and 47th SMW and highest during 41st SMW with 7.90% SS. Stem borer incidence ranged from 0.05 and 5.70 % during 51st and 40th SMW respectively. Lowest incidence of leaf folder was recorded during 33rd SMW (0.10% LFDL) and highest (1.40 %) during 40th SMW. The whorl maggot was observed only for two weeks *i.e.*, 38 and 39th with 1.50 and 8.70 % WMDL, respectively. White ear incidence was high during 48th SMW (5.91 % WE) and lowest *i.e.*, 0.65 % during 47th SMW (Fig 4 a and 4b). In Zone-III, the relation between the field incidence of rice insect pests, at weekly intervals along with the weather parameters, *i.e.,* maximum temperature, minimum temperature, relative humidity morning, relative humidity evening and rainfall was estimated using Pearson correlation coefficients. Gall midge silver shoots had shown significant positive correlation (0.53*) with minimum temperature and non-significant positive correlation with maximum temperature (0.43), morning relative humidity (0.09), evening relative humidity (0.42) and rainfall (0.38). Stem borer dead hearts (SBDH) showed highly significant positive correlation (0.60**) with minimum temperature, significant positive correlation with maximum temperature (0.48*) and non-significant positive correlation with evening relative humidity (0.14) and negative correlation with morning relative humidity (-0.12) and rainfall (0.06). Leaf folder damaged leaves (LFDL) showed significant positive correlation (0.53*) with minimum temperature, evening relative humidity (0.53*); positive correlation with maximum temperature (0.44), rainfall (0.08) and negative correlation with morning relative humidity (-0.16). Whorl maggot incidence has positive correlation with all the weather parameters such as maximum temperature (0.37), minimum temperature (0.39), morning relative humidity (0.46), evening relative humidity (0.49) and rainfall (0.04). The stem borer white ears recorded significant negative correlation with minimum temperature (-0.59*), morning relative humidity (-0.53*) and evening relative humidity (-0.55*) and showed non-significant negative correlation with maximum temperature (-0.43) and rainfall (-0.11) (Fig. 4).

Fig 4a Population Dynamics of stem borer in rice ecosystem (ZONE III)





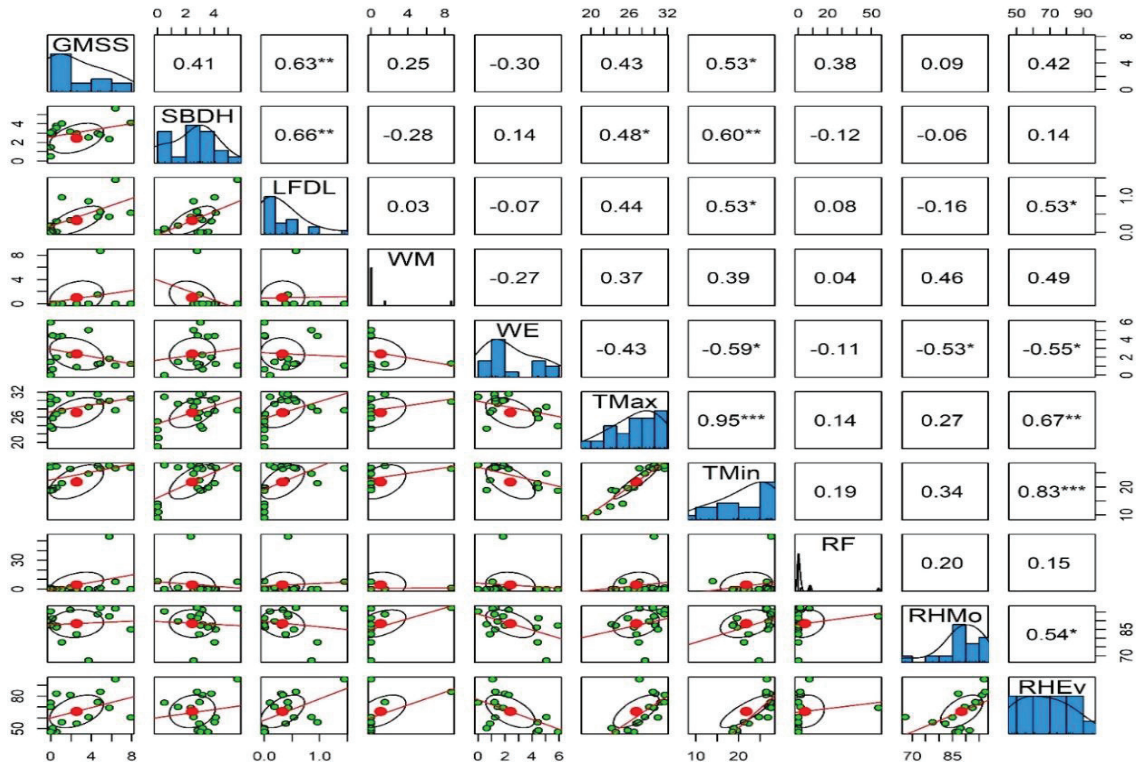
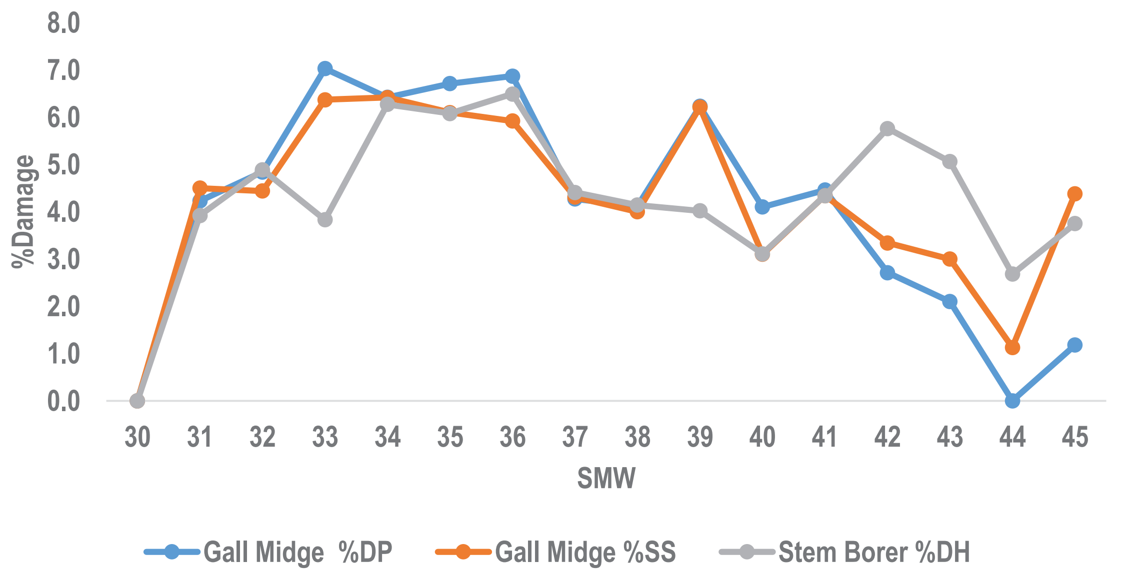


Fig: 4 Correlation matrix - field incidence of insect pests & weather parameters in Zone-III, *Kharif,* 2023

Zone IV

In Zone-IV, the pest incidence was noticed from 31st SMW. Gall midge incidence was slightly more in this zone with 7.0 % SS (33rd SMW) and 6.40% DP (33rd and 34th SMW) and lowest damage (1.20 and 1.10 %) was observed during 45th and 44th SMW. Dead heart incidence ranged from 2.7% during 44th SMW and 6.50 %during 36th SMW. White ear damage (7.74%) was recorded only during the last SMW. Leaf folder incidence ranged from 0.80% (45th SMW) to 5.5% LFDL (33rd SMW). Whorl maggot damage ranged from 1.7% WMDL to 4.2 % during 38th and 33-34th SMW, respectively (Fig 5a & 5b). The pest incidence was correlated with weather parameters in zone-IV. The gall midge damaged plants (GMDP) showed highly significant positive correlation (0.71**) with minimum temperature and positive correlation with maximum temperature (0.34), morning relative humidity (0.27) and rainfall (0.24) and negative correlation with evening relative humidity (-0.11) and sunshine hours (-0.22). In case of gall midge silver shoots, (GMSS) positive correlation was seen with minimum temperature (0.48), maximum temperature (0.25), morning relative humidity (0.14) and rainfall (0.15) and negative correlation was observed with evening relative humidity (-0.29) and sunshine hours (-0.18). Stem borer dead (SBDH) hearts showed positive correlation with minimum temperature (0.08), maximum temperature (0.17), morning relative humidity (0.33) and rainfall (0.24) whereas, negative correlation was observed with evening relative humidity (-0.24) and sunshine hours (-0.11). Leaf folder damage has significant positive correlation (0.60*) with minimum temperature, non-significant positive correlation with maximum temperature (0.31), morning relative humidity (0.22) and rainfall (0.06) and negative correlation with evening relative humidity (-0.16) and sunshine hours (-0.14).The whorl maggot incidence showed highly significant positive correlation (0.81***) with minimum temperature, significant positive correlation with maximum temperature (0.56*), and non-significant positive correlation with morning relative humidity (0.27) and rainfall (0.17), negative correlation with evening relative humidity (-0.17) and sunshine hours (-0.20) (Fig 5).

Fig: 5a Population Dynamics of gall midge and stem borer in rice ecosystem (ZONE IV)



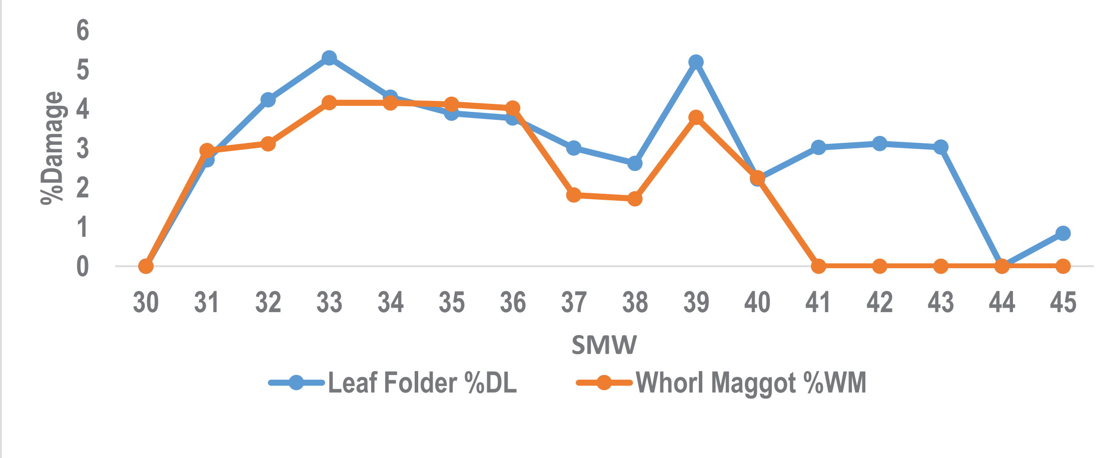


Fig: 5b Population Dynamics of leaf folder and whorl maggot in rice ecosystem (ZONE IV)

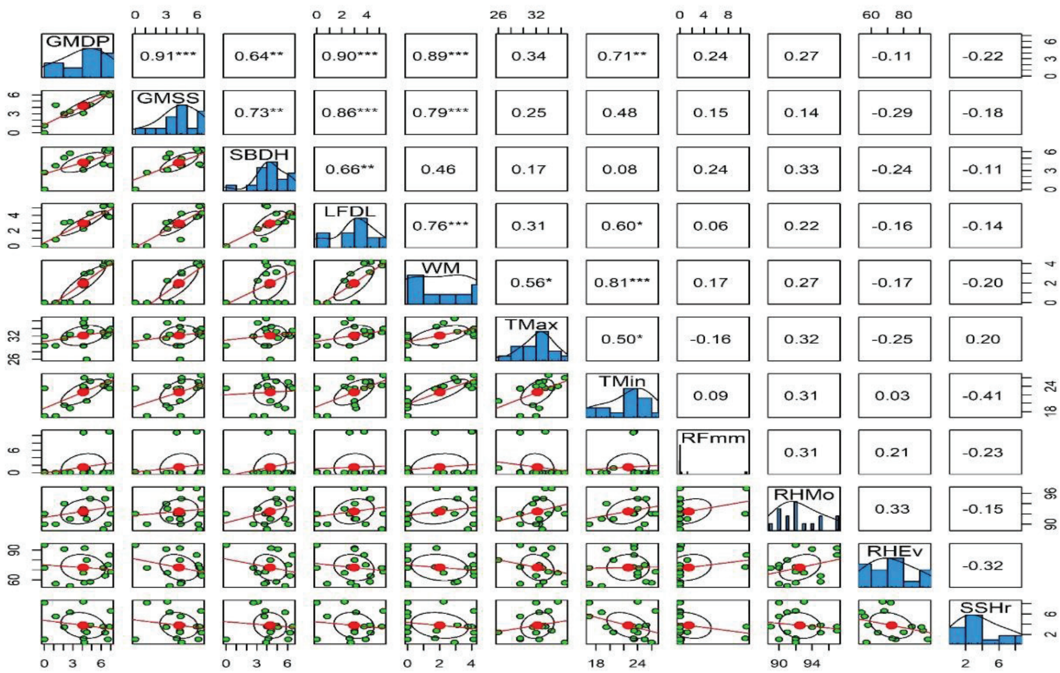


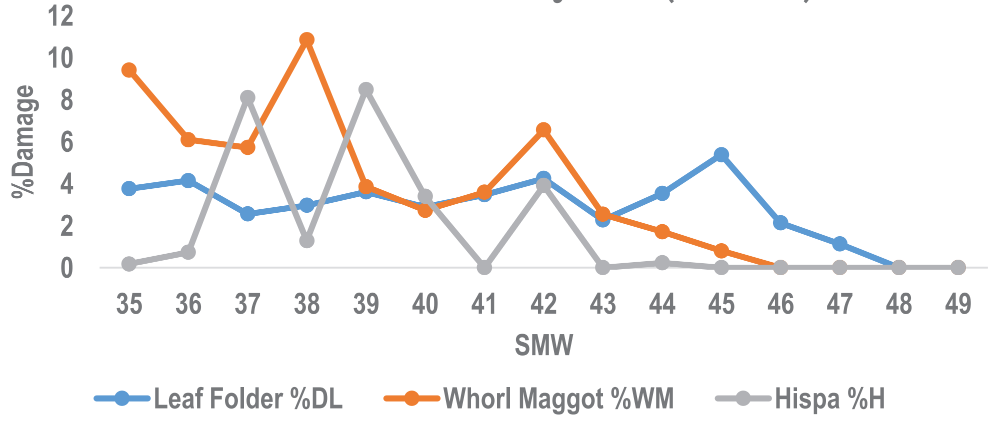
Fig: 5 Correlation matrix between field incidence of insect pests & weather parameters in Zone-IV, *Kharif*, 2023

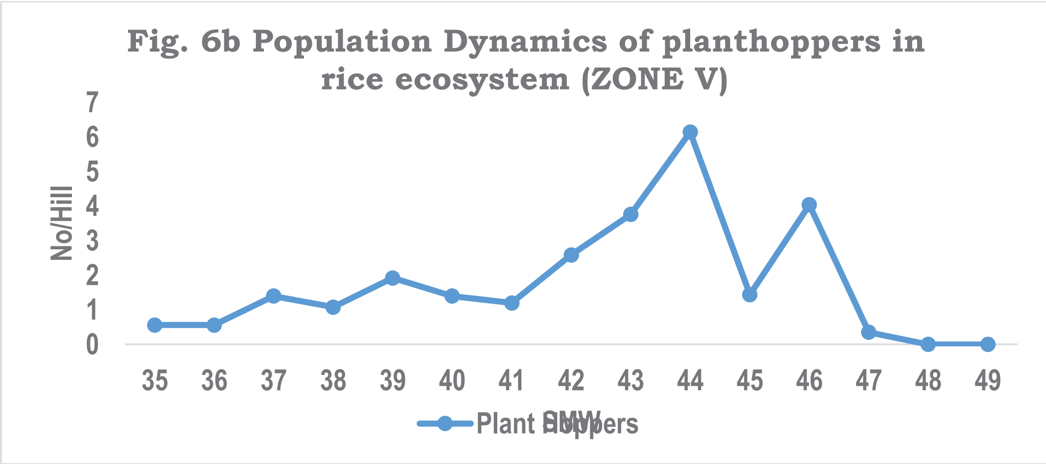
Zone V

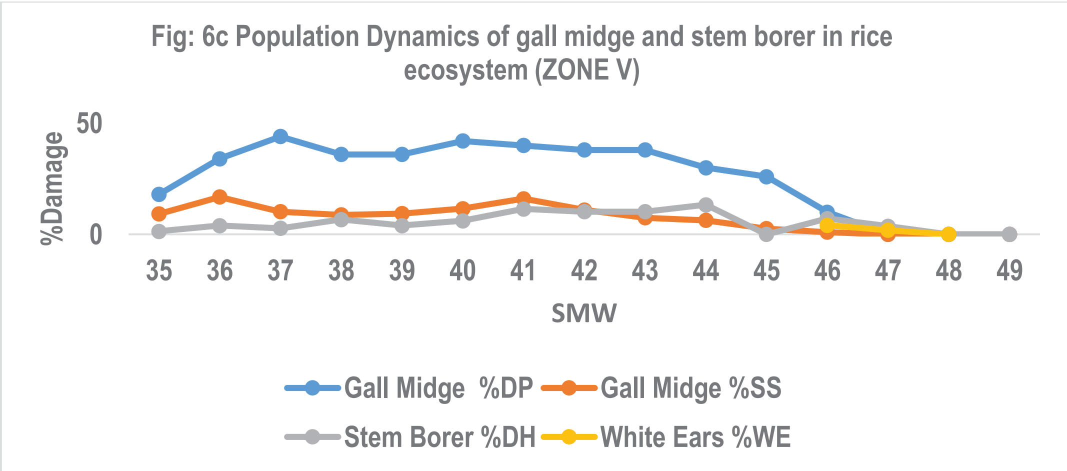
In Zone –V, the pest incidence was observed between 35th to 47th SMW. Highest incidence of gall midge (44% DP) was recorded in this zone during 37th SMW and lowest damage (10% DP) during 46th SMW. Silver shoots were high (16.8%) during 36th SMW and low (1.0%) during 46th SMW. Stem borer incidence was more (13.3% DH) during 44th week and low (1.4% DH) during 35th SMW. Leaf folder incidence ranged from 1.13% to 5.38 % LFDL during 45th and 47th SMW, respectively. High incidence of whorl maggot (10.09%) was seen during 38th SMW and low incidence (0.80%) during 45th SMW. Rice hispa incidence was high during 39th SMW (8.50 %) and low (0.20%) during 35th and 44th SMW.

Planthopper incidence ranged from 0.35 hoppers/hill during 47th SMW to 6.14 hoppers/hill during 44th SMW. White ears were recorded during 46th (2.02%) and 47th weeks (1.75%) (Fig 6a, 6b & 6c). The gall midge damaged plants (GMDP) showed significant positive correlation with maximum temperature (0.59*), minimum temperature (0.53*), non-significant positive correlation with rainfall (0.38) and negative correlation with morning (-0.47) and evening relative humidity (-0.37). Gall midge silver shots (GMSS) showed significant positive correlation with maximum temperature (0.58*), minimum temperature (0.58*) and significant negative correlation with morning relative humidity (-0.55*) and non-significant positive correlation with rainfall (0.16) and negative correlation with evening relative humidity (-0.38). Stem borer dead hearts (SBDH) showed significant positive correlation with maximum temperature (0.59*) and negative correlation with minimum temperature (-0.33), rainfall (-0.27), morning relative humidity (-0.23) and evening relative humidity (-0.37). Leaf folder damage showed highly significant negative correlation (-0.78***) with morning relative humidity, significant negative correlation (-0.63*) with evening relative humidity, significant positive correlation with maximum temperature (0.64*), positive correlation with minimum temperature (0.36) and rainfall (0.08). Whorl maggot incidence showed significant positive correlation (0.59*) with minimum temperature, positive correlation with maximum temperature (0.47) and rainfall (0.06), and significant negative correlation with morning relative humidity (-0.56*), negative correlation with evening relative humidity (-0.38). Rice hispa showed highly significant positive correlation with minimum temperature (0.66**) and rainfall (0.91***), positive correlation with maximum temperature (0.14), morning (0.16) and evening relative humidity (0.25). Planthopper incidence showed positive correlation with maximum temperature (0.23), negative correlation with minimum temperature (-0.47), rainfall (-0.09), morning relative humidity (-0.04) and evening relative humidity (-0.20) (Fig 6).

Fig: 6a Population Dynamics of leaf folder, hispa and WM in rice ecosystem (ZONE V)







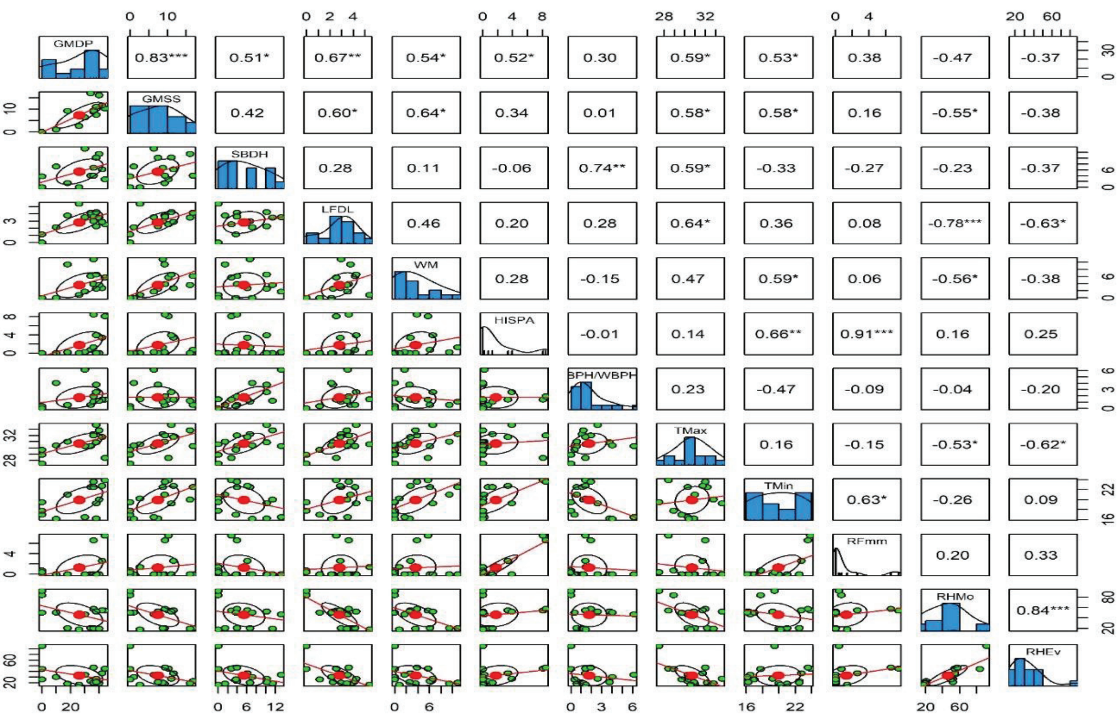
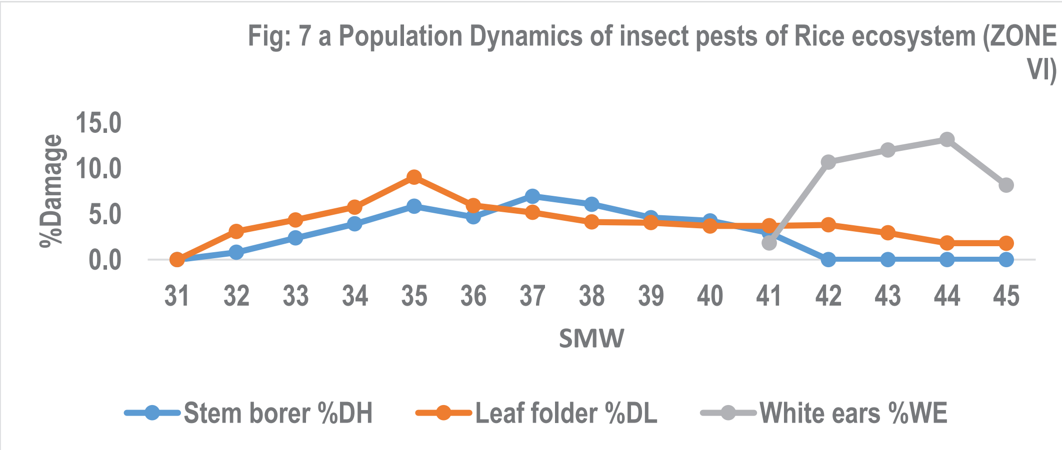


Fig: 6 Correlation matrix - field incidence of insect pests & weather parameters in Zone-V, *Kharif*, 2023

Zone VI

In Zone-VI only stem borer and leaf folder incidence was recorded during 32nd SMW and 41st SMW, respectively. The dead heart incidence ranged from 0.80% (32nd SMW) to 6.90% (37th SMW). Leaf folder damage was high during 35th SMW (9.0%LFDL) and lowduring 44th and 45th SMW (1.80%). White ear damage was high 13.15% during 44th SMW and lowest (1.84%) during 41st SMW (Fig. 7a). Rice yellow stem borer dead hearts (SBDH) showed significant positive correlation with minimum temperature (0.54*) and evening relative humidity (0.61*), non-significant positive correlation with rainfall (0.07) and morning relative humidity (0.19), negative correlation with maximum temperature (-0.46). Leaf folder damage (LFDL) showed positive correlation with minimum temperature (0.47) and evening relative humidity (0.34) and negative correlation with maximum temperature (-0.17), rainfall (-0.30) and morning relative humidity (-0.17) (Fig 7)



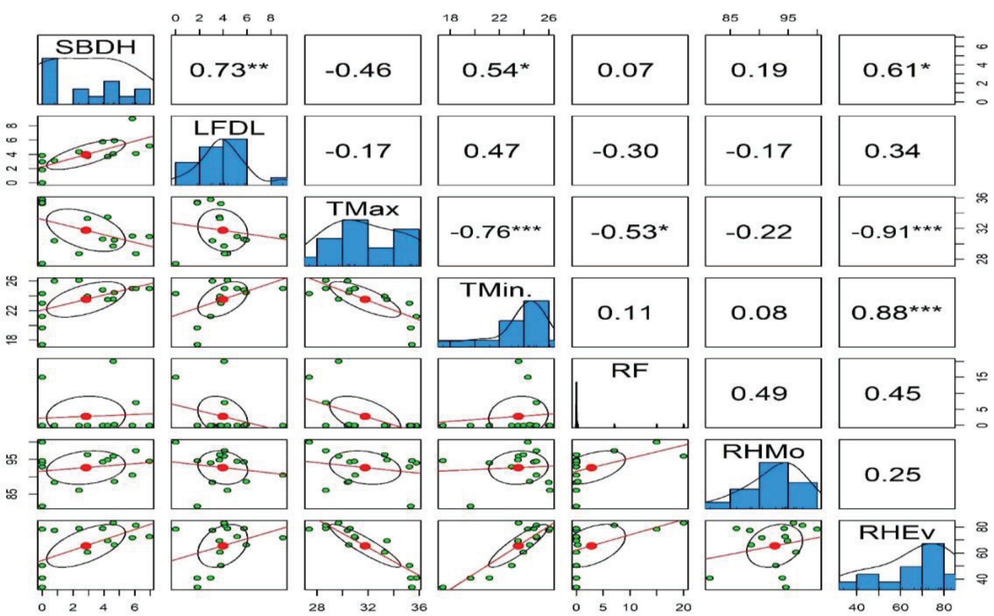


Fig: 7 Correlation matrix - field incidence of stem borer, leaf folder & weather parameters in Zone-VI, *Kharif*, 2023

Zone VII

In Zone –VII, gall midge incidence was high with plant damage ranging from 6.0 to 38.90 % during 49th SMW and 39th SMW, respectively. Similarly, silver shoots were also high (11.75%) during 39th SMW and lowest (0.30%) during second SMW. Stem borer damage ranged from 0.16% DH during 34th SMW to 8.48 %DH during 41st SMW. Leaf folder damage was highest during 43rd SMW (7.10%) and lowest during 34th, 2nd and 4th SMWs (0.40 % LFDL). Whorl maggot damage was at peak during 35th SMW (3.10%) and hispa damage during 38th SMW (2.30%) and their damage was lowest (0.1% DL) during 49th and 49-50 SMW, respectively. Planthoppers were high (27.7 hoppers/hill) during 47th SMW and lowest (0.20 hoppers/hill) during 33rd and 34th SMW. White ears were high (20.91%) during 51st SMW and were lowest during 49th SMW (2.73%) (Fig: 8a, 8b & 8c). Hispa incidence is positively correlated with Tmin and morning RH and negatively correlated with rainfall. Gall midge damaged plants showed positive correlation with maximum temperature (0.39), minimum temperature (0.35), sunshine hours (0.19), morning (0.33) and evening relative humidity (0.40) and negative correlation (-0.20) with rainfall. Gall midge silver shoots showed significant positive correlation with maximum temperature (0.49*), non-significant positive correlation with minimum temperature (0.37), sunshine hours (0.29), morning (0.32) and evening relative humidity (0.34) and negative correlation with (-0.32) with rainfall. Stem borer dead heart damage showed highly significant positive correlation with maximum temperature (0.62**), significant positive correlation with minimum temperature (0.51*) and positive correlation with sunshine hours (0.35), morning (0.20) and evening relative humidity (0.21) and showed negative correlation (-0.32) with rainfall. Leaf folder damage (LFDL) showed positive correlation with maximum temperature (0.06), minimum temperature (0.09), evening relative humidity (0.06) and negative correlation with morning relative humidity (-0.02), rainfall (0.08) and sunshine hours (0.29). Whorl maggot incidence showed highly significant positive correlation with maximum temperature (0.58**), morning relative humidity 0.59**) and evening relative humidity (0.58**); significant positive correlation with minimum temperature (0.53*); positive correlation with sunshine hours (0.38); highly significant negative correlation with rainfall (-0.61**). Planthopper incidence showed negative correlation with maximum temperature (-0.40), minimum temperature (-0.31), sunshine hours (-0.34), morning relative humidity (-0.05) and evening relative humidity (-0.03) and positive correlation with rainfall (0.19). Stem borer white ears damage showed negative correlation with maximum temperature (-0.33), minimum temperature (-0.12), sunshine hours (-0.13), morning relative humidity (-0.15), evening relative humidity (-0.32) and positive correlation (0.19) with rainfall (Fig. 8).

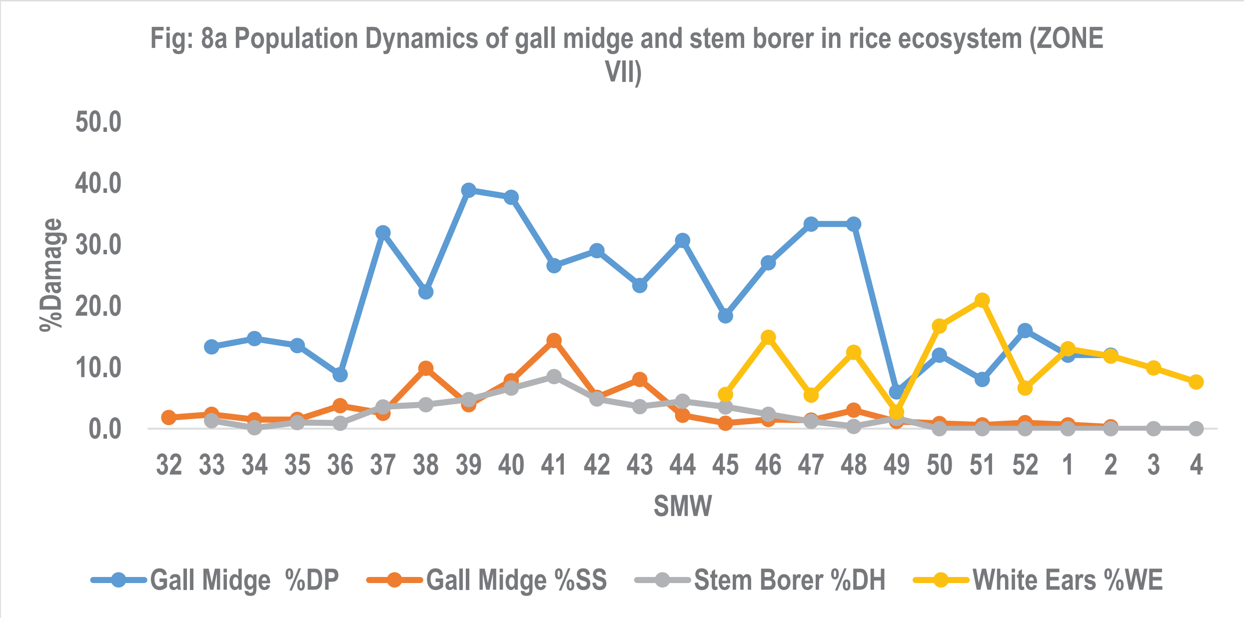


Fig: 8a Population Dynamics of gall midge and stem borer in rice ecosystem (ZONE VII)
%Damage
50.0
40.0
30.0
20.0
10.0
0.0
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 1 2 3 4
SMW
Gall Midge %DP
Gall Midge %SS
Stem Borer %DH
White Ears %WE

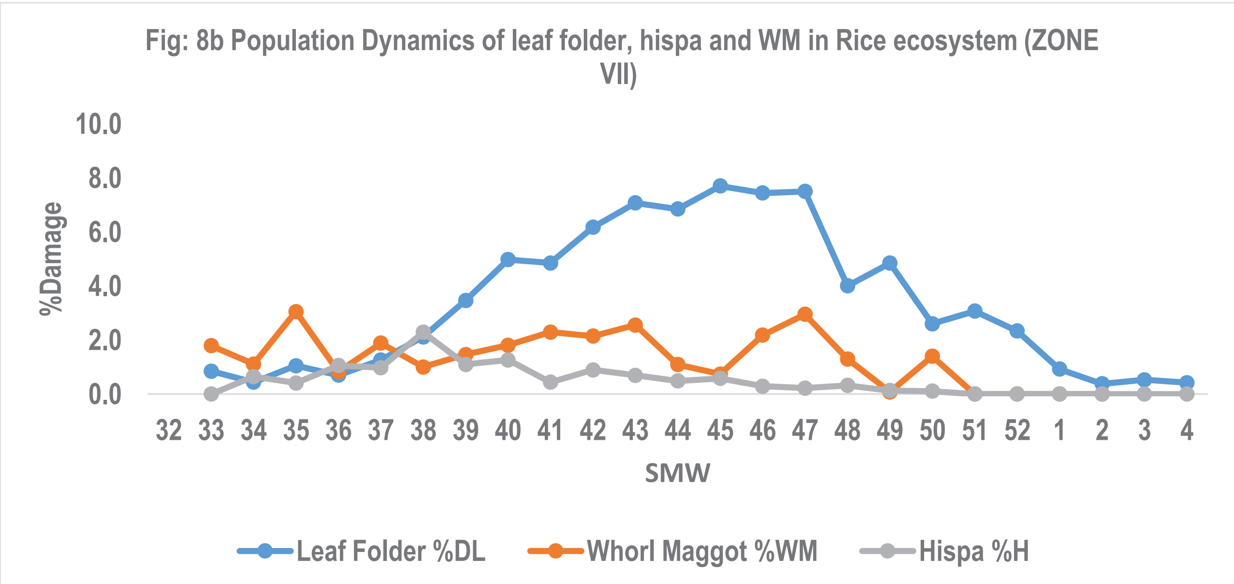


Fig: 8b Population Dynamics of leaf folder, hispa and WM in Rice ecosystem (ZONE VII)
%Damage
10.0
8.0
6.0
4.0
2.0
0.0
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 1 2 3 4
SMW
Leaf Folder %DL
Whorl Maggot %WM
Hispa %H

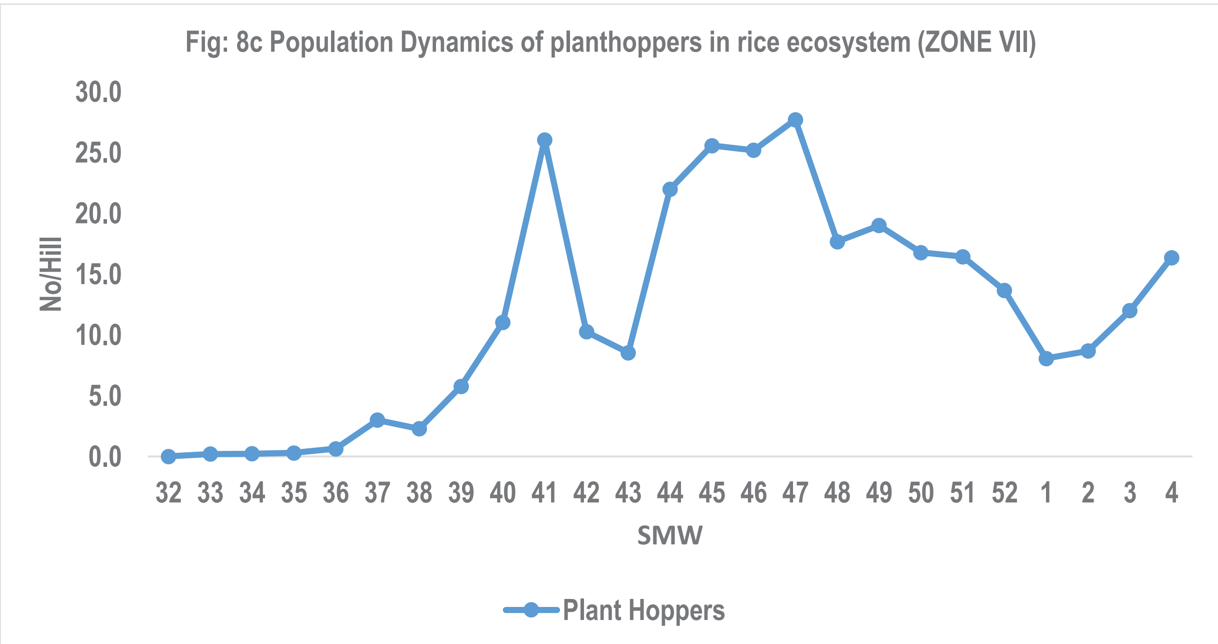


Fig: 8c Population Dynamics of planthoppers in rice ecosystem (ZONE VII)
No/Hill
30.0
25.0
20.0
15.0
10.0
5.0
0.0
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 1 2 3 4
SMW
Plant Hoppers

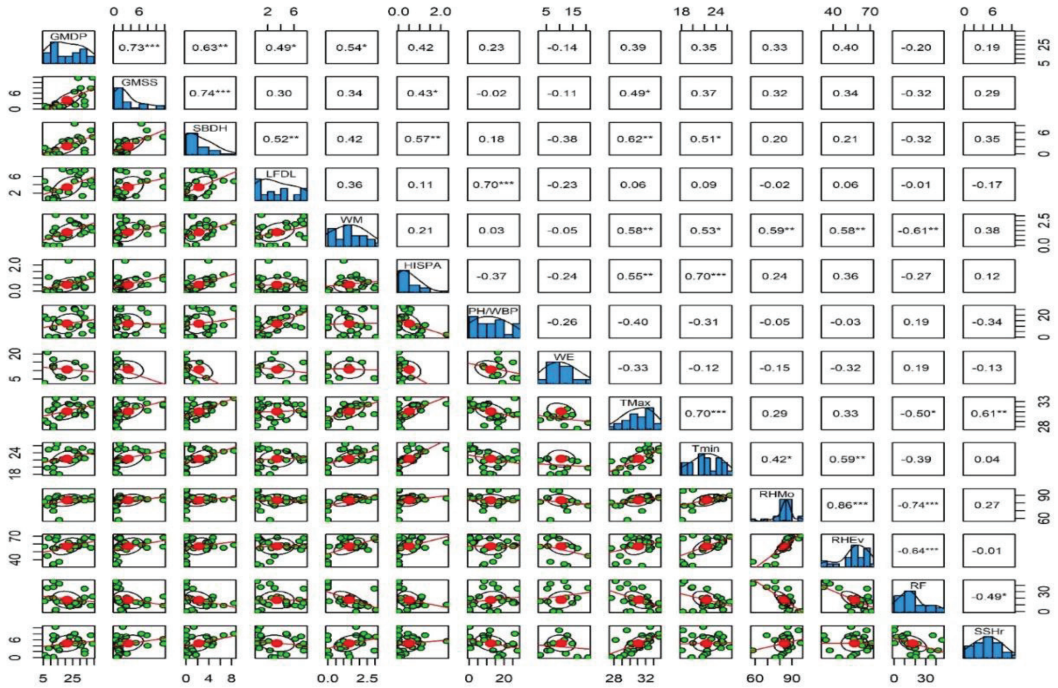


Fig: 8 Correlation matrix - field incidence of insect pests & weather parameters in Zone-VII, *Kharif,* 2023

Summary:

Population dynamics of insect pests and natural enemies in rice ecosystem was carried out at 26 locations across the country to know the population dynamics of insect pests in relation to changes in weather parameters, crop phenology, growing season and cropping systems for designing ecologically sound and economically viable pest management strategies. Yellow stem borer, brown planthopper, leaf folder and gall midge were observed as major pests of rice across the centres during *kharif,* 2023. Rice hispa and whorl maggot were recorded as minor pests. Pest incidence varied across different zones, with factors like weather parameters and crop phenology exerting significant influences on their populations. In Zone III and Zone V, gall midge and stem borer incidence displayed a pronounced correlation with maximum and minimum temperatures. Furthermore, the study revealed intriguing patterns in pest damage across various regions. In Zone IV, peak incidence of gall midge occurred 33rd SMW whereas in Zone VII it happened during the 39th SMW. The comprehensive investigation conducted across multiple regions sheds light on the complex interactions between insect pests, natural enemies, and environmental variables within rice ecosystems.

b. Population Dynamics of Rice Insect Pests Assessed Through Light Trap Catches (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 AICRIP 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 the year 2023, insect populations in rice ecosystems were recorded daily, throughout the year using light traps (Chinsurah/Robinson type) in 30 locations. These locations are namely; ADT, CHN, CHP, BRH, GNV, KRK, KJT, KUL, LDN, MLN, MND, MTU, MSD, MNC, KHD, NVS, NWG, NLR, PNT, PTB, RNR, RPR, CBT, JDP, TTB, CHT, RGL, GGT and WGL. Corresponding weather data on temperature, rainfall, relative humidity, sunshine hours, etc. were also collected. Weekly cumulative catches of insects and weekly averages of weather parameters were worked out on standard week (SW) basis. Highlights and trends of the data collected during the year 2023 are presented hereunder:

Yellow stem borer: Yellow stem borer was recorded in 27 locations, except in KHD and CHT. Annual cumulative catches were highest at MTU (22274), GGT (14009), followed by GNV (12838). Highest weekly catch was at MTU, GNV, and NLR in 16th, 17th and 38th SW respectively. In the previous year 2022, annual cumulative catches were highest at PTB (15728), followed by MTU (12200) and ADT (9776). Highest weekly catch was at ADT, PTB, and GNV in 34th, 52nd, and 17th SW respectively (Table 2.7.1 and Fig 2.7.1).

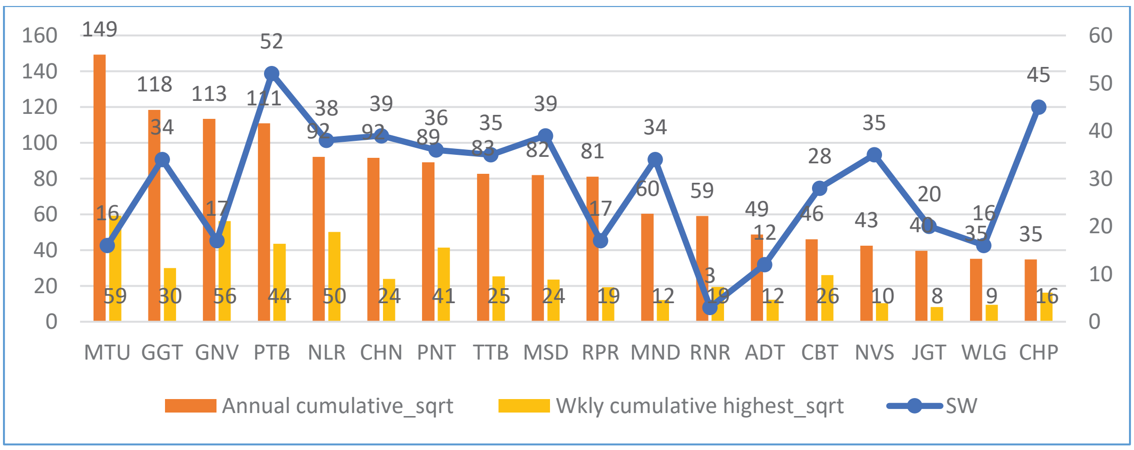


Fig. 2.7.1. Seasonal incidence of yellow stem borer (Catches>1000)

Table 2.7.1. Seasonal incidence of yellow stem borer based on light trap catches

S. No.	Zone	Location	Annual cum.	Wkly cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	Zone-II North	PNT	7932	1712	36	34.9	25.6	5.9	88.0	62.3	6.5
2		LDN	122	39	38						
3		KUL	349	43	36	35.4	24.6	0.0	92.9	66.3	
4	Zone-III East	CHP	1207	264	45	30.7	17.7	0.0	89.8	48.0	
5		CHN	8391	574	39	33.4	27.4	4.8	93.1	79.4	
6		GGT	14009	893	34						
7		MSD	6703	553	39						
8	Zone-III N-East	TTB	6837	638	35	35.0	24.6	7.8	92.3	68.7	5.3
9	Zone V Central	JDP	675	36	47	29.7	16.9	0.1			
10		RPR	6577	371	17	35.9	21.2	4.5	73.4	39.9	8.3
11	Zone-VI Western	KJT	169	15	25	35.6	26.4	0.1	78.9	53.1	0.0
12		NWG	510	31	48	27.1	18.1	4.2	86.7	70.4	4.5
13		NVS	1807	105	35	32.3	24.4	0.1	93.2	58.4	
14	Zone-VII Sothern	CBT	2127	677	28	31.7	23.4	0.1	90.0	53.6	3.7
15		ADT	2368	149	12	34.9	23.6	3.5	94.3	62.3	7.7
16		KRK	759	59	4	30.0	20.6	0.1	93.3	64.4	6.2
17		GNV	12838	3169	17	33.0	23.8	0.1	72.9	51.7	
18		MND	3631	147	34	34.0	19.7	0.3	85.1	59.0	0.0
19		BRH	156	16	38	30.8	21.7	21.8	92.3	77.9	
20		MNC	729	45	42	32.8	26.7	17.3	90.4	80.0	
21		PTB	12277	1895	52	33.0	22.4	0.0	94.8	66.9	
22		RGL	451	36	45	32.4	24.4	0.0	87.3	59.3	8.3
23		NLR	8500	2510	38	34.6	25.2	0.7	59.9	47.6	5.1
24		MTU	22274	3506	16	35.1	23.1	0.0	88.4	41.0	
25		RNR	3498	375	3	30.7	13.3	0.0	84.7	30.0	9.1
26		WGL	1231	87	16	39.2	24.0	0.0	64.6	27.9	9.3
27		JGT	1575	66	20	42.9	24.5	0.0	61.9	27.1	9.6

Gall midge: Gall midge occurrence was observed in 9 locations. It was not recorded from Northern hill, Northern and Western Zones. 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 in GNV (2950) in 45th SW, followed by PTB (1234) in 41stSW and MTU (456) in 47th SW (Fig. 2.7.2 and Table 2.7.2). In the previous year (2022), annual cumulative catches were highest in GNV (14436) followed by MTU (9483) and WGL (3186) and in terms of weekly cumulative catch, it was most active in MTU (2201) in 50th SW, followed by GNV (1962) in 48th SW and WGL (765) in 45th SW.

Table 2.8.2. Seasonal incidence of gall midge based on light trap catches

S.No	Location	Annual cum.	Wkly cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	GNV	13330	2950	45	30.0	23.5	5.5	92.7	77.6	
2	CHN	190	9	42	32.2	22.5	0.0	91.9	64.0	
3	PTB	6849	1234	41	32.1	22.0	8.5	95.3	70.1	
4	MTU	5661	456	47	30.6	22.0	2.3	91.1	63.0	
5	NLR	1134	296	3	24.3	83.9	0.0	27.3	77.7	0.0
6	WGL	1424	389	44	31.5	20.9	0.0	88.6	63.6	5.3
7	JGT	149	18	40	33.3	22.5	20.0	92.7	56.9	8.0
8	CHP	1001	247	42	31.7	22.0	0.0	85.1	60.8	
9	BRH	305	54	32	30.6	21.7	7.8	95.0	79.6	

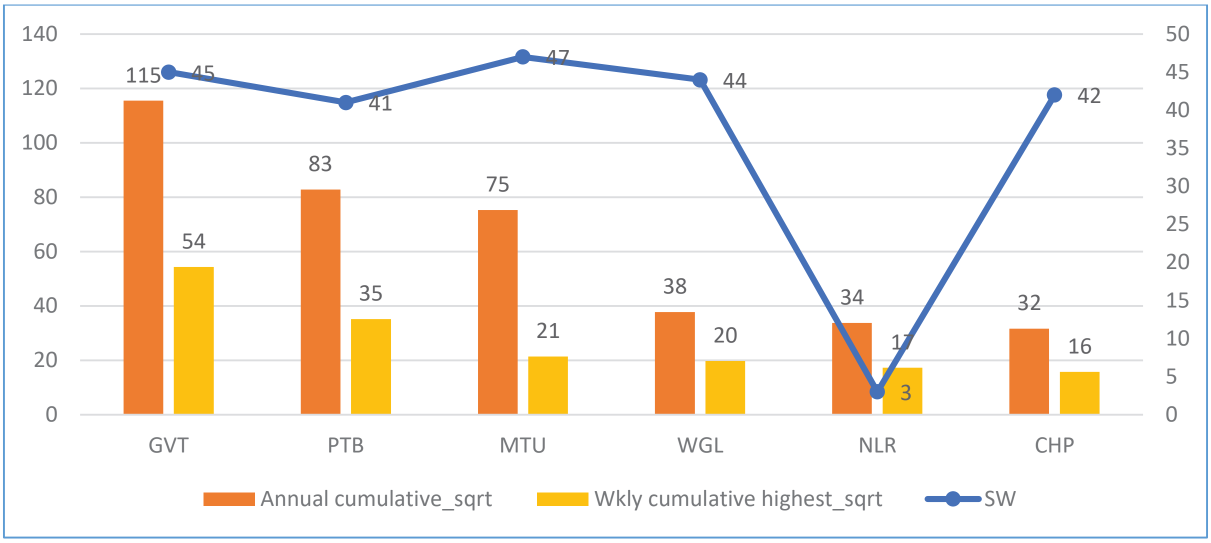


Fig. 2.7.2. Seasonal incidenece of gall midge (Catches>1000)

Leaf folder: Leaf folder also was recorded at 27 locations across all the zones. 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. In the previous year 2022, it was most active in ADT, GNV, and KJT in terms of annual cumulative catches. Whereas, weekly cumulative catches were highest at ADT, MND, followed by PTB during 35th, 46th, and 5th SWs respectively (Table 2.7.3 and Fig. 2.7.3).

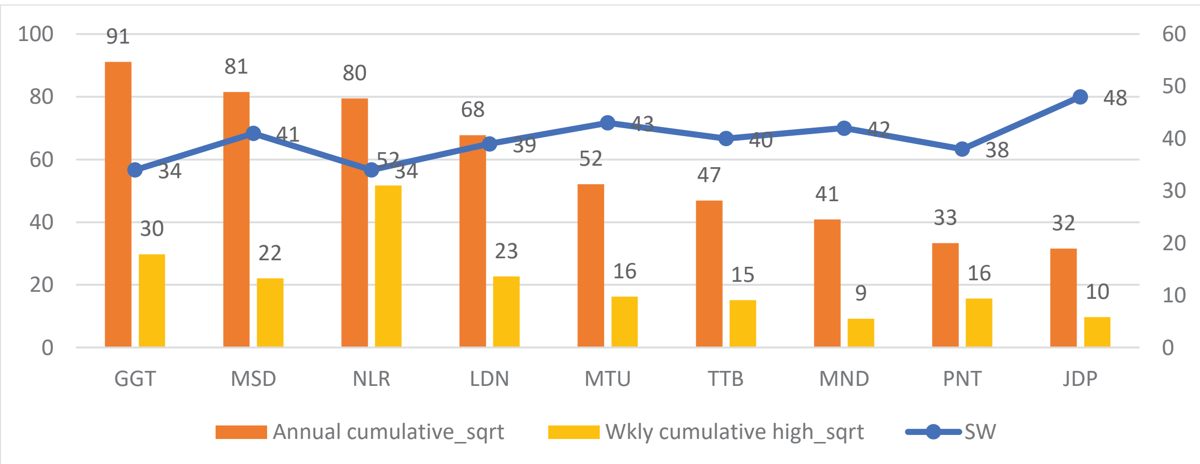


Fig. 2.7.3. Seasonal incidenece of leaf folder (Catches>1000)

Table 2.8.3. Seasonal incidence of leaf folder based on light trap catches

S. No.	Zone	Location	Annual cum.	Wkly cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	Zone-I NW-Hills	MLN	369	51	17	30.0	11.3	0.0	76.1	72.0	
2	Zone-II North	PNT	1107	245	38	32.7	24.9	89.6	70.0	3.8	6.2
3		LDN	4589	517	39						
4		CHT	508	58	47						
5		KUL	840	116	37						
6	Zone-III East	CHP	165	23	42	31.7	22.0	0.0	85.1	60.8	
7		CHN	269	20	39	33.4	27.4	79.4	4.8	93.1	
8		GGT	8297	887	34	33.0	23.8	0.1	72.9	51.7	
9		MSD	6637	487	41						
10	Zone-III N-East	TTB	2197	228	40	34.6	23.9	0.0	92.3	66.0	6.8
11	Zone V-Central	JDP	1000	94	48	30.5	15.6	0.2	13.4	15.5	88.6
12		RPR	663	187	41	34.4	23.3	0.0	92.3	45.4	8.0
13	Zone-VI Western	KJT	126	25	17	37.8	24.5	0.0	83.7	41.4	9.0
14		NWG	649	42	41	34.3	22.8	0.0	81.9	50.3	9.1
15		NVS	242	27	36	32.0	24.2	8.1	92.1	70.0	
16	Zone-VII: Sothern	CBT	509	33	27	30.1	23.1	5.8	88.6	67.3	2.2
17		ADT	194	54	42	33.4	24.2	0.3	92.9	73.3	
18		GNV	548	68	47	30.0	20.9	0.0	88.3	67.9	
19		MND	1667	86	42	31.1	19.4	0.8	83.8	60.2	6.7
20		BRH	216	27	39	30.1	22.0	21.1	94.3	85.3	
21		MNC	278	24	15	35.7	26.6	67.4	4.5	76.3	
22		PTB	385	78	12	34.3	21.8	43.7	0.0	90.0	
23		RGL	536	73	43	31.6	24.3	0.0	84.6	63.7	5.1
24		NLR	6323	2675	34	34.0	25.3	6.3	60.4	46.9	0.0
25		MTU	2715	265	43	30.9	23.7	2.3	79.4	64.6	
26		RNR	831	264	41	33.1	20.7	0.0	90.0	39.9	7.6
27		WGL	29	9	47	30.2	20.8	0.3	66.9	90.4	3.8

Brown planthopper: Brown planthopper was recorded in 20 locations. It was most abundant at RPR, PTB, and MTU on annual cumulative basis. Whereas, it was most active in 18th SW at RPR, in 45 SW at PNT and in 41stSW at MTU. In the previous year 2022, BPH was most abundant in MTU, PTB, and PNT on annual cumulative basis. Weekly cumulative catches were also highest in MTU followed by PNT, and WGL during 45th, 18th and 16th SW respectively.

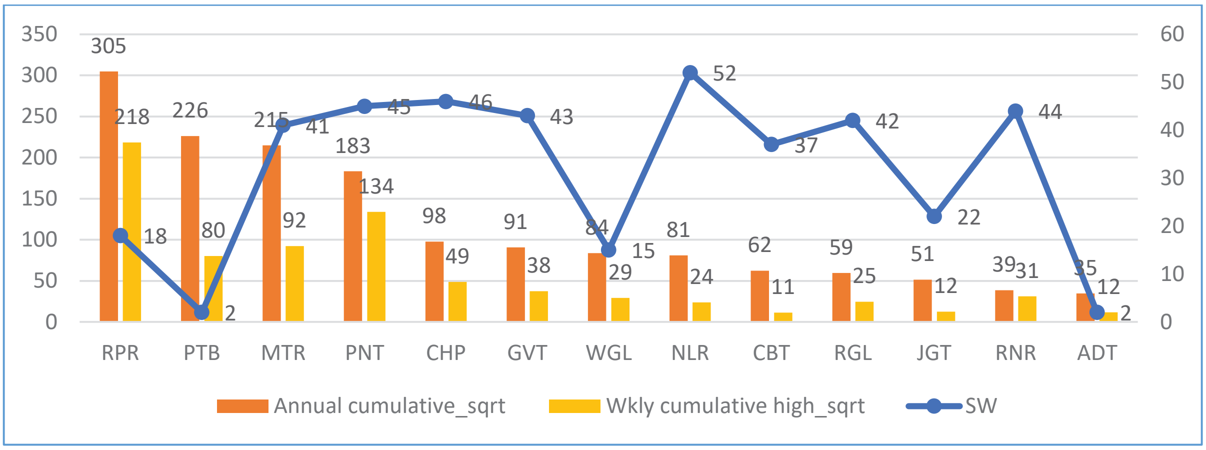


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Fig. 2.7.4. Seasonal incidence of brown planthopper (Catches>1000)

Table 2.8.4. Seasonal incidence of brown planthopper based on light trap catches

S. No.	Zone	Location	Annual cum.	Wkly cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	Zone-II North	PNT	33565	17935	45	29.0	13.6	0.0	88.6	41.3	7.1
2		LDN	619	190	40						
3		KUL	716	114	42						
4	Zone-III East	CHP	9571	2353	46	30.0	18.7	0.0	87.8	48.8	
5		CHN	457	95	29	34.4	27.1	75.0	3.0	87.3	
6	Zone-III N-East	TTB	31	31	31	34.6	24.2	3.3	93.1	63.0	5.7
7	Zone V-Central	RPR	92772	47740	18	32.0	22.1	8.7	82.0	50.1	6.6
8	Zone-VII:	CBT	3877	128	37	32.1	23.9	1.0	82.7	52.7	5.2
9		ADT	1211	133	2	29.1	19.9	0.3	92.6	68.1	5.9
10		KRKL	46	19	11	32.6	23.5	0.0	93.3	59.3	8.6
11		GNV	8248	1411	43	31.5	19.0	0.0	61.9	53.1	
12		BRH	454	25	33	30.3	21.5	6.6	94.7	80.7	
13		MNC	785	64	42	32.8	26.7	17.3	90.4	80.0	
14		PTB	51203	6439	2	31.9	19.0	0.0	90.9	51.7	
15		RGL	3526	606	42	33.8	24.6	0.0	86.1	65.1	7.3
16		NLR	6560	565	52	22.1	27.0	3.6	77.5	66.1	0.0
17		MTU	46143	8497	41	33.3	27.7	74.4	67.9	0.0	
18		RNR	1494	970	44	31.1	21.1	0.0	82.9	50.3	3.9
19		WGL	7004	863	15	37.9	24.0	0.0	63.1	33.7	9.1
20		JGT	2635	155	22						

Whitebacked planthopper: Whitebacked planthopper was recorded in 17 locations spread across all the zones. It was most abundant at MTU, RGL, and NLR in terms of annual cumulative catches. It was most active in 46th, 45th and 45thSW at MTU, RGL and WGL respetively. In the previous year 2022, highest annual cumulative catches were recorded at MTU, NLR, and GNV. Whereas, white backed planthopper was most active during 45th, 26th, and 35th SW at MTU, NLR and KUL respectively.

Table 2.8.5. Seasonal incidence of whitebacked planthopper based on light trap catches

S. No.	Zone	Location	Annual cum.	Wkly cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	Zone-II North	LDN	181	26	28						
2		KUL	143	23	41						
3	Zone-III East	CHP	852	284	44	30.7	19.9	0.0	70.8	56.2	
4		CHN	5696	898	45	30.2	18.8	0.0	95.3	57.6	
5	Zone-III N-East	TTB	27	27	31	34.6	24.2	3.3	93.1	63.0	5.7
6	Zone V-Central	JDP	663	187	41	32.7	19.5	0.0	91.6	51.4	
7	Zone-VI Western	NWG	1974	108	45	35.4	18.8	0.0	71.1	31.0	8.2
8	Zone-VII: Sothern	CBT	3380	119	36	32.4	23.7	0.2	81.4	54.0	3.8
9		KRK	25	6	50	31.1	23.6	1.7	90.6	74.3	6.5
10		GNV	3757	577	43	31.5	19.0	0.0	61.9	53.1	
11		MNC	427	30	47	33.4	27.5	4.6	89.7	81.0	
12		RGL	7445	1906	45	32.4	24.4	0.0	87.3	59.3	8.3
13		NLR	6046	392	52	22.1	27.0	0.0	77.5	66.1	3.6
14		MTU	9362	2456	46	30.9	22.6	0.0	88.1	68.1	
15		WGL	3313	1056	45	31.5	21.6	0.0	90.4	61.7	5.1

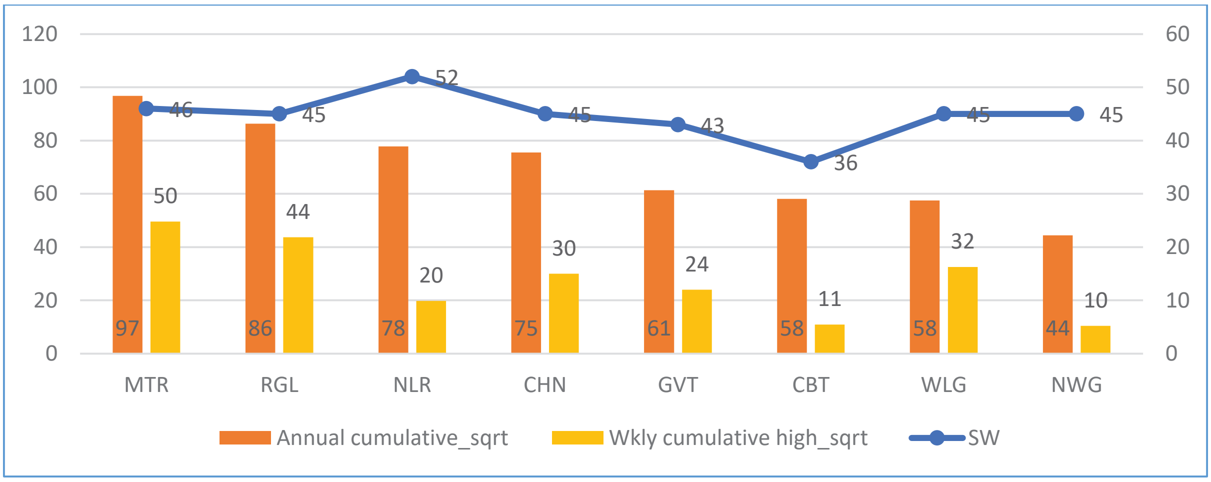

Fig. 2.7.5 Seasonal incidenece of white backed planthopper (Catches>1000)

Green leafhopper: Green leafhopper was recorded from 26 locations. GLH was predominant at JDP, PTB, and GGT in terms of annual cumulative catches. It was most active in 44th, 42nd and 45th SW at JDP, MTU and PTB respectively. In the previous year 2022, highest annual cumulative population was found at JDP, MTU, and MSD. It was most active during 44th, 46th and 37th SW at JDP, MTU and TTB respectively.

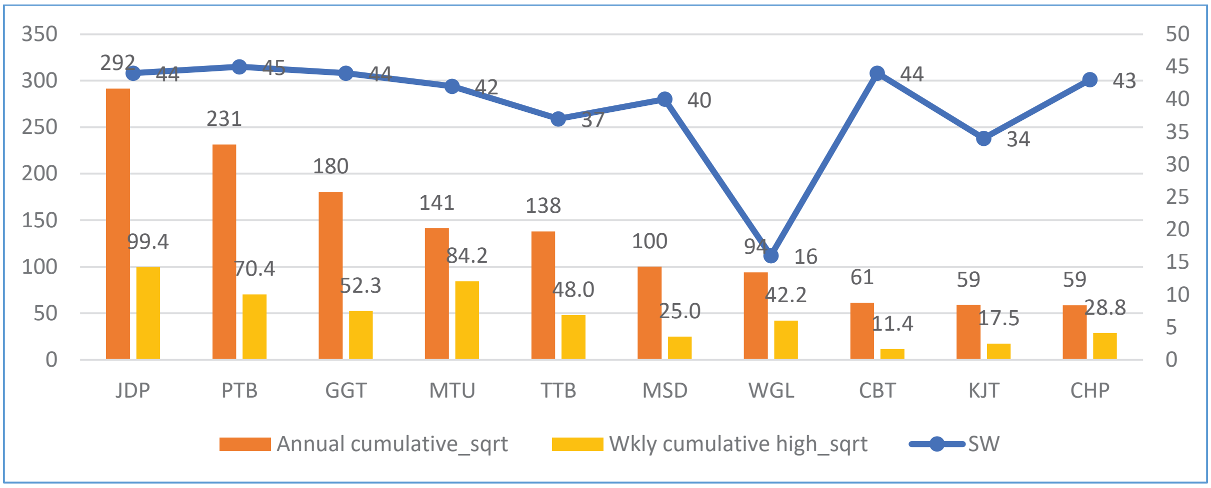

Fig. 2.7.6. Seasonal incience of green leafhopper (Catches>3000)

Table 2.8.6. Seasonal incidence of green leafhopper based on light trap catches

S. No.	Zone	Location	Annual cum.	Wkly cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	Zone-I NW-Hills	MLN	297	48	20	29.7	12.4	14.8	74.4	69.7	
2	Zone-II North	PNT	2127	703	44	30.7	15.2	0.0	86.4	39.7	8.4
3		KUL	884	220	27						
4	Zone-III East	CHP	3435	832	43	31.0	18.9	0.0	86.0	51.8	
5		CHN	1220	95	45	30.2	18.8	0.0	95.3	57.6	
6		GGT	32579	2731	44						
7		MSD	10049	627	40						
8	Zone-III N-East	TTB	19071	2308	37	32.8	23.4	4.5	93.3	69.7	1.7
9	Zone V-Central	JDP	84999	9885	44	31.2	16.2	1.8	14.4	16.1	85.9
10		RPR	398	65	47	30.6	17.4	0.0	84.0	42.0	6.5
11	Zone-VI Western	KJT	3456	307	34	29.7	24.4	21.6	90.9	82.4	1.2
12		NVS	49	10	27	30.8	24.9	36.3	93.7	83.8	
13	Zone-VII: Sothern	CBT	3776	130	44	30.9	23.2	13.5	89.3	57.0	3.9
14		ADT	1880	149	2	29.1	19.9	0.3	92.6	68.1	5.9
15		KRK	609	72	49	32.2	25.3	3.0	94.1	77.1	4.5
16		GNV	2592	208	47	30.0	20.9	0.0	88.3	67.9	
17		MND	1333	72	38	30.3	20.4	1.6	85.7	57.1	6.9
18		BRH	1574	174	32	30.6	21.7	7.8	95.0	79.6	
19		MNC	990	57	11	35.5	25.1	1.1	83.6	67.6	
20		PTB	53545	4950	45	32.6	21.7	25.7	95.3	71.1	
21		RGL	195	34	44	31.5	23.3	0.5	88.4	64.3	6.8
22		NLR	1077	262	2	23.0	85.1	0.0	27.1	76.4	0.0
23		MTU	19985	7096	42	32.4	25.1	0.0	71.1	67.3	
24		RNR	626	145	39	30.2	22.6	6.5	93.4	68.1	4.5
25		WGL	8848	1778	16	39.2	24.0	0.0	64.6	27.9	9.3
26		JGT	2570	82	42	33.8	21.0	0.0	93.4	52.3	7.4

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 and was most active in 43rd, 35th and 34th SW at GGT, MSD, and TTB. In the previous year 2022, it was most active in MSD, GGT, and GNV (Table 2.7.7 and Fig. 2.7.7).

Table 2.8.7. Seasonal incidence of caseworm based on light trap catches

S. No.	Zone	Location	Annual cum.	Wkly Cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	Zone-I NW-Hills	KHD	422	124	15	6	2	1	1	6	
2		MLN	12	6	12	30.3	15.4	12.2	76.3	72.3	
3	Zone-III East	CHP	101	16	45	30.7	17.7	0.0	89.8	48.0	
4		GGT	16428	1703	43						
5		MSD	9119	609	34						
6	Zone-III N-East	TTB	1963	710	35	35.0	24.6	7.8	92.3	68.7	5.3
7	Zone V-Central	RPR	382	86	41	34.4	23.3	0.0	92.3	45.4	8.0
8	Zone-VI Western	KJT	1	1	32	30.1	25.0	8.7	91.1	76.3	1.4
9		NVS	1289	68	47	34.1	18.7	0.0	82.3	39.0	
10	Zone-VII: Sothern	CBT	5	3	6	32.3	18.2	0.0	80.6	22.7	8.4
11		GNV	664	39	41	33.2	22.7	0.0	69.0	56.6	
12		BRH	92	9	43	34.2	22.7	0.0	91.4	62.3	
13		RNR	62	14	9	33.8	14.7	0.0	76.3	19.4	8.7

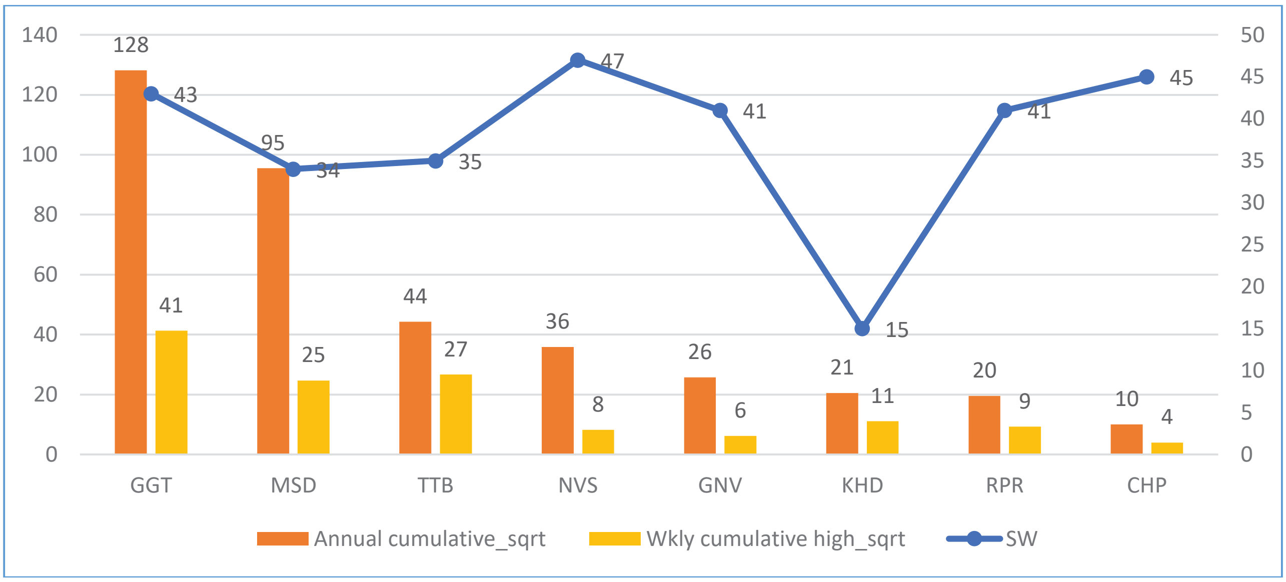

Fig. 2.7.7 Seasonal incidence of case worm (Catches>1000

Gundhi bug: Rice gundhi bug was recorded at five locations: PTB, TTB, PNT, RPR, and KJT. It was most abundant at PTB, TTB, and PNT on annual cumulative basis and was most active during 40th, 39th and 40th SW respectively. In the previous year 2022, it was most abundant in PTB followed by TTB and NVS (Table 2.7.8 and Fig. 2.7.8).

Table 2.8.8. Seasonal incidence of gundhi bug based on light trap catches

S.No	Location	Annual cum.	Wkly cum.	SW	MaxT	MinT	RF	RH1	RH2	SSH
1	PTB	5910	419	40	30.8	21.5	16.7	95.9	78.6	
2	TTB	1604	282	39	32.1	23.6	1.8	90.6	68.6	3.2
4	PNT	1050	332	40	33.8	23.0	0.0	88.9	51.4	9.5
6	RPR	351	216	15	38.9	23.7	0.0	59.7	20.7	6.9
5	KJT	278	48	38	29.7	24.8	15.8	95.4	80.1	2.8

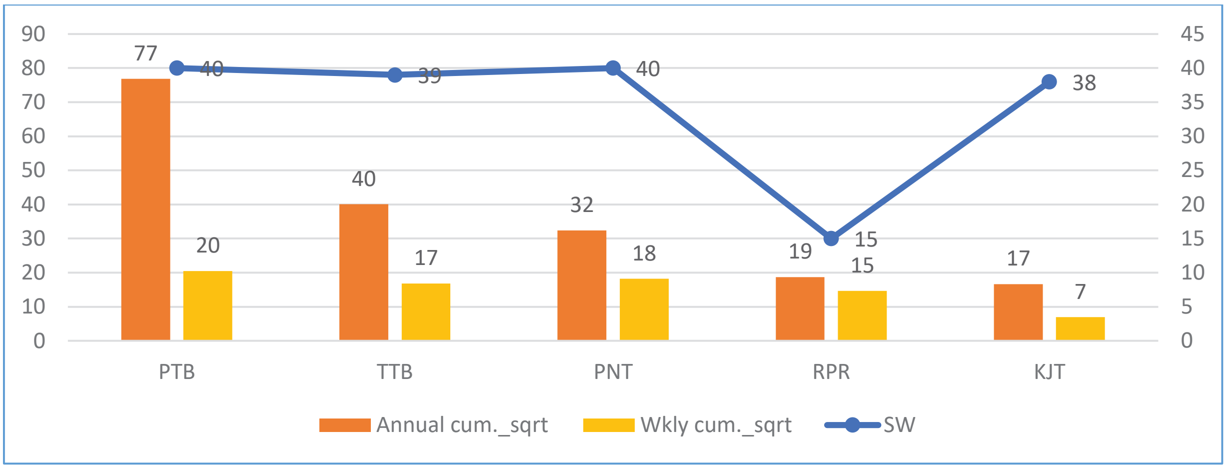

Fig. 2.7.8 Seasonal incidence of gundhi bug

Mirid bugs: It was reported from four locations: PTB, MTU, GNV, and NVS. It was most active in 3rd, 42nd, 45th and 31stSW. In the previous year 2022, it was most abundant in KJT, LDN, MND followed by MTU. Highest weekly catches were recorded at LDN and MND followed by MTU in 42ndand 43rdSWs respectively (Table 2.7.9 and Fig. 2.7.9).

Table 2.8.9. Seasonal incidence of mirid bug based on light trap catches

S.No	Location	Annual cumulative	Weekly cumulative high	SW	MaxT	MinT	RF	RH1	RH2
1	PTB	87885	9351	3	31.8	18.7	0.0	91.4	59.4
2	MTU	15299	5387	42	32.4	25.1	0.0	71.1	67.3
3	GNV	4577	370	45	30.0	23.5	5.5	92.7	77.6
4	NVS	86	9	31	29.7	25.2	5.9	90.6	87.5

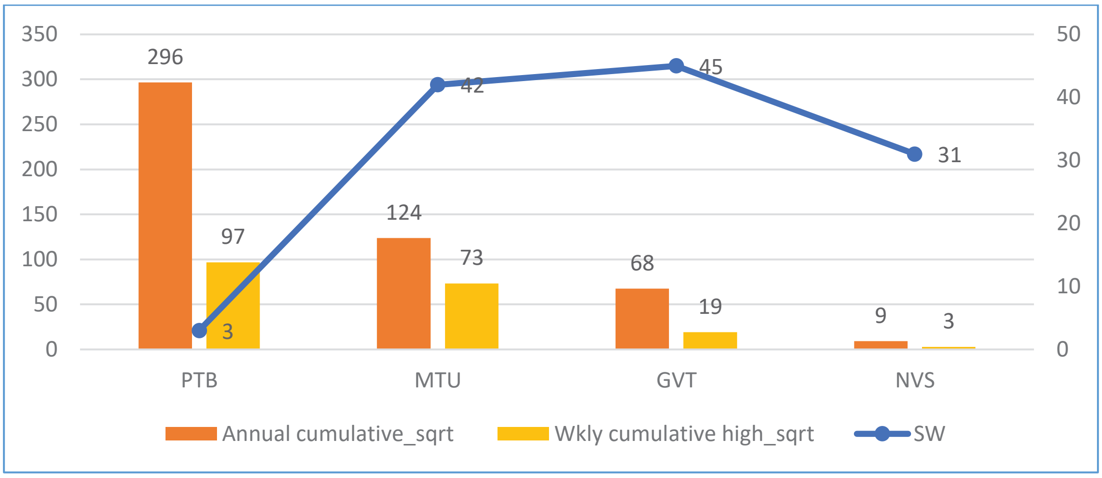

Fig. 2.7.9 Seasonal incidence of mirid bugs

Other Insect Pests:

White stem borer was reported from TTB, PTB, WGL and MLN. Pink stem borer was also reported from LDN, KUL, RNR, and RPR. Black bug was reported from five locations: MLN, ADT, TTB, MTU, and MNC. Zigzag leafhopper was found in three locations: MTU, NVS, CHN and JDP. White grub was a concern at KHD and CHT. Grasshoppers were regular pests at CHT.

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 data indicates that the key pests are reaching their peak levels in the months of October and November in the kharif season. Therefore, strategies are to be timed accordingly for the effective management of insect pests in rice.

Rabi 2022-23

SUMMARY

Stem borer screening Trial (SBST): Evaluation of 55 entries in 6 locations in 8 valid tests against stem borer damage at two phases of crop growth identified, 5 entries as promising in 2-3 of the 8 valid tests. RP 6505-82 was promising in 3 tests for dead heart damage. CR Dhan 308*, RP-6112-SM-92-R-293-1-1-3-3 and RP-6112-SM-92-R-293-2-2-4-4(a) were promising in 2 tests each. NSR 114 (RP BIO 4919)* and BK 49-76* were promising at both dead heart and white ear damages in 3 and 2 tests, respectively

Multiple Resistance screening Trial (MRST) In this trial , 40 entries were evaluated against two leaf damaging insect pests *viz.*, whorl maggot at Rajendranagar and grasshoppers at Khudwani. None of them were promising.

National Screening Nursery (Boro): The trial was constituted with 52 entries (41 entries AVT and IVT Boro along with 10 insect checks) and evaluated at 7 locations against 7 insect pests. RP 6726-JB 19247-1-1-1 was promising in only one test at Coimbatore against BPH with a ≤DS 3.0. CR 4379-6-2-1-1-1 and CR 4121-16-3-1-2 recorded <5% WE damage at Pattambi.

Optimum pest control trial *was conducted at IIRR and Pattambi. Stem borer damage at both the locations, leaf folder and whorl maggot damage only at Pattambi was recorded. W1263 had lower dead heart damage at both the locations. At Pattambi, insecticide sprays had significantly reduced the insect damage (%DH, %WMDL and %LFDL) at vegetative phase and mirid bug population in the protected treatments as compared to unprotected treatments.*

Rabi 2022-23

2.1 Host Plant Resistance Trials

i) 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 rabi 2022-23 with 55 entries which included 37 nominations from IIRR (one BPT mutant and its derivatives, ILs derived from *O. nivara; O. rufipogon* and *O. glaberrima*); 10 nominations from IIRR-PTB; one each from Cuttack, Jagtial, and Rudrur; along with the checks, PB1, TN1, W 1263, Sasyasree and TKM6. Of these, 15 entries were under retesting. The entries were evaluated at 6 locations *viz.*, IIRR, CBT, Gerua, CHN, PTB, and MTU. For effective screening, two staggered sowings were taken up at Chinsurah and IIRR Rajendranagar. At IIRR and CBT, infestation was augmented through pinning of 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. 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 60.0% with an average damage of 18.6% DH across 5 locations in 5 valid tests. Evaluation of entries for dead heart damage helped in identification of five entries. RP 6505-82 was promising in 3 valid tests of the 5 valid tests with <20% dead hearts. CR Dhan 308*, NSR 114 (RP BIO 4919)*, RP-6112-SM-92-R-293-1-1-3-3 and RP-6112-SM-92-R-293-2-2-4-4(a) were promising in 2 tests each.

Table 2.1.1 Reaction of most promising cultures to stem borer in SBST, *rabi* 2022-23

S. No.	Entries	CHN1	GER	IIRR	PTB	CBT	SBDH NPT	IIRR	MTU	PTB	SBWE NPT	Overall
		57DAT	25DAT	18DAT	30DAT	73DAT		91DAT	90DAT	85DAT		SB NPT
		%DH	%DH	%DH	%DH	%DH	5	%WE		%WE	3	8
8	RP 6505-82	4.8	6.3	21.9	16.0	11.8	**3**	18.2	2.3	35.1	**0**	**3**
16	NSR 114 (RP BIO 4919)*	16.9	4.1	14.2	42.8	4.5	**2**	21.5	0.0	29.2	**1**	**3**
11	BK 49-76*	0.0	20.4	12.3	57.6	21.0	**1**	23.3	0.0	32.6	**1**	**2**
26	RP-6112-SM-92-R-293-1-1-3-3	10.4	6.5	21.3	14.6	13.2	**2**	14.9	27.7	49.7	**0**	**2**
28	RP-6112-SM-92-R-293-2-2-4-4(a)	11.1	9.4	14.1	38.8	3.0	**2**	18.4	17.0	40.7	**0**	**2**
1	CR Dhan 308*	8.9	8.8	18.9	16.8	17.5	**2**	24.7	32.6	30.7	**0**	**2**
Total Count		54	52	55	55	55		48	55	45		
Max. damage in the trial		33.9	22.6	43.5	60.0	31.5		49.6	40.3	61.2		
Min. damage in the trial		0.0	4.1	8.5	14.6	0.0		5.0	0.0	20.8		
Ave. damage in the trial		12.7	12.3	21.3	35.5	12.6		18.1	13.2	39.3		
Damage in TN1		11.7	0.0	22.5	39.8	14.2		34.3	11.0	35.3		
Promising level		5	10	10	20	5		5	5	5		
No. of Promising entries		5	16	1	5	8		0	11	0		

- Entries under retesting; SBDH & SBWE from RNR, SBWE from CBT was not included due to low pest pressure.

White ear damage: The white ear damage across 3 locations in 3 valid tests varied from 0.0 to 61.2% WE with a mean of 23.5% WE in the trial. Evaluation of entries identified, NSR 114 (RP BIO 4919)* and BK 49-76* as promising at one location as they recorded nil damage. This could be an escape as in the other two locations they had high damage. Mean no. of larvae in the stubbles varied from 0-2.3 larvae/ hill.

Overall reaction: Evaluation of 55 entries in 6 locations in 8 valid tests against stem borer damage at two phase of crop growth identified, 5 entries as promising in 2-3 tests of the 8 valid tests. RP 6505-82 was promising in 3 tests for dead heart damage. CR Dhan 308*, RP-6112-SM-92-R-293-1-1-3-3 and RP-6112-SM-92-R-293-2-2-4-4(a) were promising in 2 tests each. NSR 114 (RP BIO 4919)* and BK 49-76* were promising at both dead heart and white ear damages in 3 and 2 tests, respectively **(Table 2.1.1)**.

ii) Multiple resistance screening trial (MRST)

In this trial, 40 entries were evaluated against two insect pests *viz.*, whorl maggot at Rajendranagar and grasshoppers at Khudwani. The average damage was 9.1% WMDL and 16.1 % grasshopper damaged leaves. None of them were promising with <5 % DL. Data on stem borer damage from IRR, Rajendranagar was not considered as the severity was low despite taking up two staggered sowings.

iii) National screening nurseries - BORO 2022-23

The trial was constituted with 52 entries (42 entries from AVT and IVT Boro trials along with 10 insect checks) and evaluated at 7 locations against 7 insect pests. Data from Chinsurah and Gerua for SBDH, SBWE & LF; from Titabar for GB damage were not included due to want of sufficient pest pressure. The results of the valid tests are discussed pest wise:

Brown planthopper: RP 6726-JB 19247-1-1-1 was promising in only one test at Coimbatore of the two greenhouse tests (IIRR and CBT) at seedling stage.

Whitebacked planthopper: None of the entries were promising in one greenhouse test at Coimbatore.

Planthoppers: None of the entries was promising in the field reaction at Maruteru.

Gall midge: None of the entries was promising.

Stem borer: None of the entries was promising in two valid field reactions at Pattambi and Titabar for dead heart damage. CR 4379-6-2-1-1-1 and CR 4121-16-3-1-2 recorded <5% WE damage at Pattambi.

Whorl maggot: At Pattambi, 10 entries had a <5 % DL at 50 DAT.

2.2. Optimum Pest Control Trial (OPCT)

The trial was constituted to evaluate the performance of the identified multiple pest resistant rice cultures under protected and unprotected conditions against the pest damages in a location. The trial was conducted at 2 locations *viz.,* IIRR and Pattambi. Nine insect pest resistant cultures *viz.*, V1-CUL M9, V2-CR 3006-8-2, V3-CR Dhan 317, V4- Akshaydhan PYL, RP5587-273-1-B-B-B, KMR 3, Suraksha, W1263, RP2068 -18-3-5 along with the susceptible check TN1 were raised in 3 replications in a split plot design with main treatments being protected and unprotected conditions and varieties as sub-treatments at IIRR. At Pattambi, only 6 varieties were tested. Observations on pest incidence were recorded along with the grain yield. Insecticide treatments were taken up based on the intensity of the damage. This is the second season where trial was conducted. The general information pertaining to the trial is given in **(Table 2.2.1).** and results are discussed location wise.

IIRR: Stem borer dead hearts and white ears damage was recorded at 82 DAT. W1263, RP 2068-18-3-5, KMR3 had significantly lower dead heart damage as compared to other test entries. No significant difference in white ear damage was observed between protected and unprotected treatments as there was an unanticipated infestation late in the season and the damage varied from 11.88 to 15.74 % WE among the varieties tested. CR 3006-8-2 and Suraksha escaped the white ear damage due to early maturity but CR 3006-8-2 had significantly higher grain yield followed by CR Dhan 317 as compared to other varieties **(Table 2.2.2 & 2.2.3).**

Pattambi: Observations on dead hearts, white ears, whorl maggot damaged leaves and leaf folder damaged leaves were recorded in this trial. Insecticide was applied at 15 DAT, 45 DAT, and 65 DAT and observations were recorded before and after the treatment. Insecticidal treatment had significantly reduced whorl maggot damage at 50 DAT; leaf folder damage at 70 DAT **(Table 2.2.2)** and the dead heart damage at 20, 50 and 70 DAT **(Table 2.2.3)** and white ear damage **(Table 2.2.4)**. Among the varieties, W1263 at 20 DAT; KMR3 and RP 2068-18-3-5 at 50 DAT had significantly lower dead heart damage as compared to other varieties. Grain yields were at par in RP 2068-18-3-5, RP5587-273-1-B-B-B and W1263 and significantly higher as compared to other varieties. Observations on spiders/ 10 hills (1.54 ± 0.13 to 3.62± 0.12), dragon flies/10 hills (1.7 to 2.0 /10 hills) and mirid bugs/10 hills were recorded along with pest incidence. It was observed that mirid bugs (8.41± 0.52 Nos) were lower in protected treatments as compared to unprotected treatments (14.04± 4.32 Nos) at 40 DAT. Further sprays reduced the population.

Optimum pest control trial *was conducted at IIRR and Pattambi. Stem borer damage at both the locations, leaf folder and whorl maggot damage only at Pattambi was recorded. W1263 had lower dead heart damage at both the locations. At Pattambi insecticide sprays had significantly reduced the insect damages (%DH, %WMDL and %LFDL) at vegetative phase and mirid bug population in the protected treatments as compared to unprotected treatments.*

Table 2.2.1 General information pertaining to OPCT trial, rabi 2022-23

Location	Common name	Time of application	Observations recorded
IIRR **D/S** 30.12.2022 **D/P** 13.02.2023	Cartap hydrochloride	56 DAT	SBDH, SBWE
Pattambi **D/S** 14.11.2022 **D/P** 05.12.2022	Cartap hydrochloride 4%	15 DAT, 45 DAT and 65 DAT	SBDH, SBWE, LF, WM, spiders, damsel flies & Coccinellids

Table2.2.2 Reaction of resistant cultures to leaf damaging pests in OPCT, rabi 2022-23

	PTB	PTB	PTB	PTB	PTB	PTB	PTB	PTB
Treatment	15DAT	20DAT	45DAT	50DAT	65DAT	70DAT	65DAT	70DAT
	BT	AT	BT	AT	BT	AT	BT	AT
	%WMDL	%WMDL	%WMDL	%WMDL	%WMDL	%WMDL	%LFDL	%LFDL
Akshayadhan PYL	5.19(2.33)	7.74(2.78)	12.44(3.52)	11.60(3.44)	5.64(2.47)	7.12(2.70)	10.86(3.35)b	14.76(3.72)b
RP5587-273-1-B-B-B	4.08(2.11)	5.47(2.38)	12.92(3.65)	11.28(3.36)	5.58(2.46)	7.08(2.69)	10.65(3.32)b	13.67(3.58)b
KMR3	3.47(1.96)	7.77(2.80)	11.74(3.45)	11.77(3.46)	5.79(2.48)	7.05(2.67)	10.09(3.22)b	14.02(3.62)b
W1263	3.78(2.06)	7.22(2.71)	8.79(3.02)	9.77(3.14)	5.85(2.48)	7.84(2.79)	10.75(3.31)b	14.44(3.72)b
RP2068-18-3-5	5.06(2.33)	5.82(2.35)	12.74(3.57)	12.55(3.57)	5.86(2.49)	7.26(2.74)	11.13(3.38)b	14.69(3.72)b
TN1	6.49(2.55)	7.90(2.75)	13.36(3.65)	14.60(3.80)	8.66(2.97)	8.85(3.01)	13.92(3.76)a	17.70(4.17)a
CD(0.05)	ns	ns	ns	ns	ns	ns	0.24	0.23
CV(%)	17.95	22.01	18.71	12.82	14.87	8.39	7.04	6.05
Main treatemnts								
Protected	4.67(2.22)	4.56(2.18)	10.96(3.33)	9.13(3.05)	6.88(2.66)	4.59(2.23)	8.89(3.05)	6.80(2.67)
UnProtected	4.69(2.23)	9.41(3.07)	13.04(3.62)	14.73(3.88)	5.57(2.45)	10.47(3.30)	13.57(3.73)	22.96(4.84)
CD(0.05)	ns	ns	ns	0.66	ns	0.68	0.67	0.47
CV(%)	23.45	37.73	11.34	20.63	22.3	26.9	21.36	13.72
Interaction								
Protection and Variety	ns	ns	ns	ns	ns	ns	ns	ns
Variety and Protection	ns	ns	ns	ns	ns	ns	ns	ns
Experimental Mean	2.22	2.63	3.48	3.46	2.56	2.76	3.39	3.76

CUL M9, CR 3006-8-2,CR Dhan 317 and Suraksha were not tested; Figures in parentheses are square root transformed values.

Table 2.2.3 Reaction of resistant cultures to dead heart damage by stem borer in OPCT, rabi 2022-23

	IIRR	IIRR	PTB	PTB	PTB	PTB	PTB	PTB
Treatment	82DAT	92DAT	15DAT	20DAT	45DAT	50DAT	65DAT	70DAT
	BT	**BT**	**BT**	**AT**	**BT**	**AT**	**BT**	**AT**
	DH	DH	DH	DH	DH	DH	DH	DH
CUL M9	6.58(2.63)a	8.09(2.77)b	NT	NT	NT	NT	NT	NT
CR 3006-8-2	2.34(1.66)b	9.36(2.95)b	NT	NT	NT	NT	NT	NT
CR Dhan 317	4.64(2.22)ab	8.51(2.91)b	NT	NT	NT	NT	NT	NT
Akshayadhan PYL	4.78(2.28)a	8.17(2.85)b	20.38(26.75)b	18.17(23.76)b	28.30(31.58)	14.30(19.83)b	12.32(3.52)	13.31(3.60)b
RP5587-273-1-B-B-B	4.15(2.06)ab	10.17(3.25)ab	18.72(25.38)bc	11.76(19.56)bc	19.70(25.93)	13.98(21.24)b	11.81(3.48)	11.88(3.43)b
KMR3	4.80(2.28)a	9.43(3.09)b	20.96(27.10)b	12.78(20.39)bc	23.04(28.41)	9.45(15.12)c	11.93(3.42)	13.54(3.62)b
Suraksha	3.81(2.06)ab	6.27(2.57)b	NT	NT	NT	NT	NT	NT
W1263	1.85(1.40)c	9.66(3.14)b	14.69(22.49)c	8.29(16.20)c	24.89(29.18)	13.09(20.53)b	10.58(3.22)	13.97(3.68)b
RP2068-18-3-5	5.86(2.50)a	8.53(2.97)b	16.10(23.34)bc	13.29(20.58)bc	26.32(30.30)	11.68(19.33)bc	11.39(3.42)	12.46(3.50)b
TN1	4.82(2.23)ab	15.16(3.93)a	27.46(31.34)a	35.21(35.46)a	24.91(29.37)	22.54(27.72)a	15.01(3.87)	17.68(4.22)a
CD(0.05)	0.6	0.7	3.86	5.7	ns	4.7	ns	0.31
CV(%)	24.1	19.86	14.49	24.65	26.43	22.32	14.9	8.31
Main treatments								
Protected	4.24(2.13)	8.62(2.89)	18.80(25.40)	9.29(17.39)	20.65(26.62)	6.89(13.99)	9.82(3.13)	7.90(2.87)
UnProtected	4.49(2.13)	10.05(3.19)	20.63(26.74)	23.87(27.93)	28.40(31.64)	21.46(27.27)	14.52(3.85)	19.71(4.48)
CD(0.05)	ns	ns	ns	9.76	ns	4.67	0.7	0.35
CV(%)	26.94	16.71	14.57	46.91	35.42	24.66	21.95	10.34
Interaction								
Protection and Variety	ns	ns	ns	8.07	ns	ns	ns	ns
Variety and Protection	ns	ns	ns	10.61	ns	ns	ns	ns
Experimental Mean	2.13	3.04	26.07	22.66	29.13	20.63	3.49	3.67

Figures in parentheses are square root transformed values. Means followed by same letter are not significantly different from eacj other at P≤ 0.05

Table2.2.4 Reaction of resistant cultures to white ear damage by stem borer and grain yield in OPCT, rabi 2022-23

Treatment	IIRR	PTB		IIRR	PTB
	113DT	%WE		Grain Yield	Grain yield
	WE(%)	WE (%)		g/hill	g/hill
CUL M9	NT	NT		NT	NT
CR 3006-8-2	Escape	NT		6505.62a	NT
CR Dhan 317	12.87(3.60)	NT		5722.85b	NT
Akshayadhan PYL	14.65(3.66)	14.62(20.86)		5426.97abc	2245.83b
RP5587-273-1-B-B-B	11.88(3.40)	12.70(19.66)		5528.09abc	2845.83a
KMR3	16.34(3.98)	15.17(21.89)		4441.95bc	2804.17a
Suraksha	Escape	NT		4588.01bc	NT
W1263	13.26(3.56)	14.49(21.07)		4498.13bc	2762.5a
RP2068-18-3-5	13.02(3.59)	14.52(20.69)		3037.45d	2966.67a
TN1	15.74(3.89)	18.78(24.81)		4872.66bc	2137.5c
CD(0.05)	ns	ns		1222.7	492.3
CV(%)	32.26	20.76		21.1	18.4
Main treatments					
Protected	13.39(3.57)	6.12(13.94)		5152.7	3430.56 a
UnProtected	14.53(3.77)	23.97(29.05)		4763.2	1823.61b
CD(0.05)	ns	2.6		ns	131.4
CV(%)	29.3	13.15		34.4	5.4

Figures in parentheses are arc sine transformed values. Means followed by same letter are not significantly different from each other at P≤ 0.05

Appendix-I

Scientists involved

IIRR headquarters, Hyderabad: Drs. V. Jhansi Lakshmi, 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. Sambasiva Rao, .Sr. Scientist (Entomology)
2	VII		Maruteru	MTU	Dr. A.D.V.S.L.P. Anand Kumar, Scientist (Entomology)
3	VII		Nellore*	NLR	Dr. I. Paramasiva Reddy, Scientist (Entomology)
4	VII		Ragolu*	RGL	Dr. Udaya Babu, Scientist, Entomology
5	IV	Assam	Titabar	TTB	Dr. Mayuri Baruah, Junior Scientist
6	III	Bihar	Pusa	PSA	Dr. Abbas Ahmed, Scientist (Entomology)
7	V	Chattisgarh	Ambikapur *	ABP	Dr.Kanhaiyalal Painkra, Scientist (Entomology)
8	V		Jagdalpur	JDP	Dr. N. C. Mandawi, Scientist
9	V		Raipur	RPR	Dr. Sanjay Sharma, Pr. Scientist (Entomology)
10	II	New Delhi	New Delhi*	NDL	Dr. S. Rajna, Scientist (Entomology)
11	III	Jharkhand	Ranchi	RCI	Dr. Binay Kumar, Jr. Scientist
12	VI	Gujarat	Nawagam	NWG	Dr. SanjuThorat, Asst. Res. Scientist
13	VI		Navsari	NVS	Dr. Parth B. Patel, Asst. Res. Scientist (Entomology)
14	II	Haryana	Kaul	KUL	Dr. Sumit Saini, Asst. Scientist (Entomology)
15	I	H.P	Malan	MLN	Dr. Chavi, SMS, Entomology
16	II	J & K (UT)	Chatha	CHT	Dr. Rajan Salalia, Jr. Scientist (Entomology)
17	I		Khudwani	KHD	Dr. Basheer Ahmed , Professor, (Entomology)
18	VII	Karnataka	Brahmavar	BRM	Dr. Revanna Revannavar, Entomologist
19	VII		Gangavathi	GNV	Dr. Sujay Hurali, Scientist (Entomology)
20	VII		Mandya	MND	Dr. Kitturmath, Entomologist
21	VII	Kerala	Moncompu	MNC	Dr. Jyoti Sara Jacob, Asst. Prof. (Entomology)
22	VII		Pattambi	PTB	Dr. K. Karthikeyan, Prof. of Entomology
23	V	M.P	Rewa	REW	**No Entomologist-No trials allotted**
24	VI	Maharashtra	Karjat	KJT	Dr. Vaishali Sawant, Entomologist
25	V		Sakoli	SKL	No Entomologist, Trials were conducted
26	IV	Manipur	Wangbal	WBL	**No Entomologist-No trials allotted**
27	III	Odisha	Cuttack*	CTC	Dr. S.D.Mohapatra, Pr. Scientist & Head (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. Sheela Venugopal, Asst. Professor (Entomology.)
32	IV	Tripura	Arundhutinagar*	AND	Smt. Mithu Rani Debnath, Asst. Director
33	VII	Telangana	Jagtial*	JGT	Dr. S. Omprakash, 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 (UT)	Karaikal*	KRK	Dr. K. Kumar, Prof. & Head (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

Trials allotted and conducted at different locations

Appendix II

State	Location	*Rabi* 2022-23		*Kharif* 2023	
		Allotted	Received	Allotted	Received
Andhra Pradesh	Bapatla *	2	2	3	3
	Maruteru	4	4	13	13
	Nellore *			8	7
	Ragolu *			5	4
Assam	Titabar	2	2	12	12
Bihar	Pusa			8	8
Chattisgarh	Ambikapur *			7	7
	Jagdalpur			12	12
	Raipur			12	12
Gujarat	Navsari			10	10
	Nawagam			9	9
Haryana	Kaul			6	5
Himachal Pradesh	Malan			8	7
Jammu & Kashmir	Chatha			6	6
	Khudwani	1	1	5	5
Jharkhand	Ranchi			6	6
Karnataka	Brahmavar	1	1	7	7
	Gangavathi			14	14
	Mandya			11	11
Kerala	Moncompu	1	1	11	11
	Pattambi	4	4	12	12
Madhya Pradesh	Rewa			0	0
Maharashtra	Karjat			7	7
	Sakoli			5	5
Manipur	Wangbal			0	0
New Delhi	New Delhi *			4	4
Odisha	Cuttack *	1	1	5	3
	Chiplima			9	9
Puducherry	Karaikal *			4	4
	Kurumbapet			0	0
Punjab	Ludhiana			17	17
Tamil Nadu	Aduthurai	2	2	13	13
	Coimbatore			12	12
Telangana State	Jagtial *			7	7
	Rajendranagar			12	12
	Warangal			11	11
Tripura	Arundhutinagar *	1	1	4	4
Uttar Pradesh	Ghaghraghat			7	7
	Masodha			6	6
Uttaranchal	Pantnagar			14	14
West Bengal	Chinsurah	4	4	10	10
Total trials in funded and voluntary centres		**23**	**23**	**332**	**326**
% Receipt of data for *kharif 2023* & *rabi 2022-23*		**100.00**		**98.2**	
Overall % Receipt of data		**99.10**			

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PLANT PATHOLOGY

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3.PATHOLOGY

SUMMARY

The All India Coordinated Rice Pathology 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 2023, a total of 16 trials were conducted at 48 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, 2023'.

I. HOST PLANT RESISTANCE (NSN-1, NSN-2, NSN-H, NHSN and DSN)

❖ LEAF BLAST

The entries for leaf blast resistance were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN and DSN at 25, 16, 11, 23 and 22 locations respectively. Screening was conducted under natural and artificial condition in different centers. The disease pressure was very high (LSI>7) at Lonavala; it was high at Cuttack, Jagdalpur and Mandya in different nurseries. The disease pressure was moderate in most of the locations; and in few centres such as Wangbal, Maruteru and Ponnampet, 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 and high promising index, some of the promising entries included were IET#30593, 30561, 30573, 31054, 29694, 30577, 32064, 29142, 29940, 30020, 31050, 30888, 29696, 29689, 30651, 30233, 28965, 30942, 30740, 29975, 30917, 30235, 30578, 31051 and 30579 under NSN-1; IET# 31989, 31068, 31532, 31508, 31597, 31525, 31638, 31552, 31857, 31971, 31533, 31075, 31621, 31715, and 31528 under NSN-2; IET# 31420, 31422, 31409, 31389, 31403, 31405, 31429, and 31388 under NSN-Hills. None of the entries found resistant against leaf blast in NHSN and DSN, however, IET# 31435, 31433, 31480, 31469, 31447, 31473, 31442, 31459, 31437, 31438, 31455 and 31474 under NHSN and RP 6469-89, CB 18577, RBN 2, RNR 31581, RBN-1, RBN-6, CB 18586, NLR 3217, RBN-7, KNM 13525, KNM 13449, KNM 15361 and JGL 3889 under DSN were considered promising.

❖ NECK BLAST

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN and DSN at 10, 5, 6, 8 and 7 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 varied from moderate to high, which was good enough for selection of the best entries. A total of 11 entries *viz*., IET # 29560, 30252, 29808, 29820, 32065, 31120, 30918, 28965, 30021, 30772, and 30907 under NSN-1 and 10 entries *viz*., IET# 31924, 31681, 31683, 31710, 31835, 31820, 31616, 31821, 31836 and 31974 under NSN-2 were found resistant. In NSN- hills nursery entries *viz*., 31420, 31423, 31412, 31416 and 31428 were found resistant with SI ≤ 3.0. None of the entries found resistant under NHSN, however some of the promising entries with low disease score and high promising index included IET# 31490, 31489, 31475, 31469,31492, 31452, 31466, 31473, 31464 and 31496. Donors such as VP-R262-SHB, VP-D6-SHB, VP-D8-SHB, VP-D9-SHB, CB 20166, VP-R45-SHB, NLRBL-8, VP-R243-SHB, WGL 14, VP-R107-SHB, VP-R109-SHB, 4857 and VP-D5-SHB were reported resistant under DSN.

❖ BROWN SPOT

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN and DSN at 19, 12, 5, 13 and 13 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 screening was carried out artificially by spraying spore suspension. In majority of the centres the brown spot pressure was moderate to high; it was very high at Gangavathi (LSI >7) across all the nurseries. None of the entries found resistant to brown spot across the locations; however, some of the some of the promising entries with low disease score and high promising index included IET# 29692, 31129, 29549, 30024, 29833, 30233, 29694, 30830, 30752, 30657, 29142, 29405, 32074, 32073, 30178, 32037 and 32040 under NSN-1; IET # 31875, 31803, 31075, 31831, 31680, 31822, 31116, 31920, 31911, 31876, 31811, 31838, 31873, 31877, 31879 and 31936 under NSN-2; IET # 31407, 30513, 31387, 29654, 31388, 31389, 31383, 31384, 31399, 31411, 30503, 31385, 31398 and 31405 under NSN-H; IET # 31474, 31464, 31473, 31480, 31442, 31466, 31495, 31498, 31487, 31489, 31449, 31444, 31490, 31460, 31461, 31465 and 31448 under NHSN. Promising donors for brown spot under DSN included NLR 3595, NLRBL-2, KNM15236, 687-3, NLRBL-7, NLRBL-5, KNM12346, 680-2, RP-Bio-Patho-4, NLRBL-3, RTCNP-138, RP-Bio-Patho-3, NLRBL-9, KNM15361, C101A51, NLRBL-6 and 683-1.

❖ SHEATH BLIGHT

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN, and DSN at 22, 20, 3, 22 and 21 locations, respectively. In most 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*-2023. The promising entries to sheath blight were IET # 30078, 29549, 30827, 30844, 30762 and 30083 in NSN-1; IET # 31682, 31662, 31696, 31687, 31906, 31681, 31836, 31059, and 31553 in NSN-2; IET # 31415, 31383 and 31420 in NSN-H; IET # 31489, 31456, 31436, 31467, 30556, and 31496 in NHSN; and entries *viz*., VP-R36-SHB, VP-R158-SHB, 19345, VP-R109-SHB, VP-R262-SHB, NLRBL-7, NLR 3186, VP-R104-SHB, VP-R298-SHB, VP-R297-SHB, CB 20164, CR1014, NLRBL-5, NLRBL-8, CK 145-3, CK 35-3, NLRBL-4, CB 20117, and RTCNP-97 in DSN.

❖ SHEATH ROT

The entries under NSN-1(432), NSN-2(643), NSN-Hills (85), NHSN (120) and DSN (212) 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.

❖ GLUME DISCOLOURATION

Glume discolouration (GD) was observed at four locations viz., at Lonavala, Navasari Nawagam and Chatha during Kharif 2023. Some of the promising entries were: IET # 30641, 30966, 30902, 30868, 31130, 30658, 30555 in NSN-1; 31582, 31589, 31642, 31719, 31725, 31729, in NSN-2; 31478, 31436, 31458, 31466, 31468, 31490, 31437 in NHSN and IET 19345, VP-R47-SHB, VP-R262-SHB AP MS-14B, 733, 19451, RBN-3, RBN-6, VP-R27-SHB VP-R278-SHB, VP-R294-SHB in DSN.

❖ RICE TUNGRO DISEASE

The entries in NSN-1, NSN-2, NHSN and DSN were evaluated at two locations for rice tungro virus disease. The promising entries identified in different nurseries were: IET # 32067, 32067, 32067, 31119, 30657, 32036, in NSN-1; IET # 31570, 31582, 31598, 31504, 31514, 31523, 31527, 31528, 31536, 31618 in NSN 2; IET # 29659, 28906, 30513 and Vivekdhan 62 in NSNH; IET # 31441, 31432, 31435, 31440, 31476, 31485 and 31497 in NHSN and VP-R289-SHB, CB 17502, WGL 1869 and 4706 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, 17, 4, 20 and 20 locations, respectively. In all the locations screening was carried out under artificial inoculation conditions. The number of entries including checks in different nurseries was 432 in NSN-1, 643 in NSN-2, 85 in NSN-Hills, 120 in NHSN and 212 in DSN. Some of the promising entries against bacterial blight in different nursery were IET # 30827, 32052, 30835, 30830, 30605, 32066, 32055, 32053, 32052, 30772, 32048, 29891, 30877, 31002, 30240, 30078, 30819, 31120, 32055 and 30827 under NSN-1; IET # 31645, 31710, 31566, 31627, 31723, 31637, 31665, 31621, 31646, 31568, 32030, 31781, 30649, 31632, 31789, 31658, 31586, 31605, 32002, 31705, 31908, 32001 and 31578 under NSN-2; IET # 31431, 28906, 31393, 31401, 31381, 31391 and 31404 in NSN-H; IET # 31450, 31480, 31471, 31460, 31451, 31495, 31449, 31459, 31436 and 31489 under NHSN; VP-R297-SHB, RP-Bio-Patho-4, RP-Bio-Patho-3, VP-R294-SHB, VP-R261-SHB, VP-R44-SHB, VP-R262-SHB, RP-Bio-Patho-9, VP-R249-SHB, NLRBL-7, VP-R25-SHB, VP-R45-SHB, VP-D6-SHB, VP-R36-SHB, RTCNP-97, VP-R289-SHB, VP-R78-SHB, 19345, NLRBL-2, NLRBL-8, RP-Bio-Patho-5, NLRBL-3, NLRBL-4 and CK 145-3 in Donor Screening Nursery.

❖ MULTIPLE DISEASE RESISTANT LINES

Among the entries tested across the locations, total of 121 entries found moderately resistant or resistant to minimum of two and maximum of four diseases. A total of 25, 18, 19, 27 and 32 entries were identified with multiple disease resistance (for 2 or more diseases) in NSN-1, NSN2, NSN-H, NHSN and DSN screening nurseries respectively. The entries IET# 30830 (MR to NB, SHB, BS, BB and SHR), 29820 (R to NB, MR to SHR, RTD and GD), 29549 (MR to SHB, BS and SHR), 29891 (MR to NB, SHB and BB), 30078 (MR to SHB, BB and SHR), 30233 (MR to LB, BS and SHR) and 30877 (MR to SHB, BB and SHR) showed moderate reaction for three diseases in NSN-1. IET# 31710 showed resistance reaction to NB, MR to BS, SHR and 31719 showed resistance to NB, SHR &GD in NSN-2. IET# 31420 (Resistant to LB, NB&SHR & MR to SHB) showed resistant or moderate resistant reaction to four diseases and 31383 (MR to SHB, BS&SHR), 31391 (MR to NB, SHB&SHR), 31402 (R to SHR&MR to NB, SHB), 31405 (MR to LB, BS&SHR) and

31422(R to SHR& MR to LB, NB) were showed resistant or moderate resistant reaction to three diseases in NSN-H. The entries IET# 31436 (MR to SHB, BB SHR &GD), 31460 (MR to BS, BB, SHR&GD), 31466 (MR to NB, BS, SHR & GD), 31473 (MR to LB, NB, BS&GD), 31489 (MR to NB, SHB, BS & BB), 31469 (MR to LB, NB& SHR), 31490 (MR to NB, BS&GD) 31495 (MR to BS, BB & SHR) and 31496 (MR to NB, SHB&RTD) showed resistance to more than two diseases in NHSN. In DSN, eleven donors exhibited resistant or moderate reaction to three and more diseases and that includes 19435 (MR to SHB, BB&GD), CK 145-3 (SHB, BB &SHR), CR 1014 (MR to NB, SHB&SHR), NLRBL-5 (MR to NB, SHB, BS & SHR), NLRBL-7 (MR to SHB, BS, BB&SHR), NLRBL-8 (MR to NB, SHB, BB & SHR), RP-Bio-Patho-3 (MR to BS, BB & SHR), VP-D6-SHB (MR to NB, BB &SHR), VP-R262-SHB (NB, SHB, BB & GD), VP-R297-SHB (MR to SHB, BB & SHR) and VP-R36-SHB (MR to SHB, BB & SHR).

II. FIELD MONITORING OF VIRULENCE

1. *Pyricularia oryzae*

The experiment was conducted at 24 locations during the crop season to monitor the blast reaction on different genotypes. The trial included 39 cultivars consisting of near isogenic lines, international differentials, donors and commercial cultivars. The disease pressure was very high at Lonavala (LSI 7.3), while it was high at Cuttack (LSI 6.4). At Gudalur, Hazaribagh, Jagtial, Almora, Coimbatore, Gangavathi, Navasari, Khudwani, and Nawagam, the LSI was recorded in between 5.0 to 6.0. Out of all 39 differentials; Tetep, RP Bio Path-3, RP Bio Path-2, Raminad str-3, and zenith showed resistant to moderate resistant reaction across the locations with SI of <4.0. Tetep was highly resistant across 14 locations but it was susceptible at Cuttack (score 7.0), indicating its use as potential donor. Differential line-RP Bio Patho 3 possessing *Pi2* and RP Bio Path 2 possessing *Pi54* showed resistance reaction at 11 and 9 locations respectively; while both were susceptible at four locations. Raminad str-3 was found highly susceptible at Lonavala, Cuttack, Gangavathi and Jagtial, while Zenith, possessing a combination of three genes (*Pi-z+Pi-a+Pi-i*) found highly susceptible at Lonavala. The susceptible check HR-12 recorded resistant reaction at Karjat, Mugad and Wangbal; while CO-39 was resistant at Imphal, Karjat, and Maruteru. The reaction pattern of genotypes at all the locations was grouped into eight major groups at 30% dissimilarity coefficient. The reaction pattern of *Pyricularia oryzae* isolate from Lonavala and Cuttack were distinct from the rest of the isolates. The isolate from Coimbatore and Gudalur are grouped in same cluster. Similarly, the isolates from Navsari and Almora; Hazaribagh and Jagtial grouped together. The other 16 isolates formed a major cluster showing same kind of reaction pattern. The difference in disease reaction score of susceptible and resistant checks reveals that shift in the pathogen population.

2. *Xanthomonas oryzae* pv. *oryzae*

Trial on monitoring virulence of bacterial blight (BB) pathogen, *Xanthomonas oryzae* pv. *oryzae* (*Xoo*) was conducted at 24 locations. At Ludhiana, the trial was conducted with 5 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, Xa4, xa5, Xa7, xa8, Xa10, Xa11* and *Xa14* were susceptible at most of the locations. BB resistance gene *xa13* was susceptible in 12 locations while *Xa21* was susceptible in 9 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 Cuttack, IIRR, Raipur, Maruteru and Chiplima were categorized as highly virulent. Majority of the isolates were categorized as moderately virulent. The isolate from Moncompu was least virulent. The isolates from Maruteru and Raipur were quite different from other isolates and from each other and formed separate clusters.

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 centers 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 late sown crops than when compared to the early and normal sown crops except at Raipur. Sheath blight and bacterial blight severity was more in early sown crop (60.52 % in Swarna & 5.78% PDI in BPT 5204) compared to normal and late sown crops in the Maruteru center. In Moncompu center, the severity of sheath blight and bacterial blight was very low, the sheath blight severity was more in early sown crop as it received more rainfall compared to the normal and 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 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 32 centres. The fungicides were evaluated against leaf blast (11 locations), neck blast (10 locations), sheath blight (15 locations), brown spot (eight locations), sheath rot (four locations), grain discoloration (two locations) and stem rot (one location).

Rice leaf blast and neck blast diseases were effectively reduced their disease severity (LB:16.6%) and incidence (LB:33.3%; NB: 13) with application of azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l). Tebuconazole 50%+ trifloxystrobin

25% w/w WG (0.4 g/l) was found next best chemical in reducing the leaf blast (DS:20.7%; DI:29.7%) and neck blast (DI:14%). Sheath blight disease severity (23.8%) and incidence (42.5%) were maximum reduced through application of azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) among other fungicides. Azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l) was also found effective in minimizing the sheath blight (DS:26.3%; DI: 42.7%). Fungicide, azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) also found effective in reducing the brown spot and sheath rot of rice. 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 two different formulations of the bioagents tested, the liquid formulation was found to be better than the solid formulation. Similarly, the combination of bioagent formulations 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 (21.54%) 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 (24.11%). Among the different treatments applied for the management of the sheath blight disease, Moncompu reported the highest percentage control over the disease (DC) viz., 93.36% followed by IIRR (90.54) 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 against three diseases of rice viz., False smut, Neck blast and Sheath rot, when the plants 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). In Rewa, 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 59% of the disease when compared to the untreated control (T8) followed by the treatment T5 (53% decrease over control) and T4 (47% decrease over control).

TRIAL 13. INTEGRATED PEST MANAGEMENT (SPECIAL - IPM TRIAL)

The trial was conducted at five different zones *viz*., Zone II (Northern zone - Ludhiana, Pantnagar, Kaul); Zone III (Eastern zone - Chiplima, Masodha); Zone V (Central zone – Jagdalpur); Zone VI (Western zone – Nawagam, Navsari) and Zone VII (Southern zone – Aduthurai, Mandya, Gangavathi, Rajendranagar). Disease severity of various diseases, recorded at weekly intervals was converted in to AUDPC values and compared. IPM practices against leaf blast were effective at Chiplima, Gangavathi, Kaul, Mandya, Masodha, and Jagdalpur compared to farmer's practices. With respect to neck blast, IPM practices were effective at Chiplima, Jagdalpur, Gangavathi, Masoda and Rajendranagar. In case of sheath blight disease, IPM practices performed well compared to farmer practices at Gangavathi, Jagdalpur, Kaul, Navasari, and Pantnagar. IPM was effective against bacterial blight at Aduthurai, Chiplima, Gangavathi, Kaul, Masodha, and Pantnagar. Sheath rot disease was reduced effectively due to adoption of IPM practices at Nawagam. Similarly, IPM practices effective against brown spot at Chiplima, Gangavathi, Navsari, Pantnagar, Rajendranagar and Jagdalpur. IPM practices reduced false smut disease incidence at Pantnagar, Jagdalpur, Aduthurai and Gangavathi.

TRIAL 14. SPECIAL TRIAL ON YIELD LOSS ASSESSMENT DUE TO MAJOR RICE DISEASES

The yield loss trial on leaf blast was conducted at Jagdalpur, Mandya, and IIRR. The overall mean value revealed that 53.63% of PDI reduced the yield up to 37.21%; 38.10% of PDI recorded 27.06% of yield reduction and 26.54% of PDI recorded the 12.20% of yield reduction. With respect to sheath blight, the trial was conducted at Gangavathi, Ludhiana, Mandya, Maruteru, Moncompu and IIRR. The mean value across the locations and the results revealed that 73.41% of PDI recorded the yield reduction of 40.13%; 53.45% of PDI recorded the yield reduction of 27.07% and 35.99% PDI recorded 16.46% of yield reduction. The trial on bacterial blight was taken up at Moncompu, Maruteru, Pantnagar, Pattambi and IIRR. The overall mean values across the locations showed that 66.88% PDI caused a yield loss of 31.35%; 47.03% of PDI caused a yield loss of 20.63% and 37.23% of PDI recorded a yield loss of 12.20%

TRIAL 15: SPECIAL SCREENING TRIAL ON FALSE SMUT

One hundred and twelve National Screening Nursery 1 (NSN-1) Advanced Varietal Trial entries were selected for false smut screening trial. The trial was proposed at five locations *viz*., Gangavathi, Gudalur, IIRR Ludhiana, Masodha and it was conducted at four locations except Ludhiana. The entries were screened naturally at all the locations and artificially at IIRR. All the location data were compared based on number smut balls per panicle/Hill. Among the 112 lines screened both artificially and naturally, fourteen entries viz., 30178, CSR 36, 30078, 29536, 30032, 30029, 30020, 29405, 29549, 30240, 30270, 29284, 29290 and ADT 39 found as tolerant with the smut balls of either 0 to 6 smut balls/Hill or 0 to 3 smut balls/Panicle. These results are preliminary and these results must be confirmed in *Kharif* 2024 across the false smut hot spot locations to confirm the false smut disease tolerance.

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 2023, a total of 16 trials were conducted at 48 locations on host plant resistance, field monitoring of virulence in major pathogens and disease management. Five national screening nurseries comprising of 1,492 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) - 432 entries drawn from Advanced Variety Trials.
- ❖ National Screening Nursery 2 (NSN-2) - 643 entries from Initial Variety Trials.
- ❖ National Screening Nursery-Hills (NSN-H) - 85 entries from Advanced and Initial Varietal Trials.
- ❖ National Hybrid Screening Nursery (NHSN) - 120 entries from Initial National Hybrid Rice Trials (HRT'S).
- ❖ Donor Screening Nursery (DSN) - 212 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 (16 states) to identify the production constraints in different rice growing ecosystems.

The weather conditions and location details are given in Annexure I to Annexure III. Out of 554 experiments proposed, data were received from 518 experiments of 16 trials indicating the good response with 93.5 % data receipt from the centres.

Table 1: Scientists involved in Plant Pathology Coordinated Programme, *Kharif* 2023. 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	18	14
2	Almora	Dr. Gaurav Verma	Voluntary	7	7
3	Arundhutinagar	Drs. Uttam Saha & Sentu Acharya	Funded	7	4
4	Bankura	Dr. C. K. Bhunia	Funded	24	14
5	Chatha	Dr. Vijay Bahadur Singh	Funded	11	14
6	Chinsurah	Dr. Dilip Kumar Patra	Funded	12	12
7	Chiplima	Dr. Rini Pal	Funded	7	7
8	Coimbatore	Dr. C. Gopalakrishnan	Funded	8	8
9	Cuttack	Drs. Arup K. Mukherjee, Srikanta Lenka & Manas Kumar Bag	Voluntary	8	8
10	Gangavathi	Dr. Pramesh Devanna	Funded	22	22
11	Ghaghraghat	Dr. Amrit Lal Upadhaya	Funded	10	9
12	Gudalur	Dr. C. Gopalakrishnan	Voluntary	6	6
13	Hazaribag	Dr. Someshwar Bhagat	Voluntary	11	9
14	ICAR-IIRR	Drs. M. S. Prasad, G. S. Laha, D. Krishnaveni, C. Kannan, D. Ladhalakshmi, V. Prakasam, K. Basavaraj and G.S. Jasudasu	HQ	31	31
15	Imphal	Dr. A. Ratankumar Singh	Voluntary	8	7
16	Jagdalpur	Dr. R. S. Netam	Funded	9	9
17	Jagtial	Dr. N. Balram	Voluntary	4	4
18	Karaikal	Dr. C. Jeyalakshmi	Voluntary	4	4
19	Karjat	Dr. Pushpa D. Patil	Funded	16	16
20	Kaul	Dr. Mahaveer Singh	Funded	7	6
21	Khudwani	Dr. F. A. Mohiddin	Funded	12	9
22	Lonavala	Dr. K. S. Raghuwanshi	Voluntary	26	26
23	Ludhiana	Dr. Jagjeet Singh Lore	Funded	15	15
24	Malan	Dr. Suman Kumar	Funded	11	5
25	Mandya	Dr. V. B. Sanath Kumar	Funded	9	9
26	Maruteru	Dr. V. Bhuvaneswari	Funded	21	21
27	Masodha (Faizabad)	Dr. Vindeshwari Prasad	Funded	11	11
28	Moncompu	Dr. M. Surendran	Funded	13	13
29	Mugad	Dr. Gurupada Balol	Voluntary	12	8
30	Navsari	Dr. Vijay A. Patil	Funded	18	22
31	Nawagam	Dr. Rakesh Kumar Gangwar	Funded	20	26
32	Nellore	Dr. P. Madhusudhan	Voluntary	8	8
33	New Delhi	Drs. B. Bishnu Maya & G. Prakash	Voluntary	9	3
34	Pantnagar	Dr. Bijendra Kumar	Funded	15	15
35	Patna	Dr. Md. Reyaz Ahmad	Funded	6	6
36	Pattambi	Dr. P. Raji	Funded	16	16
37	Ponnampet	Dr. Imran Khan H. S.	Funded	13	13
38	Pusa	Dr. R. K. Ranjan	Funded	11	11
39	Raipur	Dr. Pradeep Kumar Tiwari	Funded	4	3
40	Rajendranagar	Dr. T. Kiran Babu	Funded	14	14
41	Ranchi	Dr. Manoj Kumar Barnwal	Voluntary	6	6
42	Rewa	Dr. S. K. Tripathi	Funded	11	10
43	Sabour	Dr. Amarendra Kumar	Voluntary	7	8
44	Titabar	Dr. Popy Bora	Funded	12	7
45	Umiam (Barapani)	Dr. Pankaj Baiswar	Voluntary	2	1
46	Upper Shillong	Dr. Victor Tariang	Funded	5	5
47	Varanasi	Dr. R. K. Singh	Funded	11	10
48	Wangbal	Dr. Kh. Ngamreishang	Funded	6	6
Total Experiments (93.5%)				**554**	**518**

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 432 entries that included national regional and pathology checks. The nursery was evaluated at 25 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 7.6) and lowest at Bankura and Maruteru (LSI 2.7). The disease pressure was very high (LSI ≥7.0) at Lonavala (LSI 7.6); while high disease pressure (LSI 6-7) was recorded at Cuttack (6.6), Jagdalpur (6.3) and Mandya (6.2). Most of the locations recorded moderate disease pressure (LSI 3-6) and that included Hazaribagh (5.9), Gagharghat (5.6), Gangavathi (5.6), Jagtial (5.6), Nawagam (5.6), Pattambi (5.0), Ranchi (5.0), Coimbatore (4.7), Navasari (4.6), Nellore (4.4), IIRR (4.4), Khudwani (4.3), Gudalur (4.1), Wangbal (3.2), Ponnampet (3.1), Mugad (3.1), Karjat (3.0) and Patna (3.0). The disease pressure was low (LSI ≤3.0) at Bankura and Maruteru and hence data from these centres was not considered for the selection of promising entries.

None of the entries found resistant (SI≤3.0) or performed better than resistant check Tetep (SI-2.9), however the entries that scored SI≤4.0 were considered as promising and presented in Table 1.1B. The entries included IET Nos. 30593, 30561, 30573, 31054, 29694, 30577, 32064, 29142, 29940, 30020, 31050, 30888, 29696, 29689, 30651, 30233, 28965, 30942, 30740, 29975, 30917, 30235, 30578, 31051 and 30579 (Table 1.1B).

- **National Screening Nursery-2 (NSN-2)**

The nursery consists of 643 lines drawn from initial variety trials (IVTs). These were evaluated at 16 centres under various ecological zones. The disease pressure was highest at Cuttack (LSI 6.9) and the lowest at Wangbal (LSI 2.2). 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 (6.9), Jagdalpur (6.3), Mandya (6.3) and Hazaribagh (6.0). Location severity index was moderate (LSI 3.0-6.0) at most of the locations and that included Gagharghat (5.9), Nawagam (5.6), Coimbatore (5.4), Gangavathi (5.4), Pattambi (5.4), Ranchi (5.3), IIRR (4.7), Rewa (4.4), Patna (3.1) and Ponnampet (3.0). The Performance of entries at locations *viz*., Wangbal (LSI 2.2) and Maruteru (LSI 2.4) were not considered for the selection of best entries, where disease pressure was low (<3.0) (Table 1.2A).

None of the entries found resistant (<3.0) or performed better than resistant check Tetep (SI 2.9), but a few promising entries with low susceptibility index was presented in Table 1.2B and that included IET # 31989, 31068, 31532, 31508, 31597, 31525, 31638, 31552, 31857, 31971, 31533, 31075, 31621, 31715, and 31528.

Table 1.1A: Location severity index (LSI) and frequency distribution of Leaf blast scores for NSN-1, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)																								
	BNK	**CBT**	**CTK**	**GDL**	**GGT**	**GNV**	**HZB**	**IIRR**	**JDP**	**JGL**	**KHD**	**KJT**	**LNV**	**MGD**	**MND**	**MTU**	**NLR**	**NVS**	**NWG**	**PNP**	**PTB**	**PTN**	**RCI**	**REW**	**WBL**
0	19	0	0	0	0	0	0	0	0	0	9	0	0	0	0	10	0	0	0	1	3	40	0	0	12
1	169	3	0	4	0	5	0	2	4	1	3	39	0	16	1	117	0	0	0	65	0	58	6	0	7
2	1	29	0	22	0	22	9	31	8	0	66	172	0	0	2	88	3	3	0	123	19	47	10	12	65
3	156	54	7	98	0	84	59	115	24	44	67	90	2	370	57	80	14	80	17	56	77	81	21	56	185
4	0	88	0	154	0	55	48	103	36	0	73	60	6	0	108	80	269	78	61	78	132	101	110	145	147
5	51	118	129	104	300	47	43	58	50	220	117	38	18	38	30	32	107	190	155	73	49	85	137	159	15
6	0	94	0	37	2	48	71	45	91	0	37	6	51	0	29	9	30	63	81	20	57	8	92	57	1
7	29	31	202	5	123	44	118	64	111	110	41	17	104	0	5	10	1	13	76	7	32	2	33	3	0
8	0	8	0	1	0	25	59	0	70	0	7	1	122	0	55	0	0	2	37	0	30	0	23	0	0
9	7	0	60	0	7	92	25	0	34	29	6	2	122	0	137	0	0	0	3	0	33	0	0	0	0
Total	**432**	**425**	**398**	**425**	**432**	**422**	**432**	**418**	**428**	**404**	**426**	**425**	**425**	**424**	**424**	**426**	**424**	**429**	**430**	**423**	**432**	**422**	**432**	**432**	**432**
LSI	**2.7**	**4.7**	**6.6**	**4.1**	**5.6**	**5.6**	**5.9**	**4.4**	**6.3**	**5.6**	**4.3**	**3.0**	**7.6**	**3.1**	**6.2**	**2.7**	**4.4**	**4.6**	**5.6**	**3.1**	**5.0**	**3.0**	**5.0**	**4.5**	**3.2**
SM	**N**	**A**	**A**	**N**	**N**	**A**	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**A**	**A**	**N**	**A**	**N**	**N**	**N**	**N**	**A**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.1B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NSN-1 to Leaf blast disease, *Kharif*-2023

P. No.	IET No.	Location/Frequency of scores (0-9)																							SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CBT	CTK	GDL	GGT	GNV	HZB	IIRR	JDP	JGL	KHD	KJT	LNV	MGD	MND	NLR	NVS	NWG	PNP	PTB	PTN	RCI	REW	WBL						
382	30593	5	-	4	5	3	3	3	3	5	3	2	7	1	2	4	3	4	1	3	3	5	4	3	**3.5**	**22**	**13**	**59**	**21**	**95**
171	30561	2	9	2	5	5	3	4	4	-	2	1	7	3	3	4	5	5	0	2	1	4	4	4	**3.6**	**22**	**10**	**45**	**20**	**91**
383	30573	5	-	4	5	2	7	2	5	3	2	2	8	3	2	4	4	5	2	3	0	5	3	4	**3.6**	**22**	**11**	**50**	**20**	**91**
406	31054	5	-	4	5	3	4	4	7	5	4	2	6	1	3	4	3	4	2	3	0	4	5	2	**3.6**	**22**	**9**	**41**	**20**	**91**
16	29694	2	7	3	7	3	2	4	1	5	2	1	7	5	3	4	5	5	3	2	2	5	4	3	**3.7**	**23**	**12**	**52**	**20**	**87**
377	30577	3	5	3	5	3	6	3	3	5	2	3	7	3	4	4	3	7	2	4	0	3	4	4	**3.7**	**23**	**12**	**52**	**20**	**87**
349	32064	-	7	-	5	-	6	-	-	-	-	-	-	-	-	-	3	-	-	0	2	5	4	2	**3.8**	**9**	**4**	**44**	**7**	**78**
29	29142	2	5	2	5	3	3	3	8	7	6	2	6	3	3	4	4	5	1	3	3	2	4	3	**3.8**	**23**	**13**	**57**	**19**	**83**
13	29940	3	9	4	5	4	3	3	3	5	4	1	7	3	3	3	3	5	3	2	5	4	5	2	**3.9**	**23**	**12**	**52**	**21**	**91**
52	30020	2	5	2	7	7	3	4	2	5	2	3	6	3	6	3	6	6	3	3	0	4	4	3	**3.9**	**23**	**12**	**52**	**17**	**74**
409	31050	5	-	4	5	2	4	3	5	-	4	2	6	3	4	5	3	3	4	3	5	6	2	4	**3.9**	**21**	**8**	**38**	**19**	**90**
317	30888	3	7	3	5	3	3	4	2	3	2	2	7	3	9	4	3	7	2	4	2	5	5	2	**3.9**	**23**	**13**	**57**	**19**	**83**
19	29696	5	5	4	5	5	3	4	4	5	2	2	6	3	4	4	3	6	2	2	5	3	5	3	**3.9**	**23**	**9**	**39**	**21**	**91**
15	29689	3	7	5	5	3	2	2	4	3	5	2	6	3	3	4	5	6	1	4	3	7	5	3	**4.0**	**23**	**11**	**48**	**19**	**83**
132	30651	3	7	4	5	6	3	4	6	5	3	1	7	3	5	5	3	4	1	4	3	4	3	2	**4.0**	**23**	**10**	**43**	**19**	**83**
56	30233	4	7	2	7	7	3	2	3	5	2	2	8	3	4	4	4	4	2	3	4	5	4	3	**4.0**	**23**	**10**	**43**	**19**	**83**
20	28965	4	7	4	5	3	6	3	6	7	1	2	5	3	5	4	3	5	1	4	3	4	4	3	**4.0**	**23**	**9**	**39**	**19**	**83**
302	30942	5	7	4	5	6	3	-	3	-	4	2	7	3	3	4	4	5	4	3	1	4	4	3	**4.0**	**21**	**8**	**38**	**18**	**86**
362	30740	5	5	4	5	3	4	3	5	5	5	3	8	3	3	4	6	5	2	3	3	5	4	0	**4.0**	**23**	**9**	**39**	**21**	**91**
24	29975	3	5	4	5	1	3	3	5	5	4	2	6	3	6	5	5	4	5	4	2	5	5	3	**4.0**	**23**	**8**	**35**	**21**	**91**
295	30917	4	9	3	5	3	4	3	5	5	5	1	6	3	4	4	4	5	1	3	1	4	5	6	**4.0**	**23**	**8**	**35**	**20**	**87**
62	30235	4	5	3	5	5	4	2	7	7	0	3	8	3	4	4	4	5	5	4	0	5	6	0	**4.0**	**23**	**7**	**30**	**19**	**83**
385	30578	6	-	4	7	2	2	3	4	7	3	2	7	3	3	5	5	5	2	3	4	5	4	3	**4.0**	**22**	**10**	**45**	**18**	**82**
401	31051	5	-	4	5	3	3	4	5	5	4	2	7	3	4	4	3	5	2	4	2	6	4	5	**4.0**	**22**	**7**	**32**	**20**	**91**
388	30579	4	-	4	5	4	5	4	6	7	2	2	6	3	3	4	6	6	4	4	0	6	4	0	**4.0**	**22**	**6**	**27**	**16**	**73**
432	**Tetep (R)**	3	5	3	5	2	3	1	3	3	0	2	3	1	3	4	3	4	2	3	-	1	6	3	**2.9**	**22**	**17**	**77**	**21**	**95**
419	**HR 12 (S)**	7	9	6	5	9	8	7	9	9	8	2	9	5	9	6	7	8	4	9	7	8	5	2	**6.9**	**23**	**2**	**9**	**6**	**26**
LSI		**4.7**	**6.6**	**4.1**	**5.6**	**5.6**	**5.9**	**4.4**	**6.3**	**5.6**	**4.3**	**3.0**	**7.6**	**3.1**	**6.2**	**4.4**	**4.6**	**5.6**	**3.1**	**5.0**	**3.0**	**5.0**	**4.5**	**3.2**						

(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)

Table 1.2A: Location severity index (LSI) and frequency distribution of Leaf blast scores of NSN-2, *Kharif* 2023

Score	Location/Frequency of scores (0-9)															
	CBT	CTK	GGT	GNV	HZB	IIRR	JDP	MND	MTU	NWG	PNP	PTB	PTN	RCI	REW	WBL
0	0	0	0	0	0	0	1	0	3	0	0	7	73	1	0	1
1	0	0	0	3	0	1	11	0	182	0	171	0	85	10	0	103
2	4	0	0	29	7	5	25	30	124	0	198	12	84	19	23	331
3	54	9	0	132	75	108	59	83	227	2	95	80	131	20	100	158
4	120	0	0	113	80	202	42	121	64	46	46	169	71	131	207	45
5	171	171	383	80	83	172	70	45	23	344	24	76	120	201	232	4
6	144	0	0	51	87	58	96	41	3	58	31	88	66	135	75	1
7	108	310	236	69	188	84	122	3	1	164	32	107	8	61	6	0
8	36	0	0	34	73	0	67	110	0	17	41	57	0	58	0	0
9	0	150	24	116	47	0	140	201	0	2	0	47	0	7	0	0
Total	**637**	**640**	**643**	**627**	**640**	**630**	**633**	**634**	**627**	**633**	**638**	**643**	**638**	**643**	**643**	**643**
LSI	**5.4**	**6.9**	**5.9**	**5.4**	**6.0**	**4.7**	**6.3**	**6.3**	**2.4**	**5.6**	**3.0**	**5.4**	**3.1**	**5.3**	**4.4**	**2.2**
Screening	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**A**	**A**	**A**	**N**	**N**	**N**	**N**	**A**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.2B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NSN-2 to leaf blast, *Kharif* 2023

P. 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	JDP	MND	NWG	PNP	PTB	PTN	RCI	REW						
467	6102	31989	5	5	5	4	4	3	3	2	7	2	3	1	4	3	**3.6**	**14**	**7**	**50**	**13**	**93**
551	5404	31068	5	5	5	3	2	6	2	3	7	2	4	2	5	2	**3.8**	**14**	**7**	**50**	**12**	**86**
96	3533	31532	5	5	5	1	3	5	3	2	5	2	6	0	6	5	**3.8**	**14**	**6**	**43**	**12**	**86**
71	3508	31508	5	7	7	3	2	4	2	3	5	3	3	2	6	2	**3.9**	**14**	**8**	**57**	**11**	**79**
44	3844	31597	5	5	5	3	3	3	3	3	5	3	4	0	8	4	**3.9**	**14**	**7**	**50**	**13**	**93**
89	3526	31525	5	3	5	7	3	5	3	3	5	4	2	2	4	3	**3.9**	**14**	**7**	**50**	**13**	**93**
151	4125	31638	5	5	7	3	3	4	2	3	5	1	3	1	6	6	**3.9**	**14**	**7**	**50**	**11**	**79**
117	3554	31552	3	3	7	9	4	4	3	4	5	1	3	1	5	3	**3.9**	**14**	**7**	**50**	**12**	**86**
424	5307	31857	3	3	5	3	3	5	5	4	7	1	3	3	6	4	**3.9**	**14**	**7**	**50**	**12**	**86**
444	5807	31971	4	5	5	6	4	4	2	3	4	2	4	1	5	6	**3.9**	**14**	**4**	**29**	**12**	**86**
97	3534	31533	8	5	5	3	4	3	3	3	5	2	4	3	4	4	**4.0**	**14**	**6**	**43**	**13**	**93**
561	5414	31075	5	9	5	5	2	5	1	2	5	1	3	3	6	4	**4.0**	**14**	**6**	**43**	**12**	**86**
133	4107	31621	6	7	5	8	4	2	4	2	6	1	3	1	3	4	**4.0**	**14**	**6**	**43**	**10**	**71**
233	4344	31715	5	5	5	5	3	4	2	3	5	3	5	1	5	5	**4.0**	**14**	**5**	**36**	**14**	**100**
92	3529	31528	6	7	7	5	4	4	2	2	5	2	3	0	5	4	**4.0**	**14**	**5**	**36**	**11**	**79**
643	**Tetep (R)**		3	5	5	3	3	1	3	2	4	2	4	1	0	5	**2.9**	**14**	**9**	**64**	**14**	**100**
630	**HR 12 (S)**		7	9	5	9	8	7	9	9	8	1	8	-	8	7	**7.3**	**13**	**1**	**8**	**2**	**15**
LSI			**5.4**	**6.9**	**5.9**	**5.4**	**6.0**	**4.7**	**6.3**	**6.3**	**5.6**	**3.0**	**5.4**	**3.1**	**5.3**	**4.4**						

(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)

- **National Screening Nursery-Hills (NSN-Hills)**

The National Screening Nursery - Hills (NSN-H) comprised of 86 entries, 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 Cuttack, Karjat and IIRR, where entries were screened under artificial method of inoculation. In 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 very high (LSI <7) at Lonavala (7.8) and it was high (LSI 6-7) at Cuttack (6.7). The disease pressure was moderate (LSI 3-6) at most of the locations such as Imphal (5.6), Almora (5.3), Khudwani (4.4), IIRR (4.2), Uppershillong (3.9), Ponnampet (3.2), Umium (3.2) and Karjat (3.1). The disease pressure very low at Wangbal (2.4), hence data from Wangbal 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 2.4); however, only one entry IET# 31420 (SI-3.0) was found resistant (SI≤3.0). The entries with SI ≤4.1 with high PI were considered promising and that included IET # 31422, 31409, 31389, 31403, 31405, 31429, and 31388 (Table 1.3B).

Table 1.3A: Location severity index (LSI) and frequency distribution of leaf blast scores of NSN-H, *Kharif* 2023

Score	Location/Frequency of scores (0-9)										
	ALM	**CTK**	**IIRR**	**IMP**	**KJT**	**KHD**	**LNV**	**PNP**	**UMM**	**USG**	**WBL**
0	0	0	0	0	0	2	0	0	0	0	5
1	0	0	1	0	11	1	0	26	4	12	8
2	0	0	7	0	27	5	0	18	16	16	30
3	10	1	27	10	21	18	1	3	31	6	34
4	11	0	21	10	9	18	0	12	25	14	9
5	36	27	15	33	7	24	1	13	9	19	0
6	6	1	0	4	2	9	5	4	0	10	0
7	15	40	12	13	3	5	24	3	0	5	0
8	2	0	0	4	1	3	32	5	0	3	0
9	3	17	2	10	2	1	21	0	0	0	0
Total	**83**	**86**	**85**	**84**	**83**	**86**	**84**	**84**	**85**	**85**	**86**
LSI	**5.3**	**6.7**	**4.2**	**5.6**	**3.1**	**4.4**	**7.8**	**3.2**	**3.2**	**3.9**	**2.4**
Screening	**N**	**A**	**A**	**N**	**A**	**N/A**	**N**	**N**	**N**	**N**	**N**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 1.3B: Promising entries with low susceptibility index (<=4.1) and high PI in NSN-H to leaf blast, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)															
			ALM	CTK	IIRR	IMP	KJT	KHD	LNV	PNP	UMM	USG	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
56	2603	31420	5	5	3	-	2	2	6	1	2	1	3.0	9	**6**	**67**	**8**	**89**
59	2606	31422	5	7	3	4	2	2	7	1	4	1	3.6	10	**5**	**50**	**8**	**80**
45	2513	31409	5	5	3	4	2	3	7	2	3	4	3.8	10	**5**	**50**	**9**	**90**
23	2312	31389	5	5	4	5	2	4	9	1	1	2	3.8	10	**4**	**40**	**9**	**90**
38	2506	31403	3	5	4	5	1	5	8	2	2	5	4.0	10	**4**	**40**	**9**	**90**
40	2508	31405	5	5	5	5	3	4	7	1	3	2	4.0	10	**4**	**40**	**9**	**90**
67	2701	31429	3	7	5	9	1	4	7	1	3	1	4.1	10	**5**	**50**	**7**	**70**
22	2311	31388	5	5	4	5	3	5	8	1	4	1	4.1	10	**3**	**30**	**9**	**90**
86	**Tetep (R)**		5	5	1	3	1	0	3	3	1	2	2.4	10	**8**	**80**	**10**	**100**
73	**HR 12 (S)**		6	9	9	5	3	8	7	8	5	7	6.7	10	**1**	**10**	**3**	**30**
LSI			**5.3**	**6.7**	**4.2**	**5.7**	**3.1**	**4.5**	**7.8**	**3.2**	**3.2**	**3.9**						

(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)

- **National Hybrid Screening Nursery (NHSN)**

One hundred and twenty hybrids that included checks were evaluated at 23 locations against leaf blast disease under NHSN. 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 Cuttack (6.6), Lonavala (6.6) and Imphal (6.3). In most of the centres, location severity index was moderate and that included Gagharghat (5.9), Jagdalpur (5.9), Nawagam (5.8), Hazaribagh (5.4), Mandya (5.4), Pattambi (5.4), Ranchi (4.9), Coimbatore (5.0), Nellore (4.5), Khudwani (4.3), Gangavathi (4.3), Rewa (4.3), IIRR (4.2), Uppershillong (3.8), Patna (3.6) and Karjat (3.3). The Performance of entries at Ponnampet, Wangbal, Maruteru and Bankura 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≤4.2 with high PI across the locations considered promising and that included IET# 31435, 31433, 31480, 31469, 31447, 31473, 31442, 31459, 31437, 31438, 31455 and 31474 (Table 1.4B).

- **Donor Screening Nursery (DSN)**

The donor screening nursery comprised of 212 entries including checks were evaluated at 22 locations. The location severity index was high (LSI 6-7) at Lonavala (6.7), Cuttack (6.6) and Gangavathi (6.6). Most of the centres showed moderate disease pressure (LSI 3-6) and that included Jagdalpur (5.9), Almora (5.8), Gagharghat (5.7), Nawagam (5.6), Hazaribagh (5.5), Mandya (5.5), Pattambi (4.8), Uppershillong (4.8), Coimbatore (4.5), Rewa (4.3), Ranch (4.2), Nellore (4.0), IIRR (3.9), Imphal (3.7), Patna (3.5) and Karjat (3.2). The locations *viz*., Maruteru, Ponnampet 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 less than 4.1 were considered as promising and presented in able 11 and that included RP 6469-89, CB 18577, RBN-2, RNR 31581, RBN-1, RBN-6, CB 18586, NLR 3217, RBN-7, KNM 13525, KNM 13449, KNM 15361 and JGL 3889 (Table 1.5B).

Table 1.4A: Location severity index (LSI) and frequency distribution of leaf blast scores of NHSN, *Kharif* 2023.

Score	Location/Frequency of scores (0-9)																						
	BNK	**CBT**	**CTK**	**GGT**	**GNV**	**HZB**	**IIRR**	**IMP**	**JDP**	**KHD**	**KJT**	**LNV**	**MND**	**MTU**	**NLR**	**NWG**	**PNP**	**PTB**	**PTN**	**RCI**	**REW**	**USG**	**WBL**
0	14	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	3	0	0	0	0	5
1	81	0	0	0	1	0	1	0	0	2	18	0	0	27	0	0	9	0	8	5	0	23	5
2	14	1	0	0	4	0	10	0	6	11	33	0	11	30	0	0	35	1	12	9	6	35	37
3	8	17	2	0	40	5	42	12	20	21	23	3	28	49	2	4	61	13	37	5	22	4	56
4	2	27	0	0	41	51	26	2	14	24	16	3	27	9	58	13	14	37	40	20	39	8	17
5	0	32	32	72	12	10	16	39	12	32	16	17	4	2	18	42	0	13	18	42	39	13	0
6	0	25	0	0	8	13	3	4	18	9	7	33	7	1	8	20	0	18	1	21	10	13	0
7	1	16	52	43	3	27	20	33	14	5	5	31	0	0	3	23	0	11	4	8	4	13	0
8	0	2	0	0	1	9	0	4	8	6	2	25	16	0	0	16	0	7	0	9	0	10	0
9	0	0	16	5	10	5	1	23	28	3	0	7	27	0	0	2	0	17	0	1	0	0	0
Total	**120**	**120**	**102**	**120**	**120**	**120**	**119**	**117**	**120**	**118**	**120**	**119**	**120**	**118**	**89**	**120**	**119**	**120**	**120**	**120**	**120**	**119**	**120**
LSI	**1.2**	**5.0**	**6.6**	**5.9**	**4.3**	**5.4**	**4.2**	**6.3**	**5.9**	**4.3**	**3.3**	**6.6**	**5.4**	**2.4**	**4.5**	**5.8**	**2.7**	**5.4**	**3.6**	**4.9**	**4.3**	**3.8**	**2.6**
Screening	**N**	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**A**	**A**	**A**	**N**	**N**	**N**	**N**	**A**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.4B: Promising entries with low susceptibility index (≤ 4.2) and high PI in NHSN to leaf blast, *Kharif* 2021.

P. 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	NLR	NWG	PTB	PTN	RCI	REW	USG						
5	2805	31435	3	7	5	2	4	2	3	4	0	2	7	2	4	4	4	5	5	3	1	**3.5**	**19**	**9**	**47**	**17**	**89**
2	2802	31433	5	7	5	3	4	3	6	3	0	1	7	3	-	4	3	1	5	4	1	**3.6**	**18**	**9**	**50**	**15**	**83**
79	3012	31480	5	7	5	3	3	3	3	4	0	1	6	4	-	5	3	3	8	4	1	**3.8**	**18**	**9**	**50**	**15**	**83**
66	2930	31469	6	5	5	3	5	3	-	5	5	2	-	2	-	5	3	4	3	4	1	**3.8**	**16**	**7**	**44**	**15**	**94**
20	2902	31447	4	5	5	7	4	3	5	3	4	1	8	3	4	5	0	5	3	5	2	**4.0**	**19**	**7**	**37**	**17**	**89**
70	3003	31473	6	5	5	4	4	2	7	3	-	3	5	3	4	4	4	4	5	2	2	**4.0**	**18**	**6**	**33**	**16**	**89**
13	2813	31442	5	7	5	3	6	3	5	3	5	1	6	2	4	8	4	3	2	5	1	**4.1**	**19**	**8**	**42**	**15**	**79**
46	2919	31459	5	5	5	2	4	4	9	2	2	2	7	3	4	6	4	3	5	4	3	**4.2**	**19**	**7**	**37**	**16**	**84**
7	2807	31437	4	5	5	4	4	2	5	3	0	2	8	3	6	4	3	5	8	6	2	**4.2**	**19**	**7**	**37**	**15**	**79**
8	2808	31438	5	3	5	3	4	4	3	5	4	2	6	2	4	5	6	5	6	6	1	**4.2**	**19**	**6**	**32**	**15**	**79**
41	2914	31455	6	5	5	4	4	3	5	3	3	2	6	4	4	6	4	2	6	5	2	**4.2**	**19**	**6**	**32**	**15**	**79**
71	3004	31474	6	9	7	3	4	3	5	3	3	2	5	2	-	5	4	3	8	2	1	**4.2**	**18**	**9**	**50**	**14**	**78**
120	**Tetep (R)**		3	5	5	3	3	1	5	7	1	2	3	3	4	5	2	1	1	5	5	**3.4**	**19**	**11**	**58**	**18**	**95**
107	**HR 12 (S)**		7	9	7	9	9	7	8	9	7	3	8	9	7	9	9	7	8	7	8	**7.7**	**19**	**1**	**5**	**1**	**5**
LSI			**5.0**	**6.6**	**5.9**	**4.3**	**5.5**	**4.2**	**6.3**	**5.9**	**4.3**	**3.3**	**6.6**	**5.4**	**4.5**	**5.8**	**5.4**	**3.6**	**4.9**	**4.3**	**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)

Table 1.5A: Location severity index (LSI) and frequency distribution of leaf blast scores of DSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)																				
	ALM	**CBT**	**CTK**	**GGT**	**GNV**	**HZB**	**IIRR**	**IMP**	**JDP**	**KJT**	**LNV**	**MND**	**MTU**	**NLR**	**NWG**	**PNP**	**PTB**	**PTN**	**RCI**	**REW**	**USG**	**WBL**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	15
1	0	0	0	0	0	0	1	0	1	22	0	0	24	1	0	69	0	12	12	0	18	7
2	0	3	0	0	0	5	26	2	5	73	0	13	52	11	0	67	7	34	32	8	21	54
3	10	35	8	0	22	43	82	128	25	46	0	41	97	47	6	24	49	53	32	43	11	88
4	31	65	0	0	16	32	37	13	24	28	8	46	26	69	33	22	69	50	30	62	37	48
5	65	65	69	141	35	12	23	64	29	18	26	15	4	32	75	20	21	38	64	58	44	0
6	24	34	0	1	10	10	8	5	32	5	58	20	1	12	35	1	20	7	29	27	31	0
7	46	3	96	70	45	76	23	0	52	17	58	1	0	4	40	4	21	9	4	0	29	0
8	17	0	0	0	15	21	2	0	15	0	43	19	0	0	19	0	9	0	8	0	17	0
9	12	0	39	0	59	2	1	0	25	1	14	50	0	0	0	0	12	0	0	0	2	0
Total	**205**	**205**	**212**	**212**	**202**	**201**	**203**	**212**	**208**	**210**	**207**	**205**	**204**	**176**	**208**	**207**	**208**	**208**	**211**	**198**	**210**	**212**
LSI	**5.8**	**4.5**	**6.6**	**5.7**	**6.6**	**5.5**	**3.9**	**3.7**	**5.9**	**3.2**	**6.7**	**5.5**	**2.7**	**4.0**	**5.6**	**2.4**	**4.8**	**3.5**	**4.2**	**4.3**	**4.8**	**2.7**
Screening	**N**	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**N**	**A**	**A**	**A**	**A**	**N**	**N**	**N**	**N**	**A**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 1.5B: Promising entries with low susceptibility index (≤ 4.1) and high PI in DSN to leaf blast, *Kharif* 2023.

P. No	Designa-tions	Location/Frequency of scores (0-9)																			SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		ALM	CBT	CTK	GGT	GNV	HZB	IIRR	IMP	JDP	KJT	LNV	MND	NLR	NWG	PTB	PTN	RCI	REW	USG						
134	RP 6469-89	5	3	5	5	5	5	2	3	5	2	6	3	5	4	3	2	2	6	1	**3.8**	**19**	**9**	**47**	**17**	**89**
139	CB 18577	4	4	7	5	3	3	4	5	2	2	7	2	2	5	3	6	5	4	1	**3.9**	**19**	**8**	**42**	**16**	**84**
25	RBN-2	4	3	5	5	9	3	4	5	4	1	6	4	4	5	4	1	1	3	3	**3.9**	**19**	**7**	**37**	**17**	**89**
125	RNR 31581	5	4	5	5	4	-	-	3	4	2	5	-	-	5	3	3	5	5	1	**3.9**	**15**	**5**	**33**	**15**	**100**
24	RBN-1	4	5	5	7	7	3	4	3	5	1	7	3	4	4	3	1	2	3	4	**3.9**	**19**	**8**	**42**	**16**	**84**
29	RBN-6	5	5	5	5	4	2	3	3	3	2	8	4	4	5	4	3	2	4	4	**3.9**	**19**	**7**	**37**	**18**	**95**
141	CB 18586	5	3	9	5	6	3	3	3	3	3	6	3	4	5	3	2	5	3	2	**4.0**	**19**	**11**	**58**	**16**	**84**
165	NLR 3217	3	5	7	5	9	3	5	3	1	3	5	4	2	4	4	3	5	3	2	**4.0**	**19**	**9**	**47**	**17**	**89**
30	RBN-7	4	4	5	5	5	2	-	5	3	2	8	4	4	4	3	2	3	5	4	**4.0**	**18**	**6**	**33**	**17**	**94**
2	KNM13525	3	5	9	5	3	3	2	3	5	2	7	4	7	4	4	0	3	4	4	**4.1**	**19**	**8**	**42**	**16**	**84**
12	KNM13449	7	5	5	5	3	3	2	5	4	3	7	6	4	5	3	1	3	2	4	**4.1**	**19**	**8**	**42**	**16**	**84**
5	KNM15361	5	3	5	5	4	4	2	3	4	4	9	4	4	4	3	5	1	5	3	**4.1**	**19**	**6**	**32**	**18**	**95**
19	JGL3889	3	4	7	5	4	3	3	3	4	1	8	4	5	6	5	0	5	4	4	**4.1**	**19**	**6**	**32**	**16**	**84**
121	**Tetep (R)**	5	5	7	7	4	4	2	3	3	4	6	2	4	4	3	4	3	4	2	**4.0**	**19**	**7**	**37**	**16**	**84**
185	**HR 12 (S)**	7	4	7	7	7	7	7	3	9	7	5	9	5	6	9	7	5	5	7	**6.5**	**19**	**1**	**5**	**6**	**32**
	LSI	**5.8**	**4.5**	**6.6**	**5.7**	**6.6**	**5.5**	**3.9**	**3.7**	**5.9**	**3.2**	**6.7**	**5.5**	**4.0**	**5.6**	**4.8**	**3.5**	**4.2**	**4.3**	**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)

❖ TRIAL No.2: SCREENING FOR NECK BLAST RESISTANCE

➢ NSN-1

During *Kharif* 2023, the National Screening Nursery-1 (NSN-1) for neck blast disease was evaluated at 10 locations across India with 432 entries. The entries were screened under natural 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 centres showed very high (LSI >7.0) location severity index. The highest location severity was observed in Mandya (6.5) while the lowest at Karaikal (0.8). The disease pressure was high (LSI 6-7) at and Mandya (6.5), while it was moderate (LSI 3-6) at Jagdalpur (5.0), Nawagam (5.0), Ponnampet (3.7), Nellore (3.5) and Rajendranagar (3.4). The disease pressure at Lonavala (2.4), Malan (2.0), Bankura (1.0) and Karaikal (0.8) was very low and hence this centre 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 and presented in Table 2.1B. Entries which scored SI ≤ 3.2 was considered and that included IET # 29560, 30252, 29808, 29820, 32065, 31120, 30918, 28965, 30021, 30772, 30907, 29696, 30830, 30757 and 29891 (Table 2.1B).

➢ NSN-2

A total of 643 entries were evaluated under NSN-2 at five different locations during *Kharif* 2023. 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) disease pressure; however, it was high (LSI 6-7) at Mandya (6.3). The locations with moderate disease pressure (LSI 3-6) included Jagdalpur (5.3), Nawagam (5.1), and Ponnampet (4.0). The selection of promising entries was done based on the data of all the locations except from Malan where disease pressure was very low.

The entries that had shown low disease scores (≤3.5) across the locations were listed in Table 2.2B and that included IET# 31924, 31681, 31683, 31710, 31835, 31820, 31616, 31821, 31836, 31974, 31719, 31827, 31868, 31525, 31987, 31595, 31521, 31754, 31774, 31895, 31505, 31507, 31509, 30684, 31676 and 31817.

➢ NSN-H

A total of 86 entries were evaluated under NSN-hills nursery at six 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 Gudalur (5.2), Almora (4.7), Ponnampet (4.2) and Imphal (4.0). The disease pressure was low at Malan (2.6) and Lonavala (1.8) and hence the data was not considered for selection of promising entries.

The entries found resistant and which performed on par with resistant check Tetep (SI 3.0) were IET# 31420, 31423, 31412, 31416 and 31428. Other promising entries with SI ≤3.7 with high PI were found moderate resistance to neck blast and with was listed in Table 2.3B.

Table 2.1A: Location severity index (LSI) and frequency distribution of Neck blast scores of NSN-1, *Kharif* 2023

Score	Location/Frequency of scores (0-9)									
	BNK	**JDP**	**KRK**	**LNV**	**MLN**	**MND**	**NLR**	**NWG**	**PNP**	**RNR**
0	195	22	283	0	0	0	0	0	3	12
1	152	15	69	150	132	0	29	0	58	113
2	0	0	0	4	166	0	0	0	0	0
3	69	61	62	247	125	5	270	94	208	135
4	0	0	0	0	0	32	0	1	0	0
5	10	205	15	24	0	158	108	235	105	131
6	0	0	0	0	0	0	0	0	0	0
7	6	114	3	0	0	109	10	100	40	34
8	0	0	0	0	0	0	0	0	0	0
9	0	11	0	0	0	120	0	0	8	3
Total	**432**	**428**	**432**	**425**	**423**	**424**	**417**	**430**	**422**	**428**
LSI	**1.0**	**5.0**	**0.8**	**2.4**	**2.0**	**6.5**	**3.5**	**5.0**	**3.7**	**3.4**
Screening	**N**	**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 (≤3.2) and high PI in NSN-1 to Neck blast, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)						SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			JDP	MND	NLR	NWG	PNP	RNR						
114	5718	29560	0	5	5	3	1	1	**2.5**	**6**	**4**	**67**	**6**	**100**
60	5605	30252	3	3	3	3	3	1	**2.7**	**6**	**6**	**100**	**6**	**100**
118	5722	30245 (R)	5	5	3	3	1	0	**2.8**	**6**	**4**	**67**	**6**	**100**
201	3603	29808	3	5	3	4	1	1	**2.8**	**6**	**4**	**67**	**6**	**100**
204	3606	29820	5	4	3	3	1	1	**2.8**	**6**	**4**	**67**	**6**	**100**
350	4246	32065	7	4	1	5	0	0	**2.8**	**6**	**3**	**50**	**5**	**83**
49	4411	29410 (R)	1	5	3	3	3	3	**3.0**	**6**	**5**	**83**	**6**	**100**
84	6008	31120	3	5	3	3	1	3	**3.0**	**6**	**5**	**83**	**6**	**100**
223	4005	29264 (R)	3	3	3	5	3	1	**3.0**	**6**	**5**	**83**	**6**	**100**
293	4519	30918	3	5	3	3	3	1	**3.0**	**6**	**5**	**83**	**6**	**100**
20	3308	28965	1	7	3	3	3	1	**3.0**	**6**	**5**	**83**	**5**	**83**
46	4408	30021	1	5	3	5	1	3	**3.0**	**6**	**4**	**67**	**6**	**100**
220	4002	30772	3	5	3	5	1	1	**3.0**	**6**	**4**	**67**	**6**	**100**
294	4520	30907	5	5	3	3	1	1	**3.0**	**6**	**4**	**67**	**6**	**100**
19	3307	29696	1	4	3	5	3	3	**3.2**	**6**	**4**	**67**	**6**	**100**
10	5111	30830	0	7	3	5	1	3	**3.2**	**6**	**4**	**67**	**5**	**83**
197	3915	30757	5	5	3	5	1	0	**3.2**	**6**	**3**	**50**	**6**	**100**
218	3621	29217 (R)	5	4	1	5	3	1	**3.2**	**6**	**3**	**50**	**6**	**100**
309	4203	29891	5	4	3	5	1	1	**3.2**	**6**	**3**	**50**	**6**	**100**
419	HR 12		7	9	7	7	7	7	**7.3**	**6**	**0**	**0**	**0**	**0**
432	Tetep		5	5	3	3	3	3	**3.7**	**6**	**4**	**67**	**6**	**100**
LSI			**5.0**	**6.5**	**3.5**	**5.0**	**3.7**	**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 2.2A: Location severity index (LSI) and frequency distribution of Neck blast scores of NSN-2, *Kharif* 2023.

Score	Location/Frequency of scores (0-9)				
	JDP	MLN	MND	NWG	PNP
0	44	0	0	0	0
1	14	222	0	0	55
2	0	225	0	0	1
3	47	196	3	126	313
4	0	0	44	0	0
5	280	0	230	337	189
6	0	0	0	3	0
7	224	0	206	165	68
8	0	0	0	0	0
9	24	0	151	2	12
Total	**633**	**643**	**634**	**633**	**638**
LSI	**5.3**	**2.0**	**6.5**	**5.1**	**4.0**
Screening	**N**	**N**	**A**	**N**	**N**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 2.2B: Promising entries with low susceptibility index (≤3.5) and high PI in NSN-2 to Neck blast, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			JDP	MND	NWG	PNP						
500	5005	31924	0	5	3	1	**2.3**	**4**	**3**	**75**	**4**	**100**
196	4307	31681	0	4	3	3	**2.5**	**4**	**3**	**75**	**4**	**100**
198	4309	31683	0	5	3	3	**2.8**	**4**	**3**	**75**	**4**	**100**
226	4337	31710	0	5	3	3	**2.8**	**4**	**3**	**75**	**4**	**100**
297	4945	31835	0	5	3	3	**2.8**	**4**	**3**	**75**	**4**	**100**
281	4929	31820	0	7	3	1	**2.8**	**4**	**3**	**75**	**3**	**75**
127	4101	31616	1	5	3	3	**3.0**	**4**	**3**	**75**	**4**	**100**
282	4930	31821	1	5	5	1	**3.0**	**4**	**2**	**50**	**4**	**100**
298	4946	31836	0	4	5	3	**3.0**	**4**	**2**	**50**	**4**	**100**
448	5811	31974	1	5	5	1	**3.0**	**4**	**2**	**50**	**4**	**100**
237	4348	31719	0	7	3	3	**3.3**	**4**	**3**	**75**	**3**	**75**
289	4937	31827	0	7	3	3	**3.3**	**4**	**3**	**75**	**3**	**75**
566	5419	31868	0	7	3	3	**3.3**	**4**	**3**	**75**	**3**	**75**
89	3526	31525	3	4	5	1	**3.3**	**4**	**2**	**50**	**4**	**100**
464	5827	31987	0	5	5	3	**3.3**	**4**	**2**	**50**	**4**	**100**
42	3842	31595	3	5	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
85	3522	31521	3	5	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
337	4622	31754	3	5	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
359	4644	31774	3	5	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
385	5507	31895	3	5	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
68	3505	31505	5	5	3	1	**3.5**	**4**	**2**	**50**	**4**	**100**
70	3507	31507	5	5	3	1	**3.5**	**4**	**2**	**50**	**4**	**100**
72	3509	31509	5	5	3	1	**3.5**	**4**	**2**	**50**	**4**	**100**
129	4103	30684	1	5	5	3	**3.5**	**4**	**2**	**50**	**4**	**100**
191	4302	31676	1	5	5	3	**3.5**	**4**	**2**	**50**	**4**	**100**
278	4926	31817	0	5	6	3	**3.5**	**4**	**2**	**50**	**3**	**75**
643	Tetep		3	5	3	1	**3.0**	**4**	**3**	**75**	**4**	**100**
630	HR 12		7	9	7	1	**6.0**	**4**	**1**	**25**	**1**	**25**
LSI			**5.3**	**6.5**	**5.1**	**4.0**						

(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 2.3A: Location severity index (LSI) and frequency distribution of Neck blast scores of NSN-H, *Kharif* 2023

Score	Location/Frequency of scores (0-9)					
	ALM	GDL	IMP	LNV	MLN	PNP
0	0	0	0	0	0	0
1	0	1	0	54	30	13
2	0	0	0	0	1	0
3	32	14	49	29	28	27
4	0	0	0	0	2	0
5	32	49	29	2	12	28
6	0	0	0	0	1	0
7	14	19	6	0	0	13
8	0	0	0	0	0	0
9	2	3	0	0	0	3
Total	**80**	**86**	**84**	**85**	**74**	**84**
LSI	**4.7**	**5.2**	**4.0**	**1.8**	**2.6**	**4.2**
Screening	**N**	**N**	**N**	**N**	**N**	**N**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 2.3B: Promising entries with low susceptibility index (<=4.0) and high PI in NSN-H to neck blast, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)									
			ALM	GDL	IMP	PNP	SI	Total	<=3*	PI (<=3)**	<=5*	PI (<=5)**
56	2603	31420	3	3	-	3	3.0	**3**	**3**	**100**	**3**	**100**
60	2607	31423	3	3	3	3	3.0	**4**	**4**	**100**	**4**	**100**
48	2516	31412	3	5	3	1	3.0	**4**	**3**	**75**	**4**	**100**
52	2520	31416	3	5	3	1	3.0	**4**	**3**	**75**	**4**	**100**
66	2613	31428	3	3	5	1	3.0	**4**	**3**	**75**	**4**	**100**
25	2314	31391	3	3	5	3	3.5	**4**	**3**	**75**	**4**	**100**
29	2318	31395	3	3	5	3	3.5	**4**	**3**	**75**	**4**	**100**
36	2504	31402	3	5	3	3	3.5	**4**	**3**	**75**	**4**	**100**
59	2606	31422	3	7	3	1	3.5	**4**	**3**	**75**	**3**	**75**
34	2502	31400	5	1	3	5	3.5	**4**	**2**	**50**	**4**	**100**
54	2601	31418	5	5	3	1	3.5	**4**	**2**	**50**	**4**	**100**
62	2609	31425	5	3	5	1	3.5	**4**	**2**	**50**	**4**	**100**
51	2519	31415	-	5	3	3	3.7	**3**	**2**	**67**	**3**	**100**
86	Tetep		3	3	3	3	3.0	**4**	**4**	**100**	**4**	**100**
73	HR-12		-	9	3	9	7.0	**3**	**1**	**33**	**1**	**33**
LSI			**4.7**	**5.2**	**4.0**	**4.2**						

(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)

➢ NHSN

The National Hybrid Screening Nursery (NHSN) was evaluated for their resistance to neck blast at eight 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) are presented in the Table 2.4A. The disease pressure was highest at Mandya (LSI 6.0) while it was lowest at Bankura (0.2). The disease pressure was moderate (LSI 3-6) at most of the locations and that included Nawagam (5.7), Jagdalpur (5.4), Malan (5.0) and Imphal (4.3). The disease pressure was low (LSI≤3.0) at Lonavala (2.3), Rajendranagar (2.6), and Bankura (0.2) and hence performance of entries from these centers was not considered for selecting the promising entries.

Based on the performance of entries across the five locations, entries *viz*., IET# 31490, 31489, 31475, 31469,31492, 31452, 31466, 31473, 31464 and 31496 were found promising (Table 2.4B).

Table 2.4A: Location severity index (LSI) and frequency distribution of neck blast scores of NHSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)							
	BNK	IMP	JDP	LNV	MLN	MND	NWG	RNR
0	103	0	0	0	0	0	0	2
1	15	0	2	43	6	0	0	48
2	1	0	0	0	12	0	0	0
3	1	59	13	77	16	5	16	45
4	0	0	0	0	4	25	0	0
5	0	41	66	0	2	40	46	20
6	0	0	0	0	23	0	0	0
7	0	17	35	0	4	22	58	4
8	0	0	0	0	1	0	0	0
9	0	0	4	0	15	28	0	0
Total	**120**	**117**	**120**	**120**	**83**	**120**	**120**	**119**
LSI	**0.2**	**4.3**	**5.4**	**2.3**	**5.0**	**6.0**	**5.7**	**2.6**
Screening	**N**	**N**	**N**	**N**	**N**	**A**	**N**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 2.4B: Promising entries with low susceptibility index (≤4.5) and high PI in NHSN to Neck blast, *Kharif* 2023.

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)					SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			IMP	JDP	MLN	MND	NWG						
92	3025	31490	3	3	-	4	3	**3.3**	**4**	**3**	**75**	**4**	**100**
90	3023	31489	3	1	-	7	3	**3.5**	**4**	**3**	**75**	**3**	**75**
73	3006	31475	3	5	-	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
66	2930	31469	-	5	3	4	5	**4.3**	**4**	**1**	**25**	**4**	**100**
94	3027	31492	3	5	-	4	5	**4.3**	**4**	**1**	**25**	**4**	**100**
36	2909	31452	5	3	6	5	3	**4.4**	**5**	**2**	**40**	**4**	**80**
63	2927	31466	5	5	3	4	5	**4.4**	**5**	**1**	**20**	**5**	**100**
70	3003	31473	5	7	1	4	5	**4.4**	**5**	**1**	**20**	**4**	**80**
61	2925	31464	5	5	-	3	5	**4.5**	**4**	**1**	**25**	**4**	**100**
99	3105	31496	5	5	-	5	3	**4.5**	**4**	**1**	**25**	**4**	**100**
27	Tetep		3	5	2	7	5	**4.4**	**5**	**2**	**40**	**4**	**80**
29	HR 12		5	5	4	9	7	**6.0**	**5**	**0**	**0**	**3**	**60**
LSI			**4.3**	**5.5**	**5.0**	**6.0**	**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)

➢ DSN

The Donor Screening Nursery (DSN) was evaluated for resistance to neck blast at seven 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 high (LSI 6-7) at Mandya (6.1); while it was moderate (LSI 3-6) at Jagdalpur (5.5), Nawagam (5.1) and Rajendranagar (3.1). The selection of promising donors in DSN was done based on the reaction at those locations where LSI was ≥3.0, accordingly data from Imphal, Lonavala and Malan 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 VP-R262-SHB, VP-D6-SHB, VP-D8-SHB, VP-D9-SHB, CB 20166, VP-R45-SHB, NLRBL-8, VP-R243-SHB, WGL 14, VP-R107-SHB, VP-R109-SHB, 4857, VP-D5-SHB, 19451, RP-Patho-12, CR1014, NLRBL-5, and 4917.

Table 2.5A: Location severity index (LSI) and frequency distribution of Neck blast scores of DSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)						
	IMP	JDP	LNV	MLN	MND	NWG	RNR
0	0	8	0	0	0	0	8
1	68	2	97	84	0	0	64
2	0	0	1	94	0	0	0
3	117	10	111	34	20	42	67
4	0	0	0	0	45	0	0
5	27	115	0	0	49	113	47
6	0	0	0	0	0	0	0
7	0	61	0	0	29	51	22
8	0	0	0	0	0	0	0
9	0	12	0	0	62	2	0
Total	**212**	**208**	**209**	**212**	**205**	**208**	**208**
LSI	**2.6**	**5.5**	**2.1**	**1.8**	**6.1**	**5.1**	**3.1**
Screening	**N**	**N**	**N**	**N**	**A**	**N**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

Table 2.5B: Promising entries with low susceptibility index (≤3.3) and high PI in DSN to Neck blast, *Kharif* 2023

P. No.	Design	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		JDP	MND	NWG	RNR						
75	VP-R262-SHB	0	5	3	1	**2.3**	**4**	**3**	**75**	**4**	**100**
88	VP-D6-SHB	0	5	3	1	**2.3**	**4**	**3**	**75**	**4**	**100**
89	VP-D8-SHB	0	5	3	1	**2.3**	**4**	**3**	**75**	**4**	**100**
90	VP-D9-SHB	0	4	3	3	**2.5**	**4**	**3**	**75**	**4**	**100**
145	CB 20166	3	4	3	0	**2.5**	**4**	**3**	**75**	**4**	**100**
92	VP-R45-SHB	3	4	3	1	**2.8**	**4**	**3**	**75**	**4**	**100**
161	NLRBL-8	0	5	5	1	**2.8**	**4**	**2**	**50**	**4**	**100**
72	VP-R243-SHB	-	-	-	3	**3.0**	**1**	**1**	**100**	**1**	**100**
50	WGL 14	5	3	3	1	**3.0**	**4**	**3**	**75**	**4**	**100**
65	VP-R107-SHB	3	3	5	1	**3.0**	**4**	**3**	**75**	**4**	**100**
66	VP-R109-SHB	5	3	3	1	**3.0**	**4**	**3**	**75**	**4**	**100**
204	4857	3	3	5	1	**3.0**	**4**	**3**	**75**	**4**	**100**
87	VP-D5-SHB	1	5	5	1	**3.0**	**4**	**2**	**50**	**4**	**100**
42	19451	5	4	3	1	**3.3**	**4**	**2**	**50**	**4**	**100**
104	RP-Patho-12	5	4	3	1	**3.3**	**4**	**2**	**50**	**4**	**100**
124	CR1014	5	4	3	1	**3.3**	**4**	**2**	**50**	**4**	**100**
158	NLRBL-5	0	7	5	1	**3.3**	**4**	**2**	**50**	**3**	**75**
207	4917	5	-	5	0	**3.3**	**3**	**1**	**33**	**3**	**100**
198	Tetep	5	3	7	3	**4.5**	**4**	**2**	**50**	**3**	**75**
185	HR-12	5	9	5	3	**5.5**	**4**	**1**	**25**	**3**	**75**
	LSI	**5.5**	**6.1**	**5.1**	**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)

TRIAL No.3: SCREENING FOR BROWN SPOT RESISTANCE

➢ **NSN-1**

The National Screening Nursery (NSN-1) comprised of 432 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) are presented in Table 3.1A. The disease pressure was highest at Gangavathi (8.2), while it was lowest at Upper shilling (2.5). The disease pressure was very high (LSI≥7.0) at Gangavathi (8.2), Pusa (7.6), IIRR (7.0); high (LSI 6-7) at Ludhiana (6.3), Hazaribagh (6.0). In most of the centres, the disease pressure was moderate (LSI 3-6) and that included Gudalur (5.8), Chinsurah (5.8), Gagarghat (5.7), Rewa (5.6), Coimbatore (5.4), Chatha (5.3), Jagdalpur (5.3), Khudwani (5.1), Ponnampet (4.7), Sabour (4.5), Lonavala (3.3) and Mugad (3.1). The selection of promising entries was done based on the data of all the locations. None of the entry was found resistant against brown spot disease under NSN-1; however, a few promising entries with low SI (≤4.8) across the centres included IET# 29692, 31129, 29549, 30024, 29833, 30233, 29694, 30830, 30752, 30657, 29142, 29405, 32074, 32073, 30178, 32037 and 32040 (Table 3.1B).

➢ **NSN-2**

A total of 642 entries including different checks were screened under NSN- 2 at 12 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 Chatha, Gagharghat, Hazaribagh, Jagdalpur, Ponnampet, Rewa and Sabour. 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 (8.0) and Jagdalpur (5.0) respectively. the disease pressure was very high (LSI ≥ 7.0) at Ganagavathi and Pusa; high (LSI 6-7) at IIRR (6.9) and Ludhiana; moderate (LSI 3-6) at Coimbatore, Gudalur (5.8), Gagharghat (5.6), Hazaribagh (5.5), Ponnampet (5.5), Rewa (5.4), Sabour (5.4), Chatha (5.1) and Jagdalpur (5.0) (Table 3.2A).

The entries with low SI (≤5.2) 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# 31875, 31803, 31075, 31831, 31680, 31822, 31116, 31920, 31911, 31876, 31811, 31838, 31873, 31877, 31879 and 31936.

Table 3.1A: Location severity index(LSI) and frequency distribution of brown spot scores of NSN-1, *Kharif* 2023

Score	Location/Frequency of scores (0-9)																		
	BNK	CBT	CHN	CHT	GDL	GGT	GNV	HZB	IIRR	JDP	KHD	LDN	LNV	MGD	PNP	PSA	REW	SBR	USG
0	21	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	20
1	139	0	1	4	0	0	0	1	0	0	0	0	1	16	18	0	0	55	105
2	0	0	0	0	0	0	0	3	0	11	4	0	13	0	40	0	0	0	125
3	181	43	46	75	14	0	0	18	0	47	75	2	296	370	54	0	3	131	66
4	0	81	18	0	32	0	0	27	4	59	2	0	104	0	69	1	32	0	48
5	43	94	181	217	128	235	5	95	17	101	261	148	8	38	117	4	158	114	52
6	0	95	24	0	124	128	25	101	139	122	3	0	2	0	67	35	189	0	9
7	39	79	103	109	98	3	81	170	114	87	66	269	0	0	19	117	49	92	0
8	0	33	20	0	29	64	90	17	115	0	1	0	0	0	27	230	1	0	0
9	8	0	39	19	0	0	222	0	42	1	14	8	0	0	12	29	0	28	0
Total	**431**	**425**	**432**	**424**	**425**	**432**	**423**	**432**	**431**	**428**	**426**	**427**	**424**	**424**	**423**	**416**	**432**	**421**	**425**
LSI	**2.9**	**5.4**	**5.8**	**5.3**	**5.8**	**5.7**	**8.2**	**6.0**	**7.0**	**5.3**	**5.1**	**6.3**	**3.3**	**3.1**	**4.7**	**7.6**	**5.6**	**4.5**	**2.5**
Screening	**N**	**A**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**N**	**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* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)																	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			CBT	CHN	CHT	GDL	GGT	GNV	HZB	IIRR	JDP	KHD	LDN	LNV	MGD	PNP	PSA	REW	SBR						
21	3309	29692	3	5	3	3	5	6	7	6	4	3	5	5	3	2	7	5	3	**4.4**	**17**	**7**	**41**	**13**	**76**
83	6007	31129	3	5	7	3	5	7	4	6	3	5	5	4	3	3	7	4	3	**4.5**	**17**	**6**	**35**	**13**	**76**
57	5602	29549	4	5	7	3	5	5	7	6	3	3	7	4	3	1	6	5	3	**4.5**	**17**	**6**	**35**	**12**	**71**
40	4402	30024	3	5	5	5	6	-	5	6	5	7	5	3	3	4	6	6	1	**4.7**	**16**	**4**	**25**	**11**	**69**
186	3904	29833	3	3	9	4	6	8	2	5	3	3	7	3	3	5	7	6	3	**4.7**	**17**	**8**	**47**	**11**	**65**
56	5601	30233	7	5	5	7	5	5	7	6	2	5	5	4	3	2	6	5	1	**4.7**	**17**	**4**	**24**	**12**	**71**
16	3304	29694	4	5	5	5	5	8	3	5	5	2	5	4	5	5	6	5	3	**4.7**	**17**	**3**	**18**	**15**	**88**
10	5111	30830	3	4	5	5	5	8	8	8	5	3	3	3	3	4	6	5	3	**4.8**	**17**	**6**	**35**	**13**	**76**
363	3705	30752	5	7	5	5	5	7	7	7	4	3	5	3	3	2	7	5	1	**4.8**	**17**	**5**	**29**	**12**	**71**
174	3449	30657	4	5	5	4	5	6	6	6	6	5	7	3	3	2	6	5	3	**4.8**	**17**	**4**	**24**	**11**	**65**
29	3317	29142 (R)	5	3	5	6	5	7	3	6	7	5	5	3	3	5	-	6	3	**4.8**	**16**	**5**	**31**	**11**	**69**
53	4415	29405 (R)	3	5	5	4	5	9	3	6	7	3	7	4	3	3	6	6	3	**4.8**	**17**	**6**	**35**	**11**	**65**
273	4825	32074	7	3	3	7	6	7	7	8	2	5	5	4	3	1	8	5	1	**4.8**	**17**	**6**	**35**	**10**	**59**
272	4824	32073	5	3	3	5	5	8	7	7	2	5	5	4	3	4	8	5	3	**4.8**	**17**	**5**	**29**	**13**	**76**
2	5102	30178	4	3	5	7	6	7	5	6	5	5	5	3	3	2	7	6	3	**4.8**	**17**	**5**	**29**	**11**	**65**
180	3455	32037	4	4	3	5	6	8	7	6	6	5	5	3	3	1	7	6	3	**4.8**	**17**	**5**	**29**	**10**	**59**
391	3734	32040	5	5	7	7	5	9	4	5	4	3	5	3	3	4	6	6	1	**4.8**	**17**	**4**	**24**	**12**	**71**
90	Rasi		4	5	5	5	5	7	7	4	4	5	5	4	3	2	6	5	1	**4.5**	**17**	**3**	**18**	**14**	**82**
432	Tetep		3	5	5	5	5	6	7	4	3	3	7	3	1	3	-	4	7	**4.4**	**16**	**6**	**38**	**12**	**75**
419	HR 12 (S)		8	5	5	8	8	9	8	8	5	8	5	3	5	2	6	6	7	**6.2**	**17**	**2**	**12**	**7**	**41**
LSI			**5.4**	**5.8**	**5.3**	**5.8**	**5.7**	**8.2**	**6.0**	**7.0**	**5.3**	**5.1**	**6.3**	**3.3**	**3.1**	**4.7**	**7.6**	**5.6**	**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)

Table 3.2A: Location severity index (LSI) and frequency distribution of brown spot scores of NSN-2, *Kharif* 2023

Score	Location/Frequency of scores (0-9)											
	CBT	CHT	GGT	GNV	HZB	IIRR	JDP	LDN	PNP	PSA	REW	SBR
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	2	0	0	0	0	1	0	0	0	0	23
2	0	0	0	0	2	0	57	0	23	0	1	0
3	23	127	0	0	28	1	81	13	77	0	2	170
4	87	0	0	1	44	3	100	0	90	0	67	0
5	156	345	400	9	228	44	112	166	130	0	278	186
6	161	0	148	19	212	182	140	0	116	16	255	0
7	138	148	5	180	81	239	142	443	124	221	39	184
8	73	0	85	200	5	147	0	0	63	381	0	0
9	0	10	0	222	0	26	0	18	15	22	1	76
Total	**638**	**632**	**638**	**631**	**600**	**642**	**633**	**640**	**638**	**640**	**643**	**639**
LSI	**5.8**	**5.1**	**5.6**	**8.0**	**5.5**	**6.9**	**5.0**	**6.5**	**5.5**	**7.6**	**5.4**	**5.4**
Screening	**A**	**N**	**N**	**A**	**N**	**A**	**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 five locations *viz*., Almora, IIRR, Khudwani, Lonavala and Ponnampet. These entries were screened through natural method in all the locations except at IIRR. The frequency distribution of disease scores and location severity indices are presented in Table 3.3A. The disease pressure was high (LSI 6-7) at IIRR (6.7) and Almora (6.4); moderate (LSI 3-6) at Khudwani (5.7), Ponnampet (4.2) and Lonavala (3.3). Data from all the centres were considered for selection of best entries. None of the entries found resistant against brown spot; however, entries with low SI (≤4.6) and high PI across the locations considered promising and they are IET # 31407, 30513, 31387, 29654, 31388, 31389, 31383, 31384, 31399, 31411, 30503, 31385, 31398 and 31405 (Table 3.3B).

- **NHSN**

One hundred and twenty hybrid entries including checks were evaluated at 13 locations against brown spot disease under NHSN. The highest and lowest disease pressure was recorded at Gangavathi (7.8) and Bankura (2.5) respectively. The disease pressure was high (LSI 6-7) at IIRR (6.8), Pusa (6.7) and Ludhiana (6.2). Most of the centres showed moderate disease pressure *viz.,* Chatha (5.6), Gagharghat (5.6), Khudwani (5.6), Coimbatore (5.2), Rewa (4.9), Chinsurah (4.7), Jagdalpur (4.1) and Lonavala (3.2). The Performance of entries at Bankura was not considered for identifying promising entries, as the disease pressure was low (< 3.0) (Table 3.4A).

The entries with low SI (≤5.2) 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 # 31474, 31464, 31473, 31480, 31442, 31466, 31495, 31498, 31487, 31489, 31449, 31444, 31490, 31460, 31461, 31465 and 31448 (Table 3.4B).

Table 3.2B: Promising entries with low susceptibility index (<=5.2) and high PI in NSN-2 to brown spot, *Kharif* 2023

P. No.	Br No.	IET No.	Location/Frequency of scores (0-9)												SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			CBT	CHT	GGT	GNV	HZB	IIRR	JDP	LDN	PNP	PSA	REW	SBR						
574	5427	31875	4	3	5	7	5	6	2	5	3	6	4	1	**4.3**	**12**	**4**	**33**	**9**	**75**
263	4911	31803	3	1	5	6	2	6	3	3	8	8	5	3	**4.4**	**12**	**6**	**50**	**8**	**67**
561	5414	31075	4	-	5	8	6	7	3	3	3	7	6	1	**4.8**	**11**	**4**	**36**	**6**	**55**
293	4941	31831	5	3	6	-	6	6	3	7	3	7	5	3	**4.9**	**11**	**4**	**36**	**6**	**55**
195	4306	31680	3	3	5	8	4	8	4	7	2	7	5	3	**4.9**	**12**	**4**	**33**	**8**	**67**
283	4931	31822	5	5	5	7	3	5	2	7	7	7	4	3	**5.0**	**12**	**3**	**25**	**8**	**67**
449	5812	31116	8	5	5	6	5	6	2	5	3	7	6	3	**5.1**	**12**	**3**	**25**	**7**	**58**
415	5538	31920	3	5	5	5	6	6	7	5	4	8	4	3	**5.1**	**12**	**2**	**17**	**8**	**67**
405	5527	31911	4	7	5	6	5	5	3	5	6	6	6	3	**5.1**	**12**	**2**	**17**	**7**	**58**
575	5428	31876	7	3	5	7	5	7	4	7	4	7	4	1	**5.1**	**12**	**2**	**17**	**7**	**58**
271	4919	31811	7	3	8	7	5	6	2	5	3	8	5	3	**5.2**	**12**	**4**	**33**	**7**	**58**
300	4948	31838	4	3	5	8	5	7	2	7	5	7	6	3	**5.2**	**12**	**3**	**25**	**7**	**58**
572	5425	31873	4	5	5	9	4	6	3	5	4	7	5	5	**5.2**	**12**	**1**	**8**	**9**	**75**
576	5429	31877	7	5	5	7	5	6	4	5	5	7	5	1	**5.2**	**12**	**1**	**8**	**8**	**67**
579	5432	31879	8	5	5	5	-	5	3	7	3	7	6	3	**5.2**	**11**	**3**	**27**	**7**	**64**
514	5019	31936	4	7	-	8	5	6	5	5	4	7	5	1	**5.2**	**11**	**1**	**9**	**7**	**64**
636	CH 45		4	5	5	9	3	3	4	7	3	6	2	5	**4.7**	**12**	**4**	**33**	**9**	**75**
632	Rasi		5	5	5	7	4	4	-	5	-	7	4	5	**5.1**	**10**	**0**	**0**	**8**	**80**
630	HR 12 (S)		8	5	8	9	7	9	4	7	7	7	7	5	**6.9**	**12**	**0**	**0**	**3**	**25**
LSI			**5.8**	**5.1**	**5.6**	**8.0**	**5.5**	**6.9**	**5.0**	**6.5**	**5.5**	**7.6**	**5.4**	**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)

Table 3.3A: Location severity index(LSI) and frequency distribution of brown spot scores of NSN-H, *Kharif* 2023

Score	Location/Frequency of scores (0-9)				
	ALM	IIRR	KHD	LNV	PNP
0	0	0	0	0	0
1	0	0	0	0	2
2	0	0	0	0	9
3	0	0	4	62	21
4	3	2	8	19	19
5	25	10	36	4	19
6	10	25	9	0	5
7	31	24	18	0	5
8	15	20	10	0	3
9	0	4	1	0	1
Total	**84**	**85**	**86**	**85**	**84**
LSI	**6.4**	**6.7**	**5.7**	**3.3**	**4.2**
Screening	**N**	**A**	**N**	**N**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 3.3B: Promising entries with low susceptibility index (<=4.6) and high PI in NSN-H to brown spot, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)					SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ALM	IIRR	KHD	LNV	PNP						
42	2510	31407	4	6	5	3	2	**4.0**	**5**	**2**	**40**	**4**	**80**
3	2403	30513	5	6	5	3	2	**4.2**	**5**	**2**	**40**	**4**	**80**
20	2309	31387	5	6	4	3	3	**4.2**	**5**	**2**	**40**	**4**	**80**
1	2401	29654	5	5	4	3	5	**4.4**	**5**	**1**	**20**	**5**	**100**
22	2311	31388	5	6	5	4	2	**4.4**	**5**	**1**	**20**	**4**	**80**
23	2312	31389	5	6	5	4	2	**4.4**	**5**	**1**	**20**	**4**	**80**
16	2305	31383	7	6	5	3	2	**4.6**	**5**	**2**	**40**	**3**	**60**
17	2306	31384	6	6	5	3	3	**4.6**	**5**	**2**	**40**	**3**	**60**
33	2501	31399	5	6	7	3	2	**4.6**	**5**	**2**	**40**	**3**	**60**
47	2515	31411	6	6	5	3	3	**4.6**	**5**	**2**	**40**	**3**	**60**
7	2407	30503	5	6	5	3	4	**4.6**	**5**	**1**	**20**	**4**	**80**
18	2307	31385	5	7	5	4	2	**4.6**	**5**	**1**	**20**	**4**	**80**
32	2321	31398	5	6	5	4	3	**4.6**	**5**	**1**	**20**	**4**	**80**
40	2508	31405	6	5	5	3	4	**4.6**	**5**	**1**	**20**	**4**	**80**
86	Tetep		5	5	5	3	4	**4.4**	**5**	**1**	**20**	**5**	**100**
79	CH-45		7	4	4	3	4	**4.4**	**5**	**1**	**20**	**4**	**80**
75	Rasi		5	5	5	3	-	**4.5**	**4**	**1**	**25**	**4**	**100**
77	Vikramarya		7	8	8	3	8	**6.8**	**5**	**1**	**20**	**1**	**20**
LSI			**6.4**	**6.7**	**5.7**	**3.3**	**4.2**						

(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)

Table 3.4A: Location severity index(LSI) and frequency distribution of brown spot scores of NHSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)												
	BNK	CBT	CHN	CHT	GGT	GNV	IIRR	JDP	KHD	LDN	LNV	PSA	REW
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	27	0	0	0	0	0	0	0	0	0	0	0	0
2	50	0	0	0	0	0	0	16	1	0	0	0	0
3	26	13	29	16	0	0	0	27	16	0	101	2	3
4	1	28	0	0	0	1	2	30	1	0	16	2	32
5	14	32	78	57	68	4	10	25	66	51	2	14	59
6	0	26	0	0	38	8	41	15	0	0	1	21	22
7	0	16	13	40	2	29	36	7	15	69	0	51	3
8	0	5	0	0	11	36	25	0	0	0	0	30	1
9	2	0	0	7	0	40	6	0	19	0	0	0	0
Total	**120**	**120**	**120**	**120**	**119**	**118**	**120**	**120**	**118**	**120**	**120**	**120**	**120**
LSI	**2.5**	**5.2**	**4.7**	**5.6**	**5.6**	**7.8**	**6.8**	**4.1**	**5.6**	**6.2**	**3.2**	**6.7**	**4.9**
Screening	**N**	**A**	**A**	**N**	**N**	**A**	**A**	**N**	**N**	**A**	**N**	**A**	**N**

(LSI-Location Severity Index; N-Natural; A-Artificial)

➢ DSN

The entries under donor screening nursery (DSN) were evaluated for their resistance to brown spot at 13 locations with 208 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 (7.9) and Lonavala (3.1) respectively. The disease Pressure was high (LSI 6-7) at IIRR (6.6), Almora (6.3), Gagharghat (6.1); moderate (LSI 3-6) at Ludhiana (5.6), Sabour (5.2), Chatha (5.1), Rewa (5.1), Hazaribagh (4.9), Coimbatore (4.6), Jagdalpur (4.1), and Lonavala (3.1). The promising donor lines with low SI (4.9) and high PI across the locations were presented in Table 3.5B and that included NLR 3595, NLRBL-2, KNM15236, 687-3, NLRBL-7, NLRBL-5, KNM12346, 680-2, RP-Bio-Patho-4, NLRBL-3, RTCNP-138, RP-Bio-Patho-3, NLRBL-9, KNM15361, C101A51, NLRBL-6 and 683-1.

Table 3.4B: Promising entries with low susceptibility index (<=5.2) and high PI in NHSN to brown spot, *Kharif* 2023

S.No.	Br No.	IET No.	Location/Frequency of scores (0-9)												SI	Total	<=3*	PI (<3)**	<=5*	PI (<5)**
			CBT	CHN	CHT	GGT	GNV	IIRR	JDP	KHD	LDN	LNV	PSA	REW						
71	3004	31474	8	3	5	5	7	6	3	2	5	3	5	5	**4.8**	**12**	**4**	**33**	**9**	**75**
61	2925	31464	5	5	5	8	5	4	2	5	5	3	7	4	**4.8**	**12**	**2**	**17**	**10**	**83**
70	3003	31473	5	3	3	6	7	6	3	-	7	4	5	5	**4.9**	**11**	**3**	**27**	**7**	**64**
79	3012	31480	5	5	7	5	7	7	2	3	5	3	5	5	**4.9**	**12**	**3**	**25**	**9**	**75**
13	2813	31442	4	3	5	5	7	6	5	5	5	3	7	4	**4.9**	**12**	**2**	**17**	**9**	**75**
63	2927	31466	7	3	5	5	8	5	5	3	5	3	6	5	**5.0**	**12**	**3**	**25**	**9**	**75**
97	3103	31495	6	5	7	6	5	5	2	5	5	3	7	4	**5.0**	**12**	**2**	**17**	**8**	**67**
102	3108	31498	7	3	3	6	7	8	3	4	7	3	7	3	**5.1**	**12**	**5**	**42**	**6**	**50**
87	3020	31487	3	3	5	5	8	6	4	7	5	3	7	5	**5.1**	**12**	**3**	**25**	**8**	**67**
90	3023	31489	4	7	3	5	8	6	3	5	5	4	6	5	**5.1**	**12**	**2**	**17**	**8**	**67**
22	2904	31449	3	3	5	5	8	9	6	5	5	3	5	5	**5.2**	**12**	**3**	**25**	**9**	**75**
16	2816	31444	4	3	3	6	8	8	6	5	5	3	6	5	**5.2**	**12**	**3**	**25**	**7**	**58**
92	3025	31490	4	5	3	6	8	7	5	5	5	3	7	4	**5.2**	**12**	**2**	**17**	**8**	**67**
47	2920	31460	5	5	5	6	6	6	3	5	7	3	6	5	**5.2**	**12**	**2**	**17**	**7**	**58**
48	2921	31461	7	5	5	6	5	6	2	5	7	3	7	4	**5.2**	**12**	**2**	**17**	**7**	**58**
62	2926	31465	7	5	5	5	7	5	4	5	5	3	6	5	**5.2**	**12**	**1**	**8**	**9**	**75**
21	2903	31448	4	5	5	-	8	7	5	5	5	3	5	5	**5.2**	**11**	**1**	**9**	**9**	**82**
52	Tetep		3	5	3	5	4	5	4	5	7	3	5	5	**4.5**	**12**	**3**	**25**	**11**	**92**
113	CH 45		4	5	5	6	7	5	3	9	7	3	6	3	**5.3**	**12**	**3**	**25**	**7**	**58**
107	HR 12 (S)		8	7	5	5	8	8	7	9	7	3	7	7	**6.8**	**12**	**1**	**8**	**3**	**25**
LSI			**5.2**	**4.7**	**5.6**	**5.6**	**7.8**	**6.8**	**4.1**	**5.6**	**6.2**	**3.2**	**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)

Table 3.5A: Location severity index (LSI) and frequency distribution of brown spot scores of DSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)												
	ALM	CBT	CHT	GGT	GNV	HZB	IIRR	JDP	LDN	LNV	PSA	REW	SBR
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	3	0	0	0	0	0	1	0	0	0	17
2	0	2	0	0	0	1	0	31	0	5	0	0	0
3	3	33	41	0	0	18	0	55	23	172	0	4	42
4	10	61	0	0	0	52	2	51	0	31	1	47	0
5	63	62	105	75	8	80	19	28	91	1	3	89	68
6	22	46	0	85	15	49	89	26	0	0	18	51	0
7	72	1	49	0	46	12	61	17	75	0	112	7	61
8	38	0	0	52	65	0	35	0	0	0	67	0	0
9	0	0	5	0	72	0	3	0	5	0	5	0	20
Total	**208**	**205**	**203**	**212**	**206**	**212**	**209**	**208**	**195**	**209**	**206**	**198**	**208**
LSI	**6.3**	**4.6**	**5.1**	**6.1**	**7.9**	**4.9**	**6.6**	**4.1**	**5.6**	**3.1**	**7.2**	**5.1**	**5.2**
Screening	**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* 2023

P. No.	Designation	Location/Frequency of scores (0-9)													SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-3)**
		ALM	CBT	CHT	GGT	GNV	HZB	IIRR	JDP	LDN	LNV	PSA	REW	SBR						
163	NLR 3595	5	6	3	8	7	5	5	3	3	3	4	5	1	**4.5**	**13**	**5**	**38**	**10**	**77**
155	NLRBL-2	6	3	1	8	9	3	7	2	3	3	6	5	3	**4.5**	**13**	**7**	**54**	**8**	**62**
9	KNM15236	4	4	3	8	9	5	7	2	3	3	6	4	1	**4.5**	**13**	**5**	**38**	**9**	**69**
53	687-3	4	5	3	6	6	5	5	3	5	3	7	4	3	**4.5**	**13**	**4**	**31**	**10**	**77**
160	NLRBL-7	5	4	5	6	8	4	6	2	3	3	5	3	5	**4.5**	**13**	**4**	**31**	**10**	**77**
158	NLRBL-5	5	5	3	8	7	4	6	2	5	3	6	3	3	**4.6**	**13**	**5**	**38**	**9**	**69**
14	KNM12346	4	3	5	6	7	5	5	2	5	3	7	4	5	**4.7**	**13**	**3**	**23**	**10**	**77**
52	680-2	5	6	5	6	5	4	5	4	7	3	6	4	1	**4.7**	**13**	**2**	**15**	**9**	**69**
108	RP-Bio-Patho-4	7	4	3	5	6	4	5	3	3	3	7	7	5	**4.8**	**13**	**4**	**31**	**9**	**69**
156	NLRBL-3	6	4	5	8	9	4	7	2	1	3	6	4	3	**4.8**	**13**	**4**	**31**	**8**	**62**
131	RTCNP-138	5	5	3	6	7	5	6	2	7	4	7	4	1	**4.8**	**13**	**3**	**23**	**8**	**62**
107	RP-Bio-Patho-3	6	6	3	5	8	3	5	2	3	3	6	6	7	**4.8**	**13**	**5**	**38**	**7**	**54**
162	NLRBL-9	7	5	1	8	8	4	5	3	5	3	5	4	5	**4.8**	**13**	**3**	**23**	**10**	**77**
5	KNM15361	5	2	5	8	7	5	6	5	5	3	7	4	1	**4.8**	**13**	**3**	**23**	**9**	**69**
120	C101A51	5	6	5	5	7	4	7	2	5	3	8	5	1	**4.8**	**13**	**3**	**23**	**9**	**69**
159	NLRBL-6	7	4	5	8	8	5	6	2	3	3	6	4	3	**4.9**	**13**	**4**	**31**	**8**	**62**
54	683-1	4	3	5	6	7	5	6	3	5	3	7	5	5	**4.9**	**13**	**3**	**23**	**9**	**69**
187	Rasi	5	-	7	5	7	5	5	3	3	3	7	5	5	**5.0**	**12**	**3**	**25**	**9**	**75**
185	HR-12	5	5	5	5	8	6	8	5	5	3	7	5	7	**5.7**	**13**	**1**	**8**	**8**	**62**
117	ISM	5	6	5	6	9	7	9	7	5	3	7	5	7	**6.2**	**13**	**1**	**8**	**5**	**38**
	LSI	**6.3**	**4.6**	**5.1**	**6.1**	**7.9**	**4.9**	**6.6**	**4.1**	**5.6**	**3.1**	**7.2**	**5.1**	**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.4: SCREENING FOR SHEATH BLIGHT RESISTANCE

➢ NSN-1

The National Screening Nursery-1 (NSN-1) was evaluated for resistance to sheath blight at 21 locations across India. The entries were screened by artificial inoculation at most of the centres except Patna where the entries were evaluated under natural condition. The highest disease pressure was recorded at Mandya (8.4) and lowest at Bankura (2.8). 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 Mandya (8.4), Gangavathi (8.1), Ludhiana (7.1), and Cuttack (7.1); high (LSI: 6 - 7), Chiplima (6.9), Chinsurah (6.8), Titabar (6.6), IIRR (6.5), New Delhi (6.5), Maruteru (6.1), Pattambi (6.3), Raipur (6.1), Masodha (6.0), moderate (LSI 3-6) at Navasari (5.9), Kaul (5.7), Moncompu (5.5), Aduthurai (5.5), Pant Nagar (5.0), Varanasi (4.8); and less (LSI <3) at Patna (2.9), Bankura (2.8). The selection of best entries in NSN-1 was done based on the reaction at those locations where LSI was ≥3. Some of the promising entries with SI ≤ 5.2 are presented in the Table 4.1B. None of the entries were found resistant (SI≤3.0) against sheath blight disease. Promising entries (SI≤5.0) were IET Nos. 30078, 29549, 30827, 30844, 30762 and 30083 were identified as better than tolerant check Tetep.

➢ NSN-2

The National Screening Nursery-2 (NSN-2) was evaluated for its resistance to sheath blight at 17 locations. The entries were screened by artificial inoculation at most of the centres except Patna where the entries were evaluated under natural conditions and observed moderate level of (LSI <2.8) 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 Mandya (8.1), Gangavathi (7.8), Cuttack (7.3), and Ludhiana (7.2); high (LSI 6 - 7) at Titabar (6.8), Pattambi (6.4), Masodha (6.0), Maruteru (6.0), IIRR (5.9), Aduthurai (5.6), Kaul (5.6), and moderate (LSI 3-6) at Raipur (5.5), Pant Nagar (5.2), Varanasi (4.9), and Moncompu (5.2); and low (LSI <3) at Patna (2.8). 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. Some of the promising entries with SI ≤ 5.0 are IETs 31682, 31662, 31696, 31687, 31906, 31681, 31836, 31059, and 31553 were found better than tolerant check Tetep are presented in 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 Cuttack (7.3), while it was high (LSI 6-7) at IIRR (6.5) and disease pressure was moderate (3-6) at Pantnagar (4.8). 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 *viz.,* IETs 31415, 31383 and 31420 were found better than tolerant checks (Tetep) and other few entries viz., IETs 31391, 31401, 31402, 31411, 31421, 30513, 31387 and 31426 were on par with checks (Table 4.3B).

Table 4.1A: Location severity index and frequency distribution of sheath blight disease score for NSN-1 entries, *Kharif*-2023

Score/ Location	Location/Frequency of scores (0-9)																				
	ADT	**BNK**	**CHN**	**CHP**	**CTK**	**GNV**	**IIRR**	**KUL**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NDL**	**NVS**	**PNT**	**PTB**	**PTN**	**RPR**	**TTB**	**VRN**
0	5	29	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0
1	10	126	0	2	7	0	0	0	0	26	0	0	0	0	0	0	0	147	0	0	0
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	89	192	17	27	31	1	4	9	0	45	0	13	0	0	29	32	10	158	65	30	136
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	150	45	140	71	49	27	114	114	0	110	10	225	182	112	191	357	173	99	122	128	184
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	108	28	143	203	179	141	303	85	397	164	107	147	222	305	186	28	196	18	187	166	77
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	62	11	132	116	158	256	8	1	26	58	307	41	4	8	23	6	47	0	58	99	11
Total	**424**	**432**	**432**	**419**	**424**	**425**	**429**	**209**	**423**	**431**	**424**	**426**	**408**	**425**	**429**	**423**	**426**	**422**	**432**	**423**	**408**
LSI	**5.5**	**2.8**	**6.8**	**6.9**	**7.1**	**8.1**	**6.5**	**5.7**	**7.1**	**5.5**	**8.4**	**6.0**	**6.1**	**6.5**	**5.9**	**5.0**	**6.3**	**2.9**	**6.1**	**6.6**	**4.8**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.1B: Promising entries with low susceptibility index (SI≤5.2) and high promising index in NSN-1 to sheath blight, *Kharif*-2023

P. No.	IET No.	Location/Frequency of scores (0-9)																										
		ADT	BNK	CHN	CHP	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NDL	NVS	PNT	PTB	PTN	RPR	TTB	VRN	SI	Total	<=3	PI (<=3)	<=5	PI (<=5)
31	30078	3	3	5	3	7	5	7	-	7	0	7	3	5	7	3	5	3	3	5	5	5	**4.6**	**20**	**8**	**40.0**	**15**	**75.0**
57	29549	3	0	3	5	7	7	5	5	7	5	7	5	5	5	7	5	5	1	3	5	3	**4.7**	**21**	**6**	**28.6**	**16**	**76.2**
9	30827	1	0	3	7	9	9	7	-	7	0	9	5	7	5	5	3	3	1	5	3	5	**4.7**	**20**	**8**	**40.0**	**13**	**65.0**
324	30844	3	1	7	3	7	7	5	7	7	0	9	5	5	7	5	5	5	1	5	3	3	**4.8**	**21**	**7**	**33.3**	**14**	**66.7**
221	30762	1	1	5	9	7	5	5	-	7	3	7	3	5	7	7	5	5	3	3	7	3	**4.9**	**20**	**7**	**35.0**	**13**	**65.0**
32	30083	7	3	5	5	7	5	7	-	7	1	9	3	5	7	5	3	5	3	5	5	3	**5.0**	**20**	**6**	**30.0**	**14**	**70.0**
10	30830	3	0	3	7	7	7	9	-	7	5	9	5	5	5	5	3	5	1	7	5	3	**5.1**	**20**	**6**	**30.0**	**13**	**65.0**
309	29891	1	3	5	3	9	7	5	-	7	5	9	5	7	7	3	5	5	3	5	5	3	**5.1**	**20**	**6**	**30.0**	**14**	**70.0**
65	30240	5	7	5	7	9	9	7	-	7	0	5	5	5	9	5	5	3	1	3	3	3	**5.2**	**20**	**6**	**30.0**	**13**	**65.0**
41	30028	5	0	3	7	3	9	7	-	7	5	7	5	5	7	5	3	7	3	5	5	5	**5.2**	**20**	**5**	**25.0**	**13**	**65.0**
316	30877	0	5	9	-	3	5	7	-	-	3	-	5	7	7	9	-	5	-	3	-	-	**5.2**	**13**	**4**	**30.8**	**8**	**61.5**
62	30235	7	0	5	7	7	5	5	5	7	7	7	5	5	9	5	5	5	3	5	3	3	**5.2**	**21**	**4**	**19.0**	**14**	**66.7**
422	TN1 (S)	7	9	9	7	9	9	9	7	9	7	9	7	5	7	7	9	9	7	7	9	7	**7.9**	**21**	**0**	**0.0**	**1**	**4.8**
427	IR 50 (S)	7	3	9	7	5	7	9	7	7	7	9	9	7	7	7	5	9	5	7	9	7	**7.1**	**21**	**1**	**4.8**	**4**	**19.0**
432	Tetep (R)	5	3	3	5	5	5	5	-	9	3	5	5	5	5	5	5	5	-	5	5	3	**4.8**	**19**	**4**	**21.1**	**18**	**94.7**
LSI		**5.5**	**2.8**	**6.8**	**6.9**	**7.1**	**8.1**	**6.5**	**5.7**	**7.1**	**5.5**	**8.4**	**6.0**	**6.1**	**6.5**	**5.9**	**5.0**	**6.3**	**2.9**	**6.1**	**6.6**	**4.8**	-	-	-	-	-	-

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

Table 4.2A: Location severity index and frequency distribution of sheath blight disease score for NSN-2 entries, *Kharif*-2023

Score/Location	ADT	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NVS	PNT	PTB	PTN	RPR	TTB	VRN
0	2	0	0	0	0	0	48	0	0	0	0	0	6	62	0	0	0
1	49	9	0	0	0	0	37	0	0	0	0	0	0	179	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	133	41	1	18	34	0	81	2	49	1	28	4	11	198	137	79	178
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	185	63	52	325	337	0	197	39	299	320	278	557	224	179	257	138	298
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	96	254	276	288	178	578	230	205	214	268	300	67	316	20	194	180	134
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	160	266	313	3	8	60	50	388	69	12	32	6	86	0	54	233	11
Total	**625**	**633**	**642**	**634**	**557**	**638**	**643**	**634**	**631**	**601**	**638**	**634**	**643**	**638**	**642**	**630**	**621**
LSI	**5.6**	**7.3**	**7.8**	**5.9**	**5.6**	**7.2**	**5.2**	**8.1**	**6.0**	**6.0**	**6.1**	**5.2**	**6.4**	**2.8**	**5.5**	**6.8**	**4.9**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.2B: Promising entries with low susceptibility index (SI≤5.0) and high promising index in NSN-2 to sheath blight, *Kharif*-2023

P. No.	IET No.	Location/Frequency of scores (0-9)																						
		ADT	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NVS	PNT	PTB	PTN	RPR	TTB	VRN	SI	Total	<=3	PI (<=3)*	<=5	PI (<=5)**
197	31682	1	9	7	5	5	7	0	5	3	7	5	3	3	1	5	3	5	**4.4**	**17**	**7**	**41.2**	**13**	**76.5**
176	31662	1	3	7	5	-	7	0	5	5	5	5	5	7	1	5	9	3	**4.6**	**16**	**5**	**31.3**	**12**	**75.0**
212	31696	1	5	7	7	5	7	0	7	5	3	7	5	3	3	5	3	5	**4.6**	**17**	**6**	**35.3**	**12**	**70.6**
202	31687	7	5	9	-	5	-	0	-	-	5	7	-	0	1	7	-	-	**4.6**	**10**	**3**	**30.0**	**6**	**60.0**
400	31906	1	7	9	5	3	7	1	7	3	5	5	5	5	3	5	5	3	**4.6**	**17**	**6**	**35.3**	**13**	**76.5**
196	31681	1	7	7	5	7	7	0	7	3	5	7	5	5	3	5	3	3	**4.7**	**17**	**6**	**35.3**	**11**	**64.7**
298	31836	3	7	7	5	3	7	3	5	5	7	5	5	5	3	5	3	3	**4.8**	**17**	**6**	**35.3**	**13**	**76.5**
550	31059	3	9	5	5	5	7	1	7	3	5	7	5	5	1	5	5	3	**4.8**	**17**	**5**	**29.4**	**13**	**76.5**
118	31553	1	9	7	5	5	7	1	7	3	7	5	5	5	1	5	5	3	**4.8**	**17**	**5**	**29.4**	**12**	**70.6**
235	31717	5	3	9	5	-	7	0	7	3	5	7	5	5	5	5	3	3	**4.8**	**16**	**5**	**31.3**	**12**	**75.0**
34	31588	3	3	7	5	5	7	0	7	5	5	5	5	7	1	5	7	5	**4.8**	**17**	**4**	**23.5**	**12**	**70.6**
633	TN1 (S)	9	5	9	9	5	7	9	9	7	7	7	5	9	7	7	9	9	**7.6**	**17**	**0**	**0.0**	**3**	**17.6**
638	IR 50 (S)	9	7	9	9	7	7	7	9	7	7	5	7	7	5	9	9	7	**7.5**	**17**	**0**	**0.0**	**2**	**11.8**
643	Tetep (R)	3	5	5	5	5	7	3	7	5	5	5	5	5	3	3	5	5	**4.8**	**17**	**4**	**23.5**	**15**	**88.2**
LSI		**5.6**	**7.3**	**7.8**	**5.9**	**5.6**	**7.2**	**5.2**	**8.1**	**6.0**	**6.0**	**6.1**	**5.2**	**6.4**	**2.8**	**5.5**	**6.8**	**4.9**	**-**	**-**	**-**	**-**	**-**	**-**

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

Table 4.3A: Location severity index(LSI) and frequency distribution of sheath blight scores of NSN-H, *Kharif* 2023

Score	Location/Frequency of scores (0-9)		
	CTK	IIRR	PNT
0	0	0	0
1	2	0	1
2	0	0	0
3	6	0	17
4	0	0	0
5	8	24	58
6	0	0	0
7	30	58	9
8	0	0	0
9	38	4	0
Total	84	86	85
LSI	**7.3**	**6.5**	**4.8**
Screening method	A	A	A

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 4.3B: Promising entries with low susceptibility index (<=5.0) and high PI in NSN-H to sheath blight, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)								
			CTK	IIRR	PNT	SI	Total	<=3*	PI (<=3)**	<=5*	PI (<=5)**
51	2519	31415	3	5	5	4.3	3	1	33	3	100
16	2305	31383	1	7	5	4.3	3	1	33	2	67
56	2603	31420	1	7	5	4.3	3	1	33	2	67
25	2314	31391	3	7	5	5.0	3	1	33	2	67
35	2503	31401	7	5	3	5.0	3	1	33	2	67
36	2504	31402	3	7	5	5.0	3	1	33	2	67
47	2515	31411	5	7	3	5.0	3	1	33	2	67
58	2605	31421	7	5	3	5.0	3	1	33	2	67
3	2403	30513	5	5	5	5.0	3	0	0	3	100
20	2309	31387	5	5	5	5.0	3	0	0	3	100
64	2611	31426	-	5	5	5.0	2	0	0	2	100
82	Swarnadhan (R)		5	5	5	5.0	3	0	0	3	100
86	Tetep (R)		5	5	5	5.0	3	0	0	3	100
76	TN1(S)		7	9	5	7.0	3	0	0	1	33
LSI			**7.3**	**6.5**	**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)

- **NHSN**

The National Hybrid Screening Nursery (NHSN) was evaluated for their resistance to sheath blight at 20 varied locations. The entries were screened by artificial inoculation at most of the centres except Patna 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 Gangavathi (8.3), Mandya (7.6), Chinsurah (7.4), Titabar (7.3), NRRI (7.2) Ludhiana (7.0); High (LSI 6-7) at Pattambi (6.7), IIRR (6.5), Aduthurai (6.4), Maruteru (6.1), Navasari (6.1), New Delhi (6.0); moderate (LSI 3-6) at Kaul (5.8), Masodha (5.7), Varanasi (5.6), Pant Nagar (4.9), Moncompu (4.7) and Bankura (3.2), Patna (3.1) and Arundhatinagar (3.0). 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 (Table 4.4B). Some of the selected promising entries are namely, IET 31489, 31465, 31436, 31467, 30556, and 31496.

- **DSN**

The Donor Screening Nursery (DSN) was evaluated for resistance to sheath blight at 20 disease hot spot locations in India. The entries were screened by artificial inoculation at all the centers except Patna, 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 Gangavathi (8.1), Mandya (7.9), Ludhiana (7.2), Aduthurai (7.1), Cuttack (7.0), and; high (LSI 6-7) at New Delhi (6.7), Titabar (6.5), Maruteru (6.3), IIRR (6.2), Kaul (6.1), and Pattambi (6.4); moderate (LSI 3-6) at Navasari (6.0), Chiplima (5.8), Varanasi (5.6), Masodha (5.5), Raipur (5.5), Pant Nagar (5.4), Moncompu (4.5), Patna (3.2); and low (LSI >3) at Arundhatinagar (2.1). The selection of promising entries in DSN was done based on the reaction at those locations where LSI was ≥3.0. None of the entries showed resistant (≤3) against sheath blight. However, some of the entries were found better than Tetep and promising (≤5) namely, VP-R36-SHB, VP-R158-SHB, 19345, VP-R109-SHB, VP-R262-SHB, NLRBL-7, NLR 3186, VP-R104-SHB, VP-R298-SHB, VP-R297-SHB, CB 20164, CR1014, NLRBL-5, NLRBL-8, CK 145-3, CK 35-3, NLRBL-4, CB 20117, and RTCNP-97 (Table 4.5B).

Table 4.4A: Location severity index and frequency distribution of sheath blight disease score for NHSN entries, *Kharif*-2023

Score/ Location	Location/Frequency of scores (0-9)																			
	ADT	ARD	BNK	CHN	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NDL	NVS	PNT	PTB	PTN	TTB	VRN
0	0	0	2	0	0	0	0	0	0	7	0	0	0	0	0	0	0	18	0	0
1	0	13	13	0	2	0	0	0	0	11	0	0	0	0	0	0	0	25	0	0
2	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	15	47	40	1	5	0	1	5	0	27	0	5	0	2	2	25	0	36	2	20
4	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	46	13	20	28	17	4	35	52	10	36	23	74	63	57	53	79	39	23	23	53
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	15	0	7	40	47	35	79	45	103	32	38	31	41	60	63	15	62	18	51	29
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	43	0	1	51	47	81	5	0	7	7	59	9	10	1	1	1	19	0	44	13
Total	**119**	**73**	**120**	**120**	**118**	**120**	**120**	**102**	**120**	**120**	**120**	**119**	**114**	**120**	**119**	**120**	**120**	**120**	**120**	**115**
LSI	**6.4**	**3.0**	**3.2**	**7.4**	**7.2**	**8.3**	**6.5**	**5.8**	**7.0**	**4.7**	**7.6**	**5.7**	**6.1**	**6.0**	**6.1**	**4.9**	**6.7**	**3.1**	**7.3**	**5.6**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.4B: Promising entries with low susceptibility index (SI≤5.2) and high promising index in NHSN to sheath blight, *Kharif*-2023

P.No.	IET No.	Location/Frequency of scores (0-9)																									
		ADT	ARD	BNK	CHN	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NDL	NVS	PNT	PTB	PTN	TTB	VRN	SI	Total	<=3	PI (<=3)*	<=5	PI (<=5)**
34	Wazuhophek	5	3	3	7	7	7	3	5	7	3	7	5	5	5	7	3	7	1	5	3	**4.9**	**20**	**7**	**35.0**	**13**	**65.0**
52	Tetep	5	-	1	5	7	7	5	5	7	0	7	5	7	7	7	3	5	3	5	5	**5.1**	**19**	**4**	**21.1**	**12**	**63.2**
90	31489	5	3	7	7	3	7	5	7	7	0	7	3	7	7	5	7	5	3	3	5	**5.2**	**20**	**6**	**30.0**	**11**	**55.0**
72	US-312 (NCH)	5	1	2	5	1	9	7	5	7	7	5	5	5	7	-	5	7	1	9	5	**5.2**	**19**	**4**	**21.1**	**12**	**63.2**
62	31465	5	-	2	5	3	9	7	5	7	3	5	5	5	7	7	5	5	3	7	5	**5.3**	**19**	**4**	**21.1**	**13**	**68.4**
6	31436	5	-	1	9	5	9	5	7	5	3	5	5	7	5	7	5	7	0	7	3	**5.3**	**19**	**4**	**21.1**	**12**	**63.2**
56	DRR Dhan 53	5	3	1	7	5	9	7	-	7	7	5	5	5	5	5	5	7	1	7	5	**5.3**	**19**	**3**	**15.8**	**12**	**63.2**
64	31467	5	3	3	5	9	9	7	5	7	1	5	5	5	5	7	5	7	0	7	7	**5.4**	**20**	**4**	**20.0**	**12**	**60.0**
25	30556	3	-	5	7	7	7	5	5	5	7	5	5	5	7	5	5	7	0	7	5	**5.4**	**19**	**2**	**10.5**	**12**	**63.2**
83	Jaya (RCV)	3	3	3	5	9	9	5	5	7	1	7	3	9	7	7	5	7	1	7	5	**5.4**	**20**	**6**	**30.0**	**11**	**55.0**
33	DRR Dhan 62	5	3	3	5	7	9	5	5	7	1	9	9	5	7	5	5	7	3	5	3	**5.4**	**20**	**5**	**25.0**	**13**	**65.0**
99	31496	9	3	1	5	9	9	5	5	7	5	7	5	-	7	3	3	5	3	7	5	**5.4**	**19**	**5**	**26.3**	**12**	**63.2**
110	TN1	9	-	5	9	7	9	9	5	7	9	7	7	7	5	7	5	9	7	9	9	**7.4**	**19**	**0**	**0.0**	**4**	**21.1**
115	IR 50	9	3	3	9	7	9	9	7	7	5	9	9	7	7	7	3	7	5	9	7	**6.9**	**20**	**3**	**15.0**	**5**	**25.0**
LSI		**6.4**	**3.0**	**3.2**	**7.4**	**7.2**	**8.3**	**6.5**	**5.8**	**7.0**	**4.7**	**7.6**	**5.7**	**6.1**	**6.0**	**6.1**	**4.9**	**6.7**	**3.1**	**7.3**	**5.6**	-	-	-	-	-	-

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

Table 4.5A: Location severity index and frequency distribution of sheath blight disease score for DSN entries, *Kharif*-2023

Score/Location	Location/Frequency of scores (0-9)																			
	ADT	ARD	CHP	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NDL	NVS	PNT	PTB	PTN	RPR	TTB	VRN
0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0
1	4	43	9	3	0	0	0	0	25	0	0	0	0	0	0	0	64	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	30	40	28	13	0	7	3	0	37	1	31	0	0	5	4	4	77	42	32	39
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	37	3	64	48	12	75	88	1	69	34	103	111	47	92	159	95	52	89	43	75
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	17	0	81	55	69	120	101	175	54	42	59	57	144	112	41	71	15	67	62	59
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	118	0	22	88	125	6	3	17	11	128	13	37	13	1	3	40	0	14	59	19
Total	**206**	**86**	**204**	**207**	**206**	**208**	**195**	**193**	**212**	**205**	**206**	**205**	**204**	**210**	**207**	**210**	**208**	**212**	**196**	**192**
LSI	**7.1**	**2.1**	**5.8**	**7.0**	**8.1**	**6.2**	**6.1**	**7.2**	**4.5**	**7.9**	**5.5**	**6.3**	**6.7**	**6.0**	**5.4**	**6.4**	**3.2**	**5.5**	**6.5**	**5.6**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**

(N- Natural; A- Artificial; LSI- Location Severity Index)

Table 4.5B: Promising entries with low susceptibility index (SI≤5.2) and high promising index in DSN to sheath blight, *Kharif*-2023

P.No.	Designation No.	Location/Frequency of scores (0-9)																									
		ADT	ARD	CHP	CTK	GNV	IIRR	KUL	LDN	MNC	MND	MSD	MTU	NDL	NVS	PNT	PTB	PTN	RPR	TTB	VRN	SI	Total	<=3	PI (<=3)	<=5	PI (<=5)
82	WP-SHB	5	3	5	1	5	3	5	5	5	5	5	5	5	5	5	5	1	3	5	5	4.3	20	5	25.0	20	100.0
59	VP-R36-SHB	3	1	5	3	7	5	3	-	1	7	5	7	7	7	5	5	1	5	5	3	4.5	19	7	36.8	14	73.7
70	VP-R158-SHB	3	3	5	5	7	3	3	7	1	5	7	5	7	5	5	5	1	5	5	5	4.6	20	6	30.0	16	80.0
49	19345	3	-	5	7	7	5	5	7	1	5	5	5	7	5	5	5	1	3	5	3	4.7	19	5	26.3	15	78.9
66	VP-R109-SHB	3	-	5	7	7	3	5	7	1	5	5	5	7	5	5	5	1	5	3	5	4.7	19	5	26.3	15	78.9
75	VP-R262-SHB	5	-	7	9	5	5	5	7	0	5	3	5	7	3	5	5	3	5	3	3	4.7	19	6	31.6	15	78.9
160	NLRBL-7	1	1	1	7	9	7	7	7	0	7	5	5	7	5	3	3	3	7	5	5	4.8	20	7	35.0	12	60.0
166	NLR 3186	3	1	3	9	9	5	5	7	0	7	5	5	7	5	5	5	1	5	5	3	4.8	20	6	30.0	15	75.0
64	VP-R104-SHB	5	-	5	5	5	5	5	7	1	5	3	7	5	5	5	5	3	3	7	5	4.8	19	4	21.1	16	84.2
80	VP-R298-SHB	9	1	5	7	5	3	5	7	1	5	3	5	7	5	5	5	5	5	3	5	4.8	20	5	25.0	16	80.0
79	VP-R297-SHB	3	-	5	5	7	5	5	7	0	5	3	7	7	5	5	5	5	5	5	3	4.8	19	4	21.1	15	78.9
144	CB 20164	5	1	1	9	9	5	7	7	3	9	3	5	-	5	5	5	1	5	3	5	4.9	19	6	31.6	14	73.7
124	CR1014	5	-	3	9	9	3	7	7	1	5	5	5	7	7	3	5	1	3	5	5	5.0	19	6	31.6	13	68.4
158	NLRBL-5	3	-	5	5	9	5	5	7	1	7	3	5	9	5	5	5	5	3	3	-	5.0	18	5	27.8	14	77.8
161	NLRBL-8	1	3	3	7	7	5	7	7	3	9	3	5	7	7	5	5	5	5	5	3	5.1	20	6	30.0	13	65.0
148	CK 145-3	3	3	5	7	9	5	5	7	3	5	5	7	7	5	5	5	3	5	3	5	5.1	20	5	25.0	15	75.0
149	CK 35-3	3	-	1	5	7	7	5	7	5	7	5	7	-	7	5	7	1	5	5	3	5.1	18	4	22.2	11	61.1
157	NLRBL-4	3	-	7	5	9	7	7	7	1	9	3	5	7	7	5	5	1	5	3	3	5.2	19	6	31.6	11	57.9
143	CB 20117	3	5	3	-	9	7	5	7	5	5	5	7	7	7	5	5	3	5	3	3	5.2	19	5	26.3	13	68.4
198	Tetep	9	1	5	9	7	5	-	7	5	5	5	7	5	5	5	5	1	5	3	5	5.2	19	3	15.8	14	73.7
132	RTCNP-97	-	3	-	9	-	-	-	-	3	-	-	5	7	5	-	5	-	5	5	-	5.2	9	2	22.2	7	77.8
188	TN1	9	1	5	9	9	9	9	7	9	9	9	5	7	7	9	9	7	9	9	7	7.7	20	1	5.0	3	15.0
193	IR-50	9	1	9	5	7	9	-	7	7	9	9	9	7	7	9	9	5	7	9	9	7.5	19	1	5.3	3	15.8
	LSI	**7.1**	**2.1**	**5.8**	**7.0**	**8.1**	**6.2**	**6.1**	**7.2**	**4.5**	**7.9**	**5.5**	**6.3**	**6.7**	**6.0**	**5.4**	**6.4**	**3.2**	**5.5**	**6.5**	**5.6**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

TRIAL No.5: SCREENING FOR SHEATH ROT RESISTANCE

➢ NSN-1

The National Screening Nursery 1 consisting of 432 entries were evaluated against sheath rot disease at 12 locations across the country. Screening was done artificially in some centers viz., Bankura, Chinsurah, Navasari, Pusa, Rajendranagar, Raipur and Titabar. In Coimbatore and Rajendranagar, inoculation done by thick inoculum spray before panicle intiation. In Chinsurah, Navasari and Raipur, inoculation done by grain culture plugging at booting stage. It was done under natural conditions at Aduthurai, Cuttack, Karjat, Lonavala and Nawagam.

High disease pressure was recorded at Chinsurah (6.9) Raipur (6.6) and Aduthurai (6.3); moderate disease pressure at Navasari (5.8), Karjat (5.3), Nawagam (5.2), Cuttack (5.1), Lonavala (3.7). The disease pressure was very low (LSI≤ 3) at Bankura, Rajendranagar, Pusa, and Titabar, 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*-2023

Score	Location/Frequency of scores (0-9)											
	ADT	BNK	CHN	CTK	KJT	LNV	NVS	NWG	PSA	RNR	RPR	TTB
0	39	97	0	121	0	0	0	0	12	223	0	0
1	24	195	11	0	0	0	0	0	183	17	0	208
2	0	2	0	0	0	0	0	0	0	0	0	0
3	56	101	16	0	39	273	21	50	149	120	0	30
4	0	0	0	0	0	0	0	0	0	0	0	0
5	46	21	98	94	265	149	236	277	65	63	163	2
6	0	0	0	0	0	0	0	0	0	0	0	0
7	39	12	176	104	85	2	156	103	7	5	191	1
8	0	0	0	0	0	0	0	0	0	0	0	0
9	220	3	131	112	10	0	16	0	0	0	77	0
Total	424	431	432	431	399	424	429	430	416	428	431	241
LSI	**6.3**	**1.7**	**6.9**	**5.1**	**5.3**	**3.7**	**5.8**	**5.2**	**2.4**	**1.7**	**6.6**	**1.3**
Screening method	**N**	**A**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**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. It includes IET#29549, 30605, 30078, 30935, 30831, 30233, 31103, 30835, 30757, 29820, 28184, 30662, 30830 and 30877.

Table 5.1B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NSN-1 to Sheath rot, *Kharif*-2023

P. No.	Entry No.	IET No.	Location/Frequency of scores (0-9)								SI	Total	<=3*	PI (<3)**	<=5*	PI (<5)**
			ADT	CHN	CTK	KJT	LNV	NVS	NWG	RPR						
57	5602	29549	0	1	0	3	3	7	5	7	**3.3**	**8**	**5**	**63**	**6**	**75**
237	4019	30605	0	3	0	5	3	5	5	5	**3.3**	**8**	**4**	**50**	**8**	**100**
31	4701	30078	1	1	0	7	5	5	5	5	**3.6**	**8**	**3**	**38**	**7**	**88**
296	4522	30935	0	5	0	3	3	5	5	9	**3.8**	**8**	**4**	**50**	**7**	**88**
322	4216	30831	0	5	0	3	5	7	5	5	**3.8**	**8**	**3**	**38**	**7**	**88**
56	5601	30233	3	3	0	3	3	7	5	7	**3.9**	**8**	**5**	**63**	**6**	**75**
100	5704	31103	0	3	0	5	3	7	5	9	**4.0**	**8**	**4**	**50**	**6**	**75**
315	4209	30835	0	7	0	5	3	7	5	5	**4.0**	**8**	**3**	**38**	**6**	**75**
53	4415	29405 (R)	3	3	0	5	3	5	7	7	**4.1**	**8**	**4**	**50**	**6**	**75**
197	3915	30757	9	1	0	5	3	5	5	5	**4.1**	**8**	**3**	**38**	**7**	**88**
204	3606	29820	0	5	5	5	3	7	3	5	**4.1**	**8**	**3**	**38**	**7**	**88**
268	4820	28184	3	5	0	7	3	5	5	5	**4.1**	**8**	**3**	**38**	**7**	**88**
136	3410	30662	0	5	5	5	5	5	3	5	**4.1**	**8**	**2**	**25**	**8**	**100**
10	5111	30830	1	5	0	5	5	5	5	7	**4.1**	**8**	**2**	**25**	**7**	**88**
316	4210	30877	0	5	0	5	-	9	5	5	**4.1**	**7**	**2**	**29**	**6**	**86**
419	HR 12 (S)		9	7	5	9	3	7	7	7	**6.8**	**8**	**1**	**13**	**2**	**25**
LSI			**6.3**	**6.9**	**5.1**	**5.3**	**3.7**	**5.8**	**5.2**	**6.6**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

➢ **NSN-2**

The NSN -2 nursery consisting of 643 entries was evaluated only at five 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 Raipur (6.6), Aduthurai (6.3), Navasari (5.8) and Nawagam (5.3) and very low disease pressure at Pusa (2.0), hence the data from these center was not considered for selecting the resistant entries for sheath rot (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#31586, 31820, 31672, 31800, 31675, 31677, 31685, 31706, 31719, 31895, 31865, 31628, 31683, 31689, 30713, 31812, 31994, 31616, 31906, 31725, 31587, 31553, 31658, 31710 and 31827.

Table 5.2A: Location severity index (LSI) and frequency distribution of sheath rot scores of NSN-2, *Kharif*-2023

Score	Location/Frequency of scores (0-9)				
	ADT	NVS	NWG	PSA	RPR
0	39	0	0	38	0
1	26	0	0	360	0
2	0	0	0	0	0
3	119	37	86	162	1
4	0	0	0	0	0
5	90	337	367	69	242
6	0	0	0	0	0
7	32	241	177	11	270
8	0	0	0	0	0
9	319	23	3	0	129
Total	625	638	633	640	642
LSI	**6.3**	**5.8**	**5.3**	**2.0**	**6.6**
Screening method	**N**	**A**	**N**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 5.2B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NSN-2 to Sheath rot, *Kharif*-2023

P. No.	Breeding No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			ADT	NVS	NWG	RPR						
32	3832	31586	0	5	3	5	**3.3**	**4**	**2**	**50**	**4**	**100**
281	4929	31820	0	5	3	5	**3.3**	**4**	**2**	**50**	**4**	**100**
187	4161	31672	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
260	4908	31800	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
190	4301	31675	0	7	3	5	**3.8**	**4**	**2**	**50**	**3**	**75**
192	4303	31677	0	3	5	7	**3.8**	**4**	**2**	**50**	**3**	**75**
200	4311	31685	0	3	5	7	**3.8**	**4**	**2**	**50**	**3**	**75**
222	4333	31706	0	5	3	7	**3.8**	**4**	**2**	**50**	**3**	**75**
237	4348	31719	0	7	3	5	**3.8**	**4**	**2**	**50**	**3**	**75**
385	5507	31895	0	7	3	5	**3.8**	**4**	**2**	**50**	**3**	**75**
557	5410	31865	0	5	3	7	**3.8**	**4**	**2**	**50**	**3**	**75**
140	4114	31628	0	5	5	5	**3.8**	**4**	**1**	**25**	**4**	**100**
198	4309	31683	0	5	5	5	**3.8**	**4**	**1**	**25**	**4**	**100**
204	4315	31689	0	5	5	5	**3.8**	**4**	**1**	**25**	**4**	**100**
13	3813	30713	3	5	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
272	4920	31812	5	3	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
473	6108	31994	3	5	3	5	**4.0**	**4**	**2**	**50**	**4**	**100**
127	4101	31616	1	5	3	7	**4.0**	**4**	**2**	**50**	**3**	**75**
400	5522	31906	1	7	3	5	**4.0**	**4**	**2**	**50**	**3**	**75**
244	4355	31725	0	-	5	7	**4.0**	**3**	**1**	**33**	**2**	**67**
33	3833	31587	1	5	5	5	**4.0**	**4**	**1**	**25**	**4**	**100**
118	3555	31553	1	5	5	5	**4.0**	**4**	**1**	**25**	**4**	**100**
172	4146	31658	1	5	5	5	**4.0**	**4**	**1**	**25**	**4**	**100**
226	4337	31710	1	5	5	5	**4.0**	**4**	**1**	**25**	**4**	**100**
289	4937	31827	1	5	5	5	**4.0**	**4**	**1**	**25**	**4**	**100**
633	TN1 (S)		9	7	5	9	**7.5**	**4**	**0**	**0**	**1**	**25**
630	HR 12(S)		9	7	7	7	**7.5**	**4**	**0**	**0**	**0**	**0**
LSI			**6.3**	**5.8**	**5.3**	**6.6**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has 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 Karjat was 4.6 and at in Lonavala 3.9. The frequency distribution of scores at Karjat centre indicated that, 17 entries showed 1 score, 20 entries showed score of 7 and 9 entries scored 9 and in Lonavala and remaining all entries showed very less score of below 5 (Table 5.3A).

The promising entries were selected based on the disease data of those locations where the disease pressure was moderate. The promising entries that had an SI less than 3.0 are IET # 28906, 31402, 31414, 31420, 31421, 31422, 29654, 31383, 31391, 31394, 31397, 31400, 31404, 31405, 31409, 31426, 31416, 31417, 31427, 31429 and 31431 (Table 5.3B).

Table 5.3A: Location severity index (LSI) and frequency distribution of sheath rot scores of NSN-H, *Kharif*-2023

Score	Location/Frequency of scores (0-9)	
	KJT	LNV
0	0	0
1	17	0
3	20	47
5	17	37
7	20	1
9	9	0
Total	83	85
LSI	**4.6**	**3.9**
Screening method	N	N

(LSI-Location Severity Index; N-Natural; A-Artificial)

Table 5.3B: Promising entries with low susceptibility index (≤ 4.0) and high PI in NSN-H to Sheath rot, *Kharif*-2023

P. No.	Entry No.	IET No.	Location/Frequency of scores (0-9)		SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			KJT	LNV						
2	2402	28906	1	3	2.0	2	2	100	2	100
36	2504	31402	1	3	2.0	2	2	100	2	100
50	2518	31414	1	3	2.0	2	2	100	2	100
56	2603	31420	1	3	2.0	2	2	100	2	100
58	2605	31421	1	3	2.0	2	2	100	2	100
59	2606	31422	1	3	2.0	2	2	100	2	100
1	2401	29654	-	3	3.0	1	1	100	1	100
16	2305	31383	3	3	3.0	2	2	100	2	100
25	2314	31391	3	3	3.0	2	2	100	2	100
28	2317	31394	3	3	3.0	2	2	100	2	100
31	2320	31397	3	3	3.0	2	2	100	2	100
34	2502	31400	3	3	3.0	2	2	100	2	100
39	2507	31404	3	3	3.0	2	2	100	2	100
40	2508	31405	3	3	3.0	2	2	100	2	100

P. No.	Entry No.	IET No.	Location/Frequency of scores (0-9) KJT	LNV	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
45	2513	31409	3	3	3.0	2	2	100	2	100
64	2611	31426	3	3	3.0	2	2	100	2	100
52	2520	31416	1	5	3.0	2	1	50	2	100
53	2522	31417	1	5	3.0	2	1	50	2	100
65	2612	31427	1	5	3.0	2	1	50	2	100
67	2701	31429	1	5	3.0	2	1	50	2	100
71	2705	31431	1	5	3.0	2	1	50	2	100
73	HR-12		1	3	2.0	2	2	100	2	100
86	Tetep		1	5	3.0	2	1	50	2	100
LSI			**4.6**	**3.9**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

➢ **NHSN**

The NHSN trial consisted of 120 entries including checks. The entries were evaluated at 12 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 (7.6) and Cuttack (7.3); high at Chinsurah (6.6), Navasari (5.9), Nawagam (5.6), Pusa (4.0) and Lonavala (3.9). The disease pressure was very low (LSI≤ 3) at Bankura, Karjat, Rajendranagar and Titabar, 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. 31495, 31469, 31470, 30558, 31466, 31436, 31460, 31471, 31478 and 31472 (Table 5.4B).

Table 5.4A: Location severity index (LSI) and frequency distribution of sheath rot scores of NHSN, *Kharif*-2023

Score	Location/Frequency of scores (0-9) ADT	BNK	CHN	CTK	KJT	LNV	NVS	NWG	PSA	RNR	TTB
0	0	46	0	9	0	0	0	0	4	63	0
1	1	47	0	0	69	0	0	0	16	33	67
2	0	14	0	0	0	0	0	0	0	0	0
3	14	12	3	0	18	65	3	8	41	18	36
4	0	0	0	0	0	0	0	0	0	0	0
5	13	1	27	8	23	55	59	66	34	2	9
6	0	0	0	0	0	0	0	0	0	0	0
7	11	0	79	44	10	0	56	46	25	4	2
8	0	0	0	0	0	0	0	0	0	0	0
9	80	0	11	54	0	0	1	0	0	0	0
Total	119	120	120	115	120	120	119	120	120	120	114
LSI	**7.6**	**1.0**	**6.6**	**7.3**	**2.6**	**3.9**	**5.9**	**5.6**	**4.0**	**1.0**	**2.1**
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*-2023

P.No.	Entry No.	IET No.	Location/Frequency of scores (0-9)							SI	Total	<=3*	PI (<=3)**	<=5*	PI (<=5)**
			ADT	CHN	CTK	LNV	NVS	NWG	PSA						
97	3103	31495	5	7	0	3	7	5	1	**4.0**	**7**	**3**	**43**	**5**	**71**
66	2930	31469	5	3	7	3	7	5	3	**4.7**	**7**	**3**	**43**	**5**	**71**
67	2931	31470	3	7	7	3	5	5	3	**4.7**	**7**	**3**	**43**	**5**	**71**
37	2910	30558	9	7	0	5	5	3	5	**4.9**	**7**	**2**	**29**	**5**	**71**
63	2927	31466	9	7	0	5	5	7	1	**4.9**	**7**	**2**	**29**	**4**	**57**
6	2806	31436	3	5	9	3	5	5	5	**5.0**	**7**	**2**	**29**	**6**	**86**
47	2920	31460	3	7	7	5	5	5	3	**5.0**	**7**	**2**	**29**	**5**	**71**
68	3001	31471	3	7	5	3	7	5	5	**5.0**	**7**	**2**	**29**	**5**	**71**
77	3010	31478	5	7	7	3	5	3	5	**5.0**	**7**	**2**	**29**	**5**	**71**
69	3002	31472	5	7	5	3	5	5	5	**5.0**	**7**	**1**	**14**	**6**	**86**
110	TN1(S)		9	7	9	3	7	7	7	**7.0**	**7**	**1**	**14**	**1**	**14**
LSI			**7.6**	**6.6**	**7.3**	**3.9**	**5.9**	**5.6**	**4.0**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

- **DSN**

The DSN trial consisted of 212 entries including checks were screened at eight locations across the country. The frequency distribution of disease scores and the LSI are presented in the Table 5.5A. The nursery was screened under natural conditions at Aduthurai, Karjat, Lonavala, Nawagam and artificially done in remaining locations viz., Navasari, Pusa, Rajendranagar and Raipur. Very high disease pressure was at Aduthurai (7.2); high disease pressure was recorded at Raipur (6.9), Karjat (5.8), Navasari (5.7), Nawagam (5.2). Moderate disease pressure was recorded at Lonavala (3.4) and very low disease pressure was observed Pusa (2.4) and Rajendranagar (0.8) during the season, so the data from these two locations were not considered for the selection of resistant lines.

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 NLRBL-7, NKRBL-8, CB 20117 and NLR 3276.

Table 5.5A: Location severity index (LSI) and frequency distribution of sheath rot scores of DSN, *Kharif*-2023

Score	Location/Frequency of scores (0-9)							
	ADT	KJT	LNV	NVS	NWG	PSA	RNR	RPR
0	5	1	0	0	0	11	126	0
1	7	0	0	0	0	101	55	0
2	0	0	1	0	0	0	0	0
3	21	14	166	12	33	49	14	0
4	0	0	0	0	0	0	0	0

Score	Location/Frequency of scores (0-9)							
	ADT	KJT	LNV	NVS	NWG	PSA	RNR	RPR
5	29	103	42	119	126	35	8	66
6	0	0	0	0	0	0	0	0
7	17	70	0	75	49	10	5	92
8	0	0	0	0	0	0	0	0
9	127	11	0	4	0	0	0	54
Total	206	199	209	210	208	206	208	212
LSI	**7.2**	**5.8**	**3.4**	**5.7**	**5.2**	**2.4**	**0.8**	**6.9**
Screening method	**N**	**N**	**N**	**A**	**N**	**A**	**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*-2023

P.No.	Designations	Location/Frequency of scores (0-9)						SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		ADT	KJT	LNV	NVS	NWG	RPR						
160	NLRBL-7	0	3	3	5	3	5	**3.2**	**6**	**4**	**67**	**6**	**100**
161	NLRBL-8	0	3	3	3	3	9	**3.5**	**6**	**5**	**83**	**5**	**83**
143	CB 20117	3	5	3	3	5	5	**4.0**	**6**	**3**	**50**	**6**	**100**
164	NLR 3276	3	3	3	5	5	5	**4.0**	**6**	**3**	**50**	**6**	**100**
166	NLR 3186	0	3	3	5	5	9	**4.2**	**6**	**3**	**50**	**5**	**83**
158	NLRBL-5	0	5	3	7	5	5	**4.2**	**6**	**2**	**33**	**5**	**83**
159	NLRBL-6	0	5	3	5	5	7	**4.2**	**6**	**2**	**33**	**5**	**83**
79	VP-R297-SHB	3	3	3	5	5	7	**4.3**	**6**	**3**	**50**	**5**	**83**
91	VP-D10-SHB	3	5	3	5	3	7	**4.3**	**6**	**3**	**50**	**5**	**83**
145	CB 20166	3	3	3	5	5	7	**4.3**	**6**	**3**	**50**	**5**	**83**
58	VP-R27-SHB	3	5	3	5	5	5	**4.3**	**6**	**2**	**33**	**6**	**100**
65	VP-R107-SHB	5	5	3	3	5	5	**4.3**	**6**	**2**	**33**	**6**	**100**
107	RP-Bio-Patho-3	3	5	3	5	5	5	**4.3**	**6**	**2**	**33**	**6**	**100**
124	CR1014	3	5	3	5	5	5	**4.3**	**6**	**2**	**33**	**6**	**100**
141	CB 18586	5	3	3	5	5	5	**4.3**	**6**	**2**	**33**	**6**	**100**
59	VP-R36-SHB	1	5	5	5	3	7	**4.3**	**6**	**2**	**33**	**5**	**83**
88	VP-D6-SHB	1	5	3	7	5	5	**4.3**	**6**	**2**	**33**	**5**	**83**
148	CK 145-3	1	7	3	5	5	5	**4.3**	**6**	**2**	**33**	**5**	**83**
154	CO 51	9	7	3	7	7	9	**7.0**	**6**	**1**	**17**	**1**	**17**
LSI		**7.2**	**5.8**	**3.4**	**5.7**	**5.2**	**6.9**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**)

TRIAL No.6: SCREENING FOR BACTERIAL BLIGHT RESISTANCE

- **NSN-1**

The National Screening Nursery-1 (NSN-1) consisted of 432 entries including checks. The entries were evaluated at 25 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> 8.0) at Cuttack (8.1); high (LSI-6-8) at Pantnagar (7.4), Pattambi (7.0), Chiplima (6.7), Maruteru (6.6), Raipur (6.6), Navasari (6.0), IIRR (6.0) and Aduthurai (6.0); moderate (LSI-3-6) at Ludhiana (5.9), Nawagam (5.9), Varanasi (5.7), Chinsurah (5.7), Gangavathi (5.6), Masodha (5.5), Chatha (5.4), Karjat (5.3), Titabar (4.8), Karaikal (4.7), Jagtial (4.9), Sabour (4.5), Nellore (4.4), Patna (3.7), Moncompu (3.0) and very low (LSI < 3) at Bankura (2.3).

For selection of the promising entries, data of Bankura was not considered as the disease pressure was very low (LSI below 3). The promising entries which exhibited an SI of less than or equal to 4.5 and which showed a disease score of 5 at or more than 60% locations are presented in Table 6.1B. Some of the promising entries which performed better than resistant check Improved Samba Mahsuri and scored SI less than 4.1 and showed a disease score of 5 at more than 60% locations were IET # 30827, 32052, 30835, 30830, 30605, 32066, 32055, 32053 and 32052. Some other promising entries which scored an SI of less than or equal to 4.5 were IET # 30772, 32048, 29891, 30877, 31002, 30240, 30078, 30819, 31120, 32055 and 30827.

- **NSN-2**

The National Screening Nursery-2 (NSN-2) consisted of 643 entries including different checks. The entries were evaluated at 17 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**.** None of the centres showed a very high (LSI >8) disease pressure; disease pressure was high (LSI- 6-8) at Pattambi (7.4), Raipur (7.2), IIRR (7.1), Pantnagar (6.9), Maruteru (6.6), Nawagam (6.0), Aduthurai (6.1) and Ludhiana (6.1). Moderate disease pressure (LSI 3-6) was recorded at Navasari (5.9), Gangavathi (5.8), Titabar (5.7), Masodha (5.6), Varanasi (5.3), Chatha (5.2), Sabour (4.0) and Patna (3.4). The disease pressure was very (LSI<3) low at Moncompu (2.7); hence for selection of the promising entries, data of Moncompu was not considered.

The promising entries with SI less than or equal to 4.8 and the entries which exhibited a score of 5 at or more than 60% 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 less than 4.6 and showed a disease score of 5 at more than 60% test locations are IET # 31645, 31710, 31566, 31627, 31723, 31637, 31665, 31621, 31646, and 31568. Some other promising entries which score an SI of less than or equal to 4.8 were IET # 32030, 31781, 30649, 31632, 31789, 31658, 31586, 31605, 32002, 31705, 31908, 32001 and 31578.

Table 6.1A: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN 1, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)											
	ADT	BNK	CHN	CHP	CHT	CTK	GNV	IIRR	JGL	KJT	KRK	LDN
0	4	45	0	0	0	0	0	0	0	0	38	0
1	6	185	0	6	0	8	15	79	17	0	46	1
2	0	2	0	0	0	0	0	0	0	0	0	0
3	54	129	123	34	35	26	91	36	80	0	62	81
4	0	0	0	0	0	0	0	0	0	0	0	0
5	137	36	109	104	276	14	133	45	174	335	152	82
6	0	0	0	0	0	0	0	0	0	0	0	0
7	148	24	127	143	106	45	120	124	89	62	79	253
8	0	0	0	0	0	0	0	0	0	0	0	0
9	75	9	73	132	7	333	66	142	7	2	55	10
Total	**424**	**430**	**432**	**419**	**424**	**426**	**425**	**426**	**367**	**399**	**432**	**427**
LSI	**6.0**	**2.3**	**5.7**	**6.7**	**5.4**	**8.1**	**5.6**	**6.0**	**4.9**	**5.3**	**4.7**	**5.9**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location Severity Index; N-Natural; A-Artificial)

(Contd.,) Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN 1, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)												
	MNC	MSD	MTU	NLR	NVS	NWG	PNT	PTB	PTN	RPR	SBR	TTB	VRN
0	133	0	0	0	0	0	0	6	0	0	57	0	0
1	38	0	0	46	0	0	10	0	77	0	57	1	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	74	38	2	111	25	3	30	6	170	18	83	131	49
4	0	0	0	0	0	0	0	1	0	0	0	0	0
5	138	255	167	187	168	233	67	89	130	87	68	215	187
6	0	0	0	0	0	0	0	2	0	0	0	0	0
7	48	129	159	64	227	191	67	202	43	294	81	59	161
8	0	0	0	0	0	0	0	0	0	1	0	0	0
9	0	4	95	4	9	3	249	126	2	32	75	17	11
Total	**431**	**426**	**423**	**412**	**429**	**430**	**423**	**432**	**422**	**432**	**421**	**423**	**408**
LSI	**3.0**	**5.5**	**6.6**	**4.4**	**6.0**	**5.9**	**7.4**	**7.0**	**3.7**	**6.6**	**4.5**	**4.8**	**5.7**
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 <4.5) with score <5 to BB at more than 60% of the locations

P.No.	Br. No.	IET No.	ADT	CHN	CHP	CHT	CTK	GNV	IIRR	JGL	KJT	KRK	LDN	MNC	MSD	MTU	NLR	NVS	NWG	PNT	PTB	PTN	RPR	SBR	TTB	VRN	SI	Total	PI (<3)**	PI (<5)**
9	5110	30827	3	3	3	5	7	7	1	1	5	1	5	0	5	5	3	7	5	3	5	1	7	1	1	5	**3.7**	**24**	**50**	**83**
329	4225	32052	3	3	5	5	3	3	1	-	-	7	3	0	3	5	3	5	7	1	5	3	7	0	5	7	**3.8**	**22**	**55**	**82**
315	4209	30835	3	3	3	5	7	5	5	7	5	0	3	0	5	-	1	7	5	5	5	3	7	0	3	3	**3.9**	**23**	**48**	**83**
10	5111	30830	3	3	1	5	5	9	1	-	5	0	7	1	3	5	1	7	7	3	7	3	7	1	3	5	**4.0**	**23**	**52**	**74**
237	4019	30605	3	7	5	3	7	7	1	-	5	0	3	0	5	7	1	7	5	3	3	1	7	0	5	7	**4.0**	**23**	**48**	**70**
351	4247	32066	1	3	-	5	3	5	1	5	-	1	3	3	5	5	-	9	-	5	7	-	5	0	3	7	**4.0**	**19**	**47**	**84**
122	5726	32055	7	3	9	5	1	3	1	5	5	3	3	0	7	5	5	5	5	1	9	1	5	0	3	5	**4.0**	**24**	**46**	**83**
333	4229	32053	7	3	3	7	1	5	1	3	5	5	3	0	5	7	3	5	5	3	7	1	7	1	5	5	**4.0**	**24**	**46**	**79**
414	5215	32052	3	3	1	5	3	9	1	7	5	9	3	0	3	5	3	5	7	5	3	3	7	1	3	5	**4.1**	**24**	**54**	**79**
220	4002	30772	3	3	3	3	3	3	5	-	5	1	7	5	5	5	3	7	5	7	7	3	5	1	5	3	**4.2**	**23**	**48**	**83**
243	4026	32048	1	5	5	5	3	3	1	7	5	5	7	0	3	7	5	5	7	3	7	3	7	0	3	5	**4.3**	**24**	**42**	**75**
309	4203	29891	3	3	5	5	7	5	7	5	5	0	3	0	7	5	3	3	5	7	5	3	7	3	3	7	**4.4**	**24**	**42**	**75**
316	4210	30877	3	7	-	-	7	5	7	-	5	0	7	1	5	5	-	5	7	-	0	-	7	0	-	-	**4.4**	**16**	**31**	**63**
256	4808	31002	5	3	7	3	7	7	1	7	5	3	3	0	3	5	1	5	5	1	9	5	9	3	3	7	**4.5**	**24**	**46**	**71**
65	5610	30240	9	3	5	3	9	3	3	3	5	3	3	0	7	5	7	5	5	5	5	7	5	0	3	5	**4.5**	**24**	**42**	**79**
31	4701	30078	5	9	3	5	9	5	3	3	5	0	7	0	5	7	3	5	5	7	5	1	8	0	3	5	**4.5**	**24**	**38**	**75**
230	4012	30819	3	5	-	5	9	3	3	3	5	3	5	0	3	5	5	7	5	9	5	1	5	3	5	7	**4.5**	**23**	**39**	**83**
84	6008	31120	9	3	7	5	9	5	3	3	5	5	3	3	5	5	3	7	5	5	7	3	3	0	3	3	**4.5**	**24**	**46**	**79**
339	4235	32055	5	3	5	3	9	3	1	5	7	9	3	0	5	7	5	5	5	1	9	3	7	3	3	3	**4.5**	**24**	**46**	**75**
326	4222	30827	5	3	7	5	3	5	1	5	5	7	3	3	3	7	3	7	7	3	5	5	5	0	5	7	**4.5**	**24**	**38**	**75**
422	**TN1 (S)**		**7**	**9**	**9**	**5**	**9**	**9**	**9**	**7**	**7**	**9**	**7**	**7**	**9**	**7**	**7**	**7**	**9**	**9**	**7**	**9**	**7**	**9**	**5**	**5**	**7.7**	**24**	**0**	**13**
430	**RP Bio 226 (R)**		**5**	**5**	**5**	**3**	**9**	**3**	**3**	**3**	**7**	**9**	**5**	**7**	**3**	**5**	**5**	**3**	**5**	**3**	**5**	**5**	**7**	**1**	**3**	**5**	**4.8**	**24**	**38**	**79**
LSI			**6.0**	**5.7**	**6.7**	**5.4**	**8.1**	**5.6**	**6.0**	**4.9**	**5.3**	**4.7**	**5.9**	**3.0**	**5.5**	**6.6**	**4.4**	**6.0**	**5.9**	**7.4**	**7.0**	**3.7**	**6.6**	**4.5**	**4.8**	**5.7**				

(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'* 2023

Score	Location/Frequency of scores (0-9)								
	ADT	CHT	GNV	IIRR	LDN	MNC	MSD	MTU	NVS
0	1	0	0	0	0	226	0	0	0
1	16	1	40	26	1	45	0	0	0
2	0	0	0	0	0	0	0	0	0
3	86	98	135	51	104	126	61	3	31
4	0	0	0	0	0	0	0	0	0
5	220	374	146	61	104	207	344	230	303
6	0	0	0	0	0	0	0	0	0
7	141	156	158	235	406	37	200	257	295
8	0	0	0	0	0	0	0	0	0
9	161	3	163	263	23	2	26	117	9
Total	**625**	**632**	**642**	**636**	**638**	**643**	**631**	**607**	**638**
LSI	**6.1**	**5.2**	**5.8**	**7.1**	**6.1**	**2.7**	**5.6**	**6.6**	**5.9**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

(Contd.,) Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-2, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)							
	NWG	PNT	PTB	PTN	RPR	SBR	TTB	VRN
0	0	1	6	16	0	144	0	0
1	0	19	0	141	0	33	0	0
2	0	0	0	0	1	0	0	0
3	22	55	3	234	9	189	96	108
4	0	0	0	0	0	0	0	0
5	314	134	81	207	46	89	296	315
6	0	0	0	0	0	0	0	0
7	267	154	303	39	449	86	144	196
8	0	0	0	0	0	0	0	0
9	30	271	250	1	137	98	94	2
Total	**633**	**634**	**643**	**638**	**642**	**639**	**630**	**621**
LSI	**6.0**	**6.9**	**7.4**	**3.4**	**7.2**	**4.0**	**5.7**	**5.3**
Screening	**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 ≤4.8) with score ≤5 to BB at more than 60% of the locations

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)																SI	Total	PI (<-3)**	PI (<-5)**
			ADT	CHT	GNV	IIRR	LDN	MSD	MTU	NVS	NWG	PNT	PTB	PTN	RPR	SBR	TTB	VRN				
159	4133	31645	3	3	9	1	3	5	3	5	5	1	7	1	3	3	3	7	**3.9**	**16**	**63**	**81**
226	4337	31710	1	5	5	3	3	5	7	7	5	3	5	1	3	3	3	-	**3.9**	**15**	**53**	**87**
8	3808	31566	1	-	5	1	3	5	5	7	5	1	7	0	7	5	5	3	**4.0**	**15**	**40**	**80**
139	4113	31627	5	5	7	1	1	3	3	7	7	1	5	5	5	1	7	5	**4.3**	**16**	**38**	**75**
242	4353	31723	5	7	9	1	3	3	5	5	5	3	5	1	7	0	3	7	**4.3**	**16**	**44**	**75**
150	4124	31637	3	5	1	1	3	5	-	7	5	3	7	3	5	5	5	7	**4.3**	**15**	**40**	**80**
179	4153	31665	3	5	5	1	3	5	5	7	7	3	9	1	5	3	3	5	**4.4**	**16**	**44**	**81**
133	4107	31621	3	5	9	3	3	3	7	7	5	3	5	3	7	3	3	3	**4.5**	**16**	**56**	**75**
160	4134	31646	5	5	9	1	3	5	5	3	3	3	7	3	7	3	5	5	**4.5**	**16**	**44**	**81**
12	3812	31568	0	5	9	5	3	5	5	7	5	5	5	5	5	0	3	5	**4.5**	**16**	**25**	**88**
619	6223	32030	5	5	3	3	3	5	5	7	5	7	9	1	7	0	3	5	**4.6**	**16**	**38**	**75**
366	4651	31781	7	7	5	1	3	5	5	5	5	5	5	1	7	0	5	7	**4.6**	**16**	**25**	**75**
1	3801	30649	1	5	3	3	5	5	5	5	5	1	7	7	7	5	7	3	**4.6**	**16**	**31**	**75**
145	4119	31632	3	5	9	7	3	3	5	7	5	9	5	1	7	0	3	3	**4.7**	**16**	**44**	**69**
375	4660	31789	-	7	5	7	-	5	-	7	5	-	0	1	7	3	5	-	**4.7**	**11**	**27**	**64**
172	4146	31658	3	5	9	3	3	5	5	5	7	3	7	3	3	3	5	7	**4.8**	**16**	**44**	**75**
32	3832	31586	3	7	3	1	7	5	5	7	5	1	9	3	7	5	3	5	**4.8**	**16**	**38**	**69**
53	3853	31605	3	5	5	1	3	5	5	7	7	5	7	3	7	3	7	3	**4.8**	**16**	**38**	**69**
482	6117	32002	5	5	5	1	3	5	9	5	5	1	9	3	5	5	5	5	**4.8**	**16**	**25**	**88**
221	4332	31705	3	3	5	7	7	7	5	3	5	7	7	3	7	0	3	5	**4.8**	**16**	**38**	**63**
402	5524	31908	5	3	1	7	7	3	5	7	5	9	5	5	7	0	5	3	**4.8**	**16**	**31**	**69**
481	6116	32001	1	7	3	1	3	7	9	5	5	5	9	5	5	0	5	7	**4.8**	**16**	**31**	**69**
24	3824	31578	5	5	3	5	7	3	5	7	7	5	5	3	7	0	5	5	**4.8**	**16**	**25**	**75**
633	**TN1 (S)**		**9**	**5**	**9**	**9**	**7**	**9**	**7**	**7**	**9**	**9**	**7**	**9**	**9**	**7**	**7**	**5**	7.8	16	0	13
641	**RP Bio 226 (R)**		**9**	**3**	**3**	**3**	**3**	**3**	**-**	**5**	**5**	**3**	**7**	**5**	**7**	**5**	**5**	**3**	4.6	15	47	80
LSI			**6.1**	**5.2**	**5.8**	**7.1**	**6.1**	**5.6**	**6.6**	**5.9**	**6.0**	**6.9**	**7.4**	**3.4**	**7.2**	**4.0**	**5.7**	**5.3**				

(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 85 entries including different checks. The entries were evaluated at 4 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- >8.0) at Cuttack (8.9) and IIRR (8.2), while it was high (LSI 6-8) at Pantnagar (7.5). Moderate disease pressure was recorded at Karjat (4.9). 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 6.5 and which exhibited a disease score of 5 at or more than 50% locations are presented in Table 6.3B. None of the entries performed better than resistant check Improved Samba Mahsuri. Some of the promising entries were IET # 31431, 28906, 31393, 31401, 31381, 31391, and 31404.

Table 6.3A: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-Hills, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)			
	CTK	IIRR	KJT	PNT
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	2	13	3
4	0	0	0	0
5	0	5	60	16
6	0	0	0	0
7	3	18	10	22
8	0	0	0	0
9	80	60	0	44
Total	**83**	**85**	**83**	**85**
LSI	**8.9**	**8.2**	**4.9**	**7.5**
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 <u><</u>5 to BB at or more than 50% of the locations

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<=3)**	<=5*	PI (<=5)**
			CTK	IIRR	KJT	PNT						
71	2705	31431	9	7	3	3	5.5	4	2	50	2	50
2	2402	28906	9	7	3	5	6.0	4	1	25	2	50
27	2316	31393	9	5	5	5	6.0	4	0	0	3	75
35	2503	31401	9	-	5	5	6.3	3	0	0	2	67
13	2302	31381	9	3	5	9	6.5	4	1	25	2	50
25	2314	31391	9	9	3	5	6.5	4	1	25	2	50
39	2507	31404	9	5	5	7	6.5	4	0	0	2	50
76	**TN1 (S)**		**9**	**9**	**7**	**9**	**8.5**	**4**	**0**	**0**	**0**	**0**
84	**RP-Bio-226 (R)**		**9**	**3**	**5**	**3**	**5.0**	**4**	**2**	**50**	**3**	**75**
LSI			**8.9**	**8.2**	**4.9**	**7.5**						

(SI-Susceptibility Index; *Promising index (PI): Percentage of locations based on no. of locations where the entry had scored ≤3 and ≤5)

➢ NHSN

The National Hybrid Screening Nursery (NHSN) consisted of 120 entries including different checks. The entries were evaluated at 20 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 Cuttack (8.1) and Pantnagar (8.0); high (LSI-6-8) at Pattambi (7.7), Aduthurai (6.8), Maruteru (6.7), Ludhiana (6.6), IIRR (6.5), Chinsurah (6.4), Masodha (6.3), Nawagam (6.1); moderate (LSI-3-6) at Navasari (5.8), Varanasi (5.7), Chatha (5.4), Titabar (5.3), Patna (5.0), Karjat (4.7), Gangavathi (4.7), Arundatinagar (3.3) and very low (LSI < 3) at Bankura (2.1) and Moncompu (2.4). The promising entries with SI less than 5.5 and which exhibited a score of 5 at or more than 50% of the locations are presented in Table 6.4B. Three entries viz., IET # 31450, 31480, and 31471 performed better than the resistant check Improved Samba Mahsuri (SI 5.0). Other promising entries were which showed an SI of less than or equal to 5.5 were IET # 31460, 31451, 31495, 31449, 31459, 31436 and 31489.

Table 6.4A: Location severity index (LSI) and frequency distribution of bacterial blight scores of NHSN, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)									
	ADT	ARD	BNK	CHN	CHT	CTK	GNV	IIRR	KJT	LDN
0	0	0	0	0	0	0	0	0	0	0
1	0	0	57	0	0	4	6	19	0	3
2	0	0	29	0	0	0	0	0	0	0
3	6	11	15	21	22	2	46	11	29	10
4	0	0	11	0	0	0	0	0	0	0
5	41	2	2	31	57	7	41	6	81	15
6	0	0	1	0	0	0	0	0	0	0
7	29	0	4	32	39	15	14	29	9	73
9	43	0	1	36	2	91	13	53	1	19
Total	**119**	**13**	**120**	**120**	**120**	**119**	**120**	**118**	**120**	**120**
LSI	**6.8**	**3.3**	**2.1**	**6.4**	**5.4**	**8.1**	**4.7**	**6.5**	**4.7**	**6.6**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

(Contd.,) Location severity index (LSI) and frequency distribution of bacterial blight scores of NHSN, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)									
	MNC	MSD	MTU	NVS	NWG	PNT	PTB	PTN	TTB	VRN
0	48	0	0	0	0	0	0	0	0	0
1	8	0	0	0	0	0	0	7	0	0
2	0	0	0	0	0	0	0	0	0	0
3	25	10	0	7	3	5	0	27	28	16
4	0	0	0	0	0	0	0	0	0	0
5	33	40	43	55	56	13	16	47	60	48
6	0	0	0	0	0	0	0	0	0	0
7	6	49	48	57	55	20	49	36	20	46
9	0	20	25	0	6	82	55	3	12	5
Total	**120**	**119**	**116**	**119**	**120**	**120**	**120**	**120**	**120**	**115**
LSI	**2.4**	**6.3**	**6.7**	**5.8**	**6.1**	**8.0**	**7.7**	**5.0**	**5.3**	**5.7**
Screening	**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 ≤5.5) with score ≤5 to BB at or more than 50% of the locations

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)																		SI	Total	PI (<-3)**	PI (<-5)**
			ADT	ARD	CHN	CHT	CTK	GNV	IIRR	KJT	LDN	MSD	MTU	NVS	NWG	PNT	PTB	PTN	TTB	VRN				
23	2905	31450	5	-	3	5	1	3	1	5	7	5	5	5	7	5	5	5	3	3	**4.3**	**17**	**35**	**88**
79	3012	31480	5	-	3	3	7	3	1	5	1	7	5	5	5	5	7	5	3	7	**4.5**	**17**	**35**	**76**
68	3001	31471	5	-	3	3	9	3	1	5	3	7	5	5	5	5	7	7	3	7	**4.9**	**17**	**35**	**71**
47	2920	31460	5	-	3	3	9	3	1	5	3	5	5	7	5	9	7	7	5	5	**5.1**	**17**	**29**	**71**
35	2908	31451	3	-	5	7	9	3	3	5	5	7	5	7	5	5	7	3	5	5	**5.2**	**17**	**24**	**71**
97	3103	31495	5	-	3	5	9	5	1	5	5	7	5	7	5	7	7	5	3	5	**5.2**	**17**	**18**	**71**
22	2904	31449	7	-	5	7	9	3	1	5	7	3	5	5	7	5	9	3	5	5	**5.4**	**17**	**24**	**65**
46	2919	31459	9	-	3	5	9	3	1	3	7	7	5	5	7	7	7	5	3	7	**5.5**	**17**	**29**	**53**
6	2806	31436	7	-	5	7	9	5	1	5	3	7	7	5	5	7	9	1	5	5	**5.5**	**17**	**18**	**59**
90	3023	31489	7	-	9	3	-	3	7	3	7	5	5	5	5	9	5	5	3	7	**5.5**	**16**	**25**	**63**
110	**TN1 (S)**		**9**	**-**	**9**	**5**	**9**	**9**	**9**	**7**	**9**	**9**	**9**	**7**	**9**	**9**	**9**	**9**	**7**	**5**	**8.2**	**17**	**0**	**12**
118	**RP Bio 226 (R)**		**9**	**5**	**3**	**3**	**9**	**3**	**3**	**5**	**3**	**3**	**7**	**3**	**5**	**3**	**9**	**5**	**5**	**7**	**5.0**	**18**	**44**	**72**
	LSI		**6.8**	**3.3**	**6.4**	**5.4**	**8.1**	**4.7**	**6.5**	**4.7**	**6.6**	**6.3**	**6.7**	**5.8**	**6.1**	**8.0**	**7.7**	**5.0**	**5.3**	**5.7**				

(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 212 entries including different checks. The entries were evaluated at 20 locations across the country. The entries were evaluated using artificial inoculation conditions. The frequency distribution of the disease scores and location severity indices are presented in Table 6.5A. In none of the centres disease pressure was very high (LSI > 8); it was high (LSI- 6-8) at Pantnagar (7.5), Pattambi (7.3), Aduthurai (7.3), Raipur (7.3), Maruteru (6.8), Cuttack (6.5), IIRR (6.5); moderate (LSI-3-6) at Chiplima (5.9), Nawagam (5.9), Varanasi (5.9), Karjat (5.7), Gangavathi (5.5), Navasari (5.5), Titabar (5.5), Chatha (5.4), Ludhiana (5.3), Masodha (5.1), Patna (4.4), Sabour (4.0) and very low (LSI- < 3) at Moncompu (2.7).

For selection of the promising entries, data of Moncompu was not considered where the disease pressure was very low. The promising entries with SI less than or equal to 5.0 and which exhibited a score of 5 at or more than 65% of the locations are presented in Table 6.5B. Some of the promising donors included VP-R297-SHB, RP-Bio-Patho-4, RP-Bio-Patho-3, VP-R294-SHB, VP-R261-SHB, VP-R44-SHB, VP-R262-SHB, RP-Bio-Patho-9, VP-R249-SHB, NLRBL-7, VP-R25-SHB, VP-R45-SHB, VP-D6-SHB, VP-R36-SHB, RTCNP-97, VP-R289-SHB, VP-R78-SHB, 19345, NLRBL-2, NLRBL-8, RP-Bio-Patho-5, NLRBL-3, NLRBL-4 and CK 145-3.

Table 6.5A: Location severity index (LSI) and frequency distribution of bacterial blight scores of DSN, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)									
	ADT	CHP	CHT	CTK	GNV	IIRR	KJT	LDN	MNC	MSD
0	0	0	0	0	0	0	0	0	75	0
1	3	7	0	0	7	26	0	1	13	0
2	0	0	0	0	0	0	0	0	0	0
3	14	30	28	5	51	16	0	66	46	41
4	0	0	0	0	0	0	0	0	0	0
5	36	73	105	67	65	23	136	36	63	114
6	0	0	0	0	0	0	0	0	0	0
7	44	55	71	108	40	60	59	90	14	46
8	0	0	0	0	0	0	0	0	0	0
9	109	39	0	29	43	81	4	2	1	5
Total	**206**	**204**	**204**	**209**	**206**	**206**	**199**	**195**	**212**	**206**
LSI	**7.3**	**5.9**	**5.4**	**6.5**	**5.6**	**6.5**	**5.7**	**5.3**	**2.7**	**5.1**
Screening	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(LSI-Location severity Index; N-Natural; A-Artificial)

(Contd.,) Location severity index (LSI) and frequency distribution of bacterial blight scores of DSN, *Kharif'* 2023

Score	Location/Frequency of scores (0-9)									
	MTU	NVS	NWG	PNT	PTB	PTN	RPR	SBR	TTB	VRN
0	0	0	0	0	1	0	0	37	0	0
1	0	0	0	5	0	30	0	5	2	0
2	0	0	0	0	0	0	0	0	0	0
3	0	21	4	12	0	45	13	66	34	22
4	0	0	0	0	0	0	0	0	0	0
5	71	118	102	33	42	96	25	51	91	72
6	0	0	0	0	0	0	0	0	0	0
7	74	70	102	37	87	35	89	29	54	83
8	0	0	0	0	0	0	0	0	0	0
9	49	1	0	120	77	2	85	20	15	15
Total	**194**	**210**	**208**	**207**	**207**	**208**	**212**	**208**	**196**	**192**
LSI	**6.8**	**5.5**	**5.9**	**7.5**	**7.3**	**4.4**	**7.3**	**4.0**	**5.5**	**5.9**
Screening	**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 ≤5) with score <5 to BB at or more than 65% of the locations

P.No.	Designations	Location/Frequency of scores (0-9)																			SI	Total	PI (<-3)**	PI (<-5)**
		ADT	CHP	CHT	CTK	GNV	IIRR	KJT	LDN	MSD	MTU	NVS	NWG	PNT	PTB	PTN	RPR	SBR	TTB	VRN				
79	VP-R297-SHB	3	1	5	7	5	5	5	3	3	5	3	5	5	5	1	3	3	3	5	**3.9**	**19**	**47**	**95**
108	RP-Bio-Patho-4	9	3	5	7	3	1	5	3	5	5	5	7	3	5	3	3	3	3	5	**4.4**	**19**	**47**	**84**
107	RP-Bio-Patho-3	1	7	5	9	3	1	5	3	3	5	7	5	3	5	5	5	0	5	7	**4.4**	**19**	**37**	**79**
78	VP-R294-SHB	5	1	3	7	3	1	5	3	7	5	3	5	3	7	5	3	7	5	7	**4.5**	**19**	**42**	**74**
74	VP-R261-SHB	5	5	5	5	5	1	5	3	5	5	3	3	9	5	5	5	3	3	5	**4.5**	**19**	**32**	**95**
61	VP-R44-SHB	5	5	7	5	5	1	5	3	3	-	5	7	1	7	1	9	3	3	7	**4.6**	**18**	**39**	**72**
75	VP-R262-SHB	5	3	5	5	5	1	5	3	5	5	3	5	7	7	1	5	5	3	9	**4.6**	**19**	**32**	**84**
113	RP-Bio-Patho-9	9	7	5	7	7	1	5	3	3	5	5	5	1	7	3	5	0	5	5	**4.6**	**19**	**32**	**74**
73	VP-R249-SHB	5	5	5	5	3	3	7	3	7	5	3	5	9	-	1	5	5	5	3	**4.7**	**18**	**33**	**83**
160	NLRBL-7	3	3	3	5	5	7	5	3	3	5	5	5	9	5	5	7	3	5	3	**4.7**	**19**	**37**	**84**
57	VP-R25-SHB	5	5	5	5	9	1	5	3	3	5	5	5	5	5	7	5	3	5	3	**4.7**	**19**	**26**	**89**
92	VP-R45-SHB	3	3	7	7	5	3	5	3	5	9	5	5	5	7	1	5	0	5	7	**4.7**	**19**	**32**	**74**
88	VP-D6-SHB	3	3	3	9	5	5	5	3	3	7	5	5	9	5	5	3	3	3	7	**4.8**	**19**	**42**	**79**
59	VP-R36-SHB	3	5	3	7	7	3	5	3	7	7	7	5	3	5	5	5	0	5	7	**4.8**	**19**	**32**	**68**
132	RTCNP-97	-	-	7	5	-	-	-	-	-	5	3	-	-	-	-	9	0	5	-	**4.9**	**7**	**29**	**71**
77	VP-R289-SHB	9	3	5	7	3	1	-	7	5	5	3	7	3	7	1	5	5	5	7	**4.9**	**18**	**33**	**67**
63	VP-R78-SHB	5	5	3	3	7	3	5	7	5	5	5	5	3	7	5	5	3	3	9	**4.9**	**19**	**32**	**79**
49	19345	7	5	5	5	7	3	5	3	3	5	5	3	7	7	7	5	3	1	7	**4.9**	**19**	**32**	**68**
155	NLRBL-2	5	3	5	7	9	5	7	3	3	5	5	5	9	5	5	5	0	3	5	**4.9**	**19**	**26**	**79**
161	NLRBL-8	5	5	7	7	3	7	5	3	3	5	5	5	9	5	5	5	0	3	7	**4.9**	**19**	**26**	**74**
109	RP-Bio-Patho-5	9	5	3	7	7	1	5	3	7	7	5	5	1	7	5	7	0	5	5	**4.9**	**19**	**26**	**63**
156	NLRBL-3	5	1	5	5	5	7	5	7	5	5	7	5	9	5	5	3	0	3	7	**4.9**	**19**	**21**	**74**
157	NLRBL-4	1	1	5	5	7	9	5	7	3	5	5	5	9	7	3	7	3	3	5	**5.0**	**19**	**32**	**68**
148	CK 145-3	3	7	3	5	1	5	5	3	7	7	5	5	9	5	5	7	3	5	5	**5.0**	**19**	**26**	**74**
188	**TN1 (S)**	**9**	**5**	**7**	**-**	**9**	**9**	**-**	**7**	**9**	**-**	**7**	**7**	**9**	**9**	**9**	**9**	**9**	**9**	**7**	**8.1**	**16**	**0**	**6**
196	**RP-Bio-226 (R)**	**9**	**7**	**5**	**7**	**3**	**3**	**5**	**5**	**3**	**7**	**3**	**7**	**5**	**9**	**5**	**5**	**1**	**5**	**7**	**5.3**	**19**	**26**	**63**
	LSI	**7.3**	**5.9**	**5.4**	**6.5**	**5.6**	**6.5**	**5.7**	**5.3**	**5.1**	**6.8**	**5.5**	**5.9**	**7.5**	**7.3**	**4.4**	**7.3**	**4.0**	**5.5**	**5.9**				

(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 432 entries including checks was proposed and conducted at 2 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 6.1 at both the locations

Table 7.1A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of NSN-1, *Kharif* 2023

Score	Location/Frequency of scores (0-9)	
	CBT	IIRR
1	0	0
3	13	19
5	196	145
7	184	264
9	27	0
Total	**421**	**428**
LSI	**6.1**	**6.1**
Screening method	**A**	**A**

(N- Natural; A- Artificial)

The entries performed better than the resistant check Vikramarya and showed resistance reaction to rice tungro disease are IET 32067, IET 32067, IET 32067, IET 31119, IET 30657, IET 32036, IET 29820, IET 29708, IET 30604, IET 30932, IET 30917, IET 30942 and IET 30735 (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* 2023

P.No	Br. No.	IET No.	Location/Frequency of scores (0-9)							
			CBT	IIRR	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
352	4248	32067	-	3	**3.0**	**1**	**1**	**100**	**1**	**100**
78	6002	31119	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
174	3449	30657	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
179	3454	32036	3	5	**4.0**	**2**	**1**	**50**	**2**	**100**
204	3606	29820	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**

P.No	Br. No.	IET No.	Location/Frequency of scores (0-9)							
			CBT	IIRR	SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
207	3609	29708	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
228	4010	30604	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
286	4512	30932	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
295	4521	30917	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
302	4528	30942	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
361	3703	30735	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
422	**TN1**		7	7	**7.0**	**2**	**0**	**0**	**0**	**0**
423	**Vikramaraya**		3	3	**3.0**	**2**	**2**	**100**	**2**	**100**
LSI			**6.1**	**6.1**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3 and ≤5)

- **NSN-2**

The national screening nursery 2 (NSN-2) trial consisting of 643 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)

Table7.2A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of NSN-2, Kharif 2023

Score	Location/Frequency of scores (0-9)
	IIRR
1	0
3	29
5	203
7	410
9	0
Total	**642**
LSI	**6.2**
Screening method	**A**

(N- Natural; A- Artificial)

Out of 642 lines tested, only 29 lines showed score 3 and 203 lines showed 5 score against RTD. The lines that were succumbed to RTD were 410. Best performing lines included IET Nos 31570, 31582, 31598, 31504, 31514, 31523, 31527, 31528, 31536, 31618, 31660, 31669, 31681, 31689, 31716, 31720, 31807, 31836, 31748, 31107, 31995, 31934, 31935, 31952, 31863 and 31885 (Table 7.2B).

Table 7.2B: NSN-2 entries with low susceptibility index (SI $\leq$ 3) against rice tungro disease, *Kharif,* 2023.

P.No.	Br. No.	IET No.	IIRR
15	3815	31570	3
28	3828	31582	3
45	3845	31598	3
67	3504	31504	3
77	3514	31514	3
87	3524	31523	3
91	3528	31527	3
92	3529	31528	3
100	3537	31536	3
130	4104	31618	3
174	4148	31660	3
183	4157	31669	3
196	4307	31681	3
204	4315	31689	3
234	4345	31716	3
239	4350	31720	3
267	4915	31807	3
298	4946	31836	3
330	4615	31748	3
443	5806	31107	3
474	6109	31995	3
512	5017	31934	3
513	5018	31935	3
532	5037	31952	3
555	5408	31863	3
586	5439	31885	3
634	Vikramaraya		3

- **NSN-H**

Eighty-six entries were screened against rice tungro disease at IIRR under high disease pressure with LSI 6.3. Out of 86 entries tested only 4 lines (IET 29659, IET 28906, IET 30513 and Vivekdhan 62) shown to be resistant for RTD (Table 7.3A).

Table 7.3A: Location severity index (LSI) and frequency distribution of rice tungro disease scores of NSN-H, *Kharif* 2023

Score	Location/Frequency of scores (0-9)
	IIRR
1	0
3	4
5	21
7	61
9	0
Total	86
LSI	6.3
Screening method	A

- (N- Natural; A- Artificial)

- **NHSN**

The National Hybrid Screening Nursery (NHSN) consisted of 120 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 5.9) and high at IIRR (LSI 6.5).

Table 7.4A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of NHSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)	
	CBT	IIRR
1	0	0
3	11	3
5	52	24
7	51	90
9	6	0
Total	120	117
LSI	5.9	6.5
Screening method	A	A

(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 31441, IET 31432, IET 31435, IET 31440, IET 31476, IET 31485 and IET 31497.

Table 7.4B: Promising entries with low susceptibility index (<=5.0) and high PI in NHSN to Rice tungro disease, *Kharif* 2023.

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)		SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			CBT	IIRR						
12	2812	31441	3	5	**4.0**	**2**	**1**	**50**	**2**	**100**
1	2801	31432	5	5	**5.0**	**2**	**0**	**0**	**2**	**100**
5	2805	31435	5	5	**5.0**	**2**	**0**	**0**	**2**	**100**
11	2811	31440	5	5	**5.0**	**2**	**0**	**0**	**2**	**100**
74	3007	31476	5	5	**5.0**	**2**	**0**	**0**	**2**	**100**
85	3018	31485	5	-	**5.0**	**1**	**0**	**0**	**1**	**100**
100	3106	31497	5	5	**5.0**	**2**	**0**	**0**	**2**	**100**
111	**Vikramaraya**		3	3	**3.0**	**2**	**2**	**100**	**2**	**100**
110	**TN1**		7	7	**7.0**	**2**	**0**	**0**	**0**	**0**
LSI			**5.9**	**6.5**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3 and ≤5)

- **DSN**

Donor screening nursery (DSN) comprising of 212 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 6.3) and moderate at Coimbatore (LSI 6.0).

Table 7.5A: Location severity index (LSI) and frequency distribution of Rice tungro disease scores of DSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)	
	CBT	IIRR
1	0	0
3	2	9
5	106	54
7	95	145
9	2	0
Total	**205**	**208**
LSI	**6.0**	**6.3**
Screening method	**A**	**A**

(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 VP-R289-SHB, CB 17502, WGL 1869 and 4706.

Table 7.5B: Promising entries with low susceptibility index (<=4.0) and high PI in DSN to rice tungro disease, *Kharif* 2023

P.No.	Br.No.	Location/Frequency of scores (0-9)		SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CBT	IIRR						
77	VP-R289-SHB	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
140	CB 17502	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
176	WGL 1869	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
202	4706	3	5	**4.0**	**2**	**1**	**50**	**2**	**100**
188	**TN1**	7	7	**7.0**	**2**	**0**	**0**	**0**	**0**
189	**Vikramarya**	5	3	**4.0**	**2**	**1**	**50**	**2**	**100**
LSI		**6.0**	**6.3**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3 and ≤5)

❖ GLUME DISCOLOURATION

Glume discolouration (GD) was observed at four locations viz., Chatha, Lonavala, Navasari, and Nawagam during *Kharif* 2023. National screening nurseries were tested for GD under natural conditions at all the four locations.

➢ NSN-1

In NSN-1, 438 entries including checks were screened against glume discolouration under natural conditions. Moderate disease pressure was observed at Navasari (LSI 5.4), Nawagam (LSI 5.1), Chatha (LSI 4.8) and Lonavala (LSI 3.6). The frequency distribution of glume discolouration scores are presented in the below table along with location severity indices.

Location severity index (LSI) and frequency distribution of glume discoloration scores of NSN-1, *Kharif* 2023

Score	Location/Frequency of scores (0-9)			
	CHT	LNV	NVS	NWG
1	0	0	0	0
3	76	303	94	70
5	230	121	159	277
7	48	0	176	81
9	0	0	0	1
Total	**354**	**424**	**429**	**430**
LSI	**4.8**	**3.6**	**5.4**	**5.1**
Screening method	**N**	**N**	**N**	**N**

(N- Natural; LSI= Location Severity Index)

The promising entries found in NSN 1 for glume discolouration are IET nos. 30641, 30966, 30902, 30868, 31130, 30658, 30555, 29284 (R), 29290 (R), 29820, 29708, 30918, 30704, 30573, 31042, 31096, 28076, 32060, 29257 (R) and 3204.

Promising entries with low susceptibility index (<=3.8) and high PI in NSN-1 to glume discoloration, *Kharif* 2023

P. No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CHT	LNV	NVS	NWG						
127	30641	-	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
251	30966	3	3	3	3	**3.0**	**4**	**4**	**100**	**4**	**100**
275	30902	3	3	3	3	**3.0**	**4**	**4**	**100**	**4**	**100**
320	30868	-	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
81	31130	5	3	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
134	30658	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
169	30555	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
184	29284 (R)	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
188	29290 (R)	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
204	29820	5	3	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
207	29708	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
293	30918	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
359	30704	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
383	30573	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
410	31042	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
98	31096	5	-	3	3	**3.7**	**3**	**2**	**67**	**3**	**100**
119	28076	-	3	3	5	**3.7**	**3**	**2**	**67**	**3**	**100**
121	32060	-	3	5	3	**3.7**	**3**	**2**	**67**	**3**	**100**
183	29257 (R)	-	3	3	5	**3.7**	**3**	**2**	**67**	**3**	**100**
242	32047	-	5	3	3	**3.7**	**3**	**2**	**67**	**3**	**100**
422		7	3	5	9	**6.0**	**4**	**1**	**25**	**2**	**50**
	LSI	**4.8**	**3.6**	**5.4**	**5.1**						

SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3 and ≤5)

- **NSN-2**

The national screening nursery 2 (NSN-2) trial consisting of 643 entries including checks was conducted only at Chatha, Navasari and Navagam. The disease pressure recorded was moderate at Nawagam (LSI 5.2) Chatha (LSI 5.1) and Navasari (4.8).

Location severity index (LSI) and frequency distribution of glume discoloration scores of NSN-2, *Kharif* 2023

Score	Location/Frequency of scores (0-9)		
	CHT	NVS	NWG
1	2	3	0
3	99	183	134
5	262	320	318
7	126	131	180
9	0	1	1
Total	**489**	**638**	**633**
LSI	**5.1**	**4.8**	**5.2**
Screening method	**N**	**N**	**N**

(N- Natural; LSI- Location Severity Index)

Best performing lines against glume discolouration included IET Nos. 31582, 31589, 31642, 31719, 31725, 31729, 31816, 31819, 31821, 31980, 31992, 31996, 32000, 31946, 31869 and 31856.

Promising entries with low susceptibility index (<=3.0) and high PI in NSN-2 to glume discoloration, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)			SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			CHT	NVS	NWG						
28	3828	31582	-	-	3	3.0	1	1	100	1	100
35	3835	31589	-	3	3	3.0	2	2	100	2	100
155	4129	31642	-	3	3	3.0	2	2	100	2	100
237	4348	31719	-	3	3	3.0	2	2	100	2	100
244	4355	31725	-	-	3	3.0	1	1	100	1	100
248	4359	31729	-	3	3	3.0	2	2	100	2	100
277	4925	31816	-	3	3	3.0	2	2	100	2	100
280	4928	31819	-	3	3	3.0	2	2	100	2	100
282	4930	31821	-	3	3	3.0	2	2	100	2	100
456	5819	31980	-	3	3	3.0	2	2	100	2	100
470	6105	31992	-	3	3	3.0	2	2	100	2	100
475	6110	31996	-	3	3	3.0	2	2	100	2	100
480	6115	32000	3	3	3	3.0	3	3	100	3	100
525	5030	31946	-	3	3	3.0	2	2	100	2	100
567	5420	31869	3	3	3	3.0	3	3	100	3	100
422	5305	31856	1	5	3	3.0	3	2	67	3	100
633	TN1		7	5	7	6.3	3	0	0	1	33
LSI			5.1	4.8	5.2						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3 and ≤5)

- **NSN-H:** A total of 86 lines from NSN hills nurseries were screened against GD only at Lonavala location where the disease pressure was moderate (LSI 3.3). Out of 86 lines tested, 73 lines showed score 3 and 10 lines showed 5 score against GD.

Location severity index (LSI) and frequency distribution of glume discoloration scores of NSN-H, *Kharif* 2023

Score	Location/Frequency of scores (0-9)
	LNV
1	0
3	73
5	10
7	2
9	0
Total	85
LSI	3.3
Screening method	N

(N- Natural; LSI- Location Severity Index)

➢ NHSN

National Hybrid Screening Nursery (NHSN) consisted of 120 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 below. The disease pressure was moderate at all locations viz., Nawagam (LSI 5.5), Chatha (LSI 4.8), Navasari (LSI 4.7) and Lonavala (LSI 3.3).

Location severity index(LSI) and frequency distribution of glume discoloration scores of NHSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)			
	CHT	LNV	NVS	NWG
1	2	0	1	0
3	22	102	28	11
5	72	17	77	71
7	14	1	13	38
9	0	0	0	0
Total	110	120	119	120
LSI	4.8	3.3	4.7	5.5
Screening method	N	N	N	N

(N- Natural; LSI- Location Severity Index)

Some of the promising entries selected from NHSN are IET Nos. 31478, 31436, 31458, 31466, 31468, 31490, 31437, 31439, 31445, 31446, 31448, 30556, 31460, 31472, 31476, 31479, 31481 and 31500.

Promising entries with low susceptibility index (<=4.0) and high PI in NHSN to glume discoloration, *Kharif* 2023

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			CHT	LNV	NVS	NWG						
77	3010	31478	3	3	3	3	3.0	4	4	100	4	100
6	2806	31436	5	3	3	3	3.5	4	3	75	4	100
45	2918	31458	3	3	3	5	3.5	4	3	75	4	100
63	2927	31466	3	3	5	3	3.5	4	3	75	4	100
65	2929	31468	5	3	1	5	3.5	4	2	50	4	100
92	3025	31490	-	3	3	5	3.7	3	2	67	3	100
7	2807	31437	3	3	5	5	4.0	4	2	50	4	100
10	2810	31439	5	3	3	5	4.0	4	2	50	4	100
17	2817	31445	5	3	3	5	4.0	4	2	50	4	100
19	2901	31446	5	3	3	5	4.0	4	2	50	4	100
21	2903	31448	5	3	3	5	4.0	4	2	50	4	100
25	2907	30556	3	3	5	5	4.0	4	2	50	4	100
47	2920	31460	5	3	5	3	4.0	4	2	50	4	100
69	3002	31472	3	3	5	5	4.0	4	2	50	4	100
74	3007	31476	5	3	3	5	4.0	4	2	50	4	100
78	3011	31479	3	3	5	5	4.0	4	2	50	4	100

P. No.	Br. No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			CHT	LNV	NVS	NWG						
80	3013	31481	3	3	5	5	4.0	4	2	50	4	100
106	3112	31500	5	3	5	3	4.0	4	2	50	4	100
28	TN 1		7	5	5	7	6.0	4	0	0	2	50
LSI			**4.8**	**3.3**	**4.7**	**5.5**						

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has 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 below. The disease pressure was moderate at Nawagam (LSI 5.2) and Chatha (LSI 5.2), Navasari (LSI 4.8), and Lonavala (LSI 3.0)

Location severity index(LSI) and frequency distribution of glume discoloration scores of DSN, *Kharif* 2023

Score	Location/Frequency of scores (0-9)			
	CHT	**LNV**	**NVS**	**NWG**
1	0	2	0	0
3	21	203	61	41
5	77	4	110	112
7	36	0	37	51
9	0	0	2	4
Total	134	209	210	208
LSI	**5.2**	**3.0**	**4.8**	**5.2**
Screening method	**N**	**N**	**N**	**N**

(N- Natural; LSI- Location Severity Index)

Some of the entries that are found to be promising are IET 19345, VP-R47-SHB, VP-R262-SHB AP MS-14B, 733, 19451, RBN-3, RBN-6, VP-R27-SHB VP-R278-SHB, VP-R294-SHB, WGL 1380, WGL 1840, WGL 1857, WGL 1870, WGL 1929 and 4857.

Promising donors with low susceptibility index (<=3.5) and high PI in DSN to glume discoloration, *Kharif* 2023

P. No.	Br. No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CHT	LNV	NVS	NWG						
49	19345	-	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
62	VP-R47-SHB	-	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**

P. No.	Br. No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
		CHT	LNV	NVS	NWG						
75	VP-R262-SHB	-	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
133	AP MS-14B	-	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
211	733	-	3	3	3	**3.0**	**3**	**3**	**100**	**3**	**100**
42	19451	-	1	5	3	**3.0**	**3**	**2**	**67**	**3**	**100**
26	RBN-3	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
29	RBN-6	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
58	VP-R27-SHB	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
76	VP-R278-SHB	5	3	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
78	VP-R294-SHB	5	3	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
168	WGL 1380	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
172	WGL 1840	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
173	WGL 1857	5	3	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
177	WGL 1870	3	3	3	5	**3.5**	**4**	**3**	**75**	**4**	**100**
181	WGL 1929	3	3	5	3	**3.5**	**4**	**3**	**75**	**4**	**100**
204	4857	5	3	3	3	**3.5**	**4**	**3**	**75**	**4**	**100**
188	TN1	7	3	5	5	**5.0**	**4**	**1**	**25**	**3**	**75**
LSI		**5.2**	**3.0**	**4.8**	**5.2**						

SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3 and ≤5)

➢ MULTIPLE DISEASE RESISTANCE

In NSN-1, a total of 25 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# 30830 (MR to NB, SHB, BS, BB and SHR), 29820 (R to NB, MR to SHR,RTD and GD), 29549 (MR to SHB,BS and SHR), 29891 (MR to NB, SHB and BB), 30078 (MR to SHB,BB and SHR), 30233 (MR to LB, BS and SHR) and 30877 (MR to SHB, BB and SHR) which showed moderate reaction for three or more diseases. Other entries under NSN-1 which showed different reaction was listed below. Entries viz., IET # 28965 (MR to LB & R to NB), 29694 (MR to LB&BS), 29696 (MR to LB&NB), 29708 (MR to RTD&GD), 30235 (MR to LB&SHB), 30240 (MR to SHB&BB), 30573 (MR to LB&GD), 30605 (MR to LB&GD), 30605 (MR to NB&SHR), 30657 (MR to BS&RTD), 30757 (MR to NB&SHR), 30772 (MR to NB&BB), 30827 (SHB&BB), 30835 (MR to BB&SHR), 30917 (MR to LB&RTD), 30918 (MR to NB&GD), 30942 (MR to LB&RTD) and 31120 (MR to NB&BB).

Multiple disease resistant lines in NSN-1, *Kharif* -2023

Sl. No.	IET No.	Disease susceptible/resistance reaction							
		LB	NB	ShB	BS	BB	ShR	RTD	GD
1	28965	4.00	3.00	-	-	-	-	-	-
2	29549	-	-	4.67	4.53	-	3.25	-	-
3	29694	3.70	-	-	4.71	-	-	-	-
4	29696	3.91	3.17	-	-	-	-	-	
5	29708	-	-	-	-	-	-	4.00	3.50
6	29820	-	2.83	-	-	-	4.13	4.00	3.50
7	29891	-	3.17	5.10	-	4.42	-	-	-
8	30078	-	-	4.55	-	4.50	3.63	-	-
9	30233	4.00	-	-	4.71		3.88		
10	30235	4.04	-	5.24	-	-	-	-	-
11	30240	-	-	5.15	-	4.50	-	-	-
12	30573	3.64	-	-	-	-	-	-	3.50
13	30605	-	-	-	-	4.00	3.25	-	-
14	30657	-	-	-	4.76	-	-	4.00	-
15	30757	-	3.17	-	-	-	4.13	-	-
16	30772	-	3.00	-	-	4.22	-	-	-
17	30827	-	-	4.70	-	3.71	-	-	-
18	30830	-	3.17	5.05	4.76	4.00	4.13	-	-
19	30835	-	-	-	-	3.91	4.00	-	-
20	30877	-	-	5.23	-	4.44	4.14	-	-
21	30917	4.04	-	-	-	-	-	4.00	-
22	30918	-	3.00	-	-	-	-	-	3.50
23	30942	4.00	-	-	-	-	-	4.00	
24	31120	-	3.00	-	-	4.54	-	-	-
25	29142(R)	3.78		-	4.81	-	-	-	-

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro; GD-Glume discoloration)

In NSN-2, a total of eighteen entries showed resistance or moderate resistance reaction to two or three diseases. The entry *viz*., IET # 31710 showed resistance reaction to NB, MR to BS, SHR and 31719 resistant to NB, SHR &GD showed resistance to three diseases. Remaining entries showed resistance or MR to two diseases and that included IET# 31075 (MR to LB&BS), 31525 (MR to LB&NB), 31553 (MR to SHB&SHR), 31586 (MR to BB&SHR), 31616 (R to NB& MR to SHR), 31621 (MR to LB&BB), 31658 (MR to BB&SHR), 31681 (R to NB& MR to SHB), 31683 (R to NB& MR to SHR), 31725 (MR to SHR&GD), 31820 (R to NB& MR to SHR), 31821 (R to NB&GD), 31827 (MR to NB&SHR), 31836 (MR to NB&SHB), 31895 (MR to NB&SHR) and 31906 (MR to SHB&SHR).

Multiple disease resistance in NSN-2, *Kharif* – 2023

Sl. No.	IET No.	Disease susceptible/resistance reaction							
		LB	NB	ShB	BS	BB	ShR	RTD	GD
1	31075	4.00	-	-	4.82	-	-	-	-
2	31525	3.86	3.25	-	-	-	-	-	-
3	31553	-	-	4.76	-	-	4.00	-	-
4	31586	-	-	-	-	4.75	3.25	-	-
5	31616	-	3.00	-	-	-	4.00	-	-
6	31621	4.00	-	-	-	4.50	-	-	-
7	31658	-	-	-	-	4.75	4.00	-	-
8	31681	-	2.50	4.71	-	-	-	-	-
9	31683	-	2.75	-	-	-	3.75	-	-
10	31710	-	2.75	-	3.93	-	4.00	-	-
11	31719	-	3.25	-	-	-	3.75	-	3.00
12	31725	-	-	-	-	-	4.00	-	3.00
13	31820	-	2.75	-	-	-	3.25	-	
14	31821	-	3.00	-	-	-		-	3.00
15	31827	-	3.25	-	-	-	4.00	-	-
16	31836	-	3.00	4.76	-	-		-	-
17	31895	-	3.50		-	-	3.75	-	-
18	31906	-		4.65	-	-	4.00	-	-

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro; GD-Glume discoloration)

In NSN-H, a total of ninteen entries showed moderate or resistant reaction to two or more than two diseases. Entry *viz.*, IET# 31420 (Resistant to LB,NB&SHR & MR to SHB) showed resistant or moderate resistant reaction to four diseases and 31383 (MR to SHB,BS&SHR), 31391 (MR to NB,SHB&SHR), 31402 (R to SHR&MR to NB,SHB), 31405 (MR to LB,BS&SHR) and 31422(R to SHR& MR to LB,NB) were showed resistant or moderate resistant reaction to three diseases. Remaining all entries viz., IET# 29654 (MR to BS&SHR), 30513 (MR to SHB&BS), 31387 (MR to SHB&BS), 31388 (MR to LB&BS), 31389 (MR to LB&BS), 31400 (MR to NB&SHR), 31409 (MR to LB&SHR), 31411 (SHB&BS), 31415 (MR to NB&SHB), 31416 (R to NB&SHR), 31421 (R to SHR&MR to SHB), 31426 (MR to SHB&SHR) and 31429 (MR to LB&SHR).

Multiple disease resistance in NSN-H, *Kharif* – 2023

Sl. No.	IET No.	Disease susceptible/resistance reaction							
		LB	NB	ShB	BS	BB	ShR	RTD	GD
1	29654	-	-	-	4.40	-	3.00	-	-
2	30513	-	-	5.00	4.20	-	-	-	-
3	31383	-	-	4.33	4.60	-	3.00	-	-
4	31387	-	-	5.00	4.20	-	-	-	-
5	31388	4.10			4.40	-		-	-
6	31389	3.80	-	-	4.40	-	-	-	-
7	31391	-	3.50	5.00	-	-	3.00	-	-
8	31400	-	3.50		-	-	3.00	-	-
9	31402	-	3.50	5.00	-	-	2.00	-	-
10	31405	4.00	-	-	4.60	-	3.00	-	-
11	31409	3.80	-	-	-	-	3.00	-	-
12	31411	-	-	5.00	4.60	-	-	-	-
13	31415	-	3.67	4.33	-	-	-	-	-
14	31416	-	3.00	-	-	-	3.00	-	-
15	31420	3.00	3.00	4.33	-	-	2.00	-	-
16	31421	-	-	5.00	-	-	2.00	-	-
17	31422	3.60	3.50	-	-	-	2.00	-	-
18	31426	-	-	5.00	-	-	3.00	-	-
19	31429	4.10	-		-	-	3.00	-	-

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro; GD-Glume discoloration)

In NHSN, a total of 27 entries found resistant or moderately resistant to two or more diseases. IET # 31436 (MR to SHB, BB SHR &GD), 31460 (MR to BS,BB,SHR&GD), 31466 (MR to NB,BS,SHR&GD), 31473 (MR to LB,NB,BS&GD), 31489 (MR to NB,SHB,BS&BB), 31469 (MR to LB,NB&SHR), 31490 (MR to NB,BS&GD) 31495 (MR to BS,BB&SHR) and 31496 (MR to NB,SHB&RTD) showed resistance to more than two diseases. Other entries for two diseases included IET# 30556 (MR to SHB&GD), 31435 (MR to LB&RTD), 31437 (MR to LB&GD), 31442 (MR to LB&BS), 31448 (MR to BS&GD), 31449 (MR to BS&BB), 31452 (MR to NB&RTD), 31459 (MR to LB&BB), 31464 (MR to NB&BS), 31465 (MR to SHB&BS), 31467 (MR to SHB&GD), 31471 (MR to BB&SHR), 31472 (MR to SHR&GD), 31474 (MR to LB&BS), 31476 (MR to RTD&GD), 31478 (MR to SHR&GD) and 31498 (MR to BS&GD).

Multiple disease resistance in NHSN, *Kharif* – 2023

Sl. No.	IET No.	Disease susceptible/resistance reaction							
		LB	NB	ShB	BS	BB	ShR	RTD	GD
1	30556	-	-	5.37	-	-	-	-	4.00
2	31435	3.53	-	-	-	-	-	5.00	
3	31436		-	5.26	-	5.5	5.00	-	3.50
4	31437	4.16	-	-	-	-	-	-	4.00
5	31442	4.11	-	-	4.92	-	-	-	-
6	31448	-	-	-	5.18	-	-	-	4.00
7	31449	-	-	-	5.17	5.4	-	-	-
8	31452	-	4.40	-	-	-	-	5.00	-
9	31459	4.16	-	-	-	5.5	-	-	-
10	31460	-	-	-	5.17	5.1	5.00	-	4.00
11	31464	-	4.50	-	4.83	-	-	-	-
12	31465	-	-	5.26	5.17	-	-	-	-
13	31466	-	4.40	-	5.00	-	4.86	-	3.50
14	31467	-	-	5.35	-	-	-	-	4.00
15	31469	3.81	4.25	-	-	-	4.71	-	-
16	31471	-	-	-	-	4.9	5.00	-	-
17	31472	-	-	-	-	-	5.00	-	4.00
18	31473	4.00	4.40	-	4.91	-	-	-	4.00
19	31474	4.17	-	-	4.75	-	-	-	-
20	31476	-	-	-	-	-	-	5.00	4.00
21	31478						5.00	-	3.00
22	31480	3.78	-	-	4.92	4.5	-	-	-
23	31489	-	3.50	5.15	5.08	5.5	-	-	-
24	31490	-	3.25	-	5.17	-	-	-	3.7
25	31495	-	-	-	5.00	5.2	4.00	-	-
26	31496	-	4.50	5.42	-	-	-	5.00	-
27	31498	-	-	-	5.08	-	-	-	4.0

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro; GD-Glume discoloration)

In DSN, a total of 32 donors were found resistant or moderate reaction to two or more diseases. Eleven donors exhibited resistant or moderate reaction to three and more diseases and that includes 19435 (MR to SHB, BB&GD), CK 145-3 (SHB,BB&SHR), CR 1014 (MR to NB,SHB&SHR), NLRBL-5 (MR to NB,SHB,BS&SHR), NLRBL-7 (MR to SHB,BS,BB&SHR), NLRBL-8 (MR to NB,SHB, BB&SHR), RP-Bio-Patho-3 (MR to BS,BB&SHR), VP-D6-SHB (MR to NB,BB&SHR), VP-R262-SHB (NB,SHBBB&GD), VP-R297-SHB (MR to SHB,BB&SHR) and VP-R36-SHB (MR to SHB,BB&SHR).Other donors showing resistant or moderate reaction to two diseases was listed below.

Multiple disease resistance in DSN, *Kharif* – 2023

Sl. No.	IET No.	Disease susceptible/resistance reaction							
		LB	NB	ShB	BS	BB	ShR	RTD	GD
1	4857	-	3.00	-	-	-	-	-	3.50
2	19345	-	-	4.68	-	4.89	-	-	3.00
3	19451	-	3.25	-	-	-	-	-	3.00
4	CB 18586	4.00	-	-	-	-	4.33	-	-
5	CB 20117	-	-	5.21	-	-	4.00	-	-
6	CB 20166	-	2.50	-	-	-	4.33	-	-
7	CK 145-3	-	-	5.10	-	5.00	4.33	-	-
8	CO 51	4.11	-	-	-	-	7.00	-	-
9	CR1014	-	3.25	5.00	-	-	4.33	-	-
10	KNM15361	4.05	-	-	4.85	-	-	-	-
11	NLR 3186	-	-	4.75	-	-	4.17	-	-
12	NLRBL-2	-	-	-	4.54	4.95	-	-	-
13	NLRBL-3	-	-	-	4.77	4.95	-	-	-
14	NLRBL-4	-	-	5.21	-	5.00	-	-	-
15	NLRBL-5	-	3.25	5.00	4.62	-	4.17	-	-
16	NLRBL-6	-	-	-	4.92	-	4.17	-	-
17	NLRBL-7	-	-	4.75	4.54	4.68	3.17	-	-
18	NLRBL-8	-	2.75	5.10	-	4.95	3.50	-	-
19	RBN-6	3.95	-	-	-	-	-	-	3.50
20	RP-Bio-Patho-3	-	-	-	4.85	4.42	4.33	-	-
21	RP-Bio-Patho-4	-	-	-	4.77	4.37	-	-	-
22	RTCNP-97	-	-	5.22	-	4.86	-	-	-
23	VP-D6-SHB	-	2.25	-	-	4.79	4.33	-	-
24	VP-R107-SHB	-	3.00	-	-	-	4.33	-	-
25	VP-R109-SHB	-	3.00	4.68	-	-	-	-	-
26	VP-R262-SHB	-	2.25	4.74	-	4.58	-	-	3.00
27	VP-R27-SHB	-	-	-	-	-	4.33	-	3.50
28	VP-R289-SHB	-	-	-	-	4.89	-	4.00	-
29	VP-R294-SHB	-	-	-	-	4.47	-	-	3.50
30	VP-R297-SHB	-	-	4.84	-	3.95	4.33	-	-
31	VP-R36-SHB	-	-	4.47	-	4.84	4.33	-	-
32	VP-R45-SHB	-	2.75	-	-	4.74	-	-	-

(LB-Leaf blast; NB-Neck blast; ShB-Sheath blight; BS-Brown spot; BB-Bacterial blight; ShR-Sheath rot; RTD-Rice tungro; GD-Glume discoloration)

II.: FIELD MONITORING OF VIRULENCE

TRIAL No.8: Leaf Blast - *Pyricularia oryzae*

The experiment was conducted at 24 locations across India against *Pyricularia oryzae* during *Kharif* 2023. The aim of this experiment was to monitor virulence pattern in the population of rice blast pathogen. 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 like HR 12 and CO-39 and resistant check like Tetep, Rasi, IR 64 were included in the trial. The reaction of 39 differentials at twenty-four locations during the crop season to monitor the blast reaction is presented in Table 8.1. The disease pressure was very high at Lonavala (LSI 7.3), while it was high at Cuttack (LSI 6.4). At Gudalur, Hazaribagh, Jagtial, Almora, Coimbatore, Gangavathi, Navasari, Khudwani, and Nawagam, the LSI was recorded in between 5.0 to 6.0. The disease pressure was recorded as less than 5.0 at Patna, Jagdalpur, Pattambi, Uppershillong, Imphal, Mandya, Nellore, Ponnampet, Mugad, IIRR, Wangbal, Maruteru and Karjat. The data from these locations are presented in Table 8.1 and Figure 8.1A.

Differentials *viz*., Tetep, RP Bio Path-3, RP Bio Path-2, Raminad str-3, and zenith were showed resistant to moderate resistant reaction across the locations with SI of <4.0. Tetep was highly resistant across 14 locations indicating its potentiality as the best donor against leaf blast disease. However, Tetep was susceptible at Cuttack (score 7.0) and moderately resistant (Score 3.0-5.0) at Coimbatore, Gudalur, Imphal, Jagtial, Patna, Pattambi, Uppershillong, Nellore and Almora. Differential line-RP Bio Patho 3 possessing *Pi2*, showed resistance reaction at 11 locations and susceptible reaction at four locations. RP Bio Path 2 possessing *Pi54* showed resistant reaction across 9 locations, moderately resistant at 26 locations while it was susceptible in 4 locations. Raminad str-3 was found highly susceptible at Lonavala, Cuttack, Gangavathi and Jagtial; resistant at nine locations. Zenith, possessing a combination of three genes (*Pi-z* + *Pi-a* + *Pi-i*) showed resistant reaction at 7 locations; moderately resistant at most of the locations and highly susceptible at Lonavala.

The susceptible checks like HR-12 and Co-39 showed susceptible reaction at most of the locations. HR-12 recorded resistant reaction at Karjat, Mugad and Wangbal; moderate at Imphal, Ponnampet, while CO-39 found resistant at Imphal, Karjat, and Maruteru; it was moderately resistant at Ponnampet and Wangbal. The resistant check Rasi was highly susceptible at Almora, Cuttack, Hazaribagh, Jagdalpur, Lonavala, Mandya and Navasari. IR 64 found highly susceptible at Cuttack, Gudalur, Lonavala and Patna.

The difference in disease reaction score of susceptible and resistant checks reveals that a minor shift in the pathogen population. Cluster analysis of *Pyricularia oryzae* reaction on 39 different genotypes at 24 locations was done and is presented in Figure 8.1B. The reaction pattern of genotypes at all the locations was grouped into eight major groups at 30% dissimilarity coefficient. The reaction pattern of *Pyricularia oryzae* isolate from Lonavala and Cuttack were distinct from the rest of the isolates. The isolate from Coimbatore and Gudalur are grouped in same cluster. Similarly, the isolates from Navsari and Almora; Hazaribagh and Jagtial grouped together. The other 16 isolates formed a major cluster showing same kind of reaction pattern (Fig 8.1B).

Table 8.1: Reaction of rice differentials to *Pyricularia oryzae* at across the locations in Idia during *Kharif* -2023

P.No	Differentials	Locations	ALM	CBT	CTK	GDL	GNV	HZB	IIRR	IMP	JDP	JGL	KHD	KJT	SI	<=3*	<=5*	Total	PI3	PI5
		Genes/Screening	N	A	A	N	N	N	A	N	N	A	N	A						
22	Tetep	*Pi-kh+*	3.5	4.0	7.0	4.0	2.0	3.0	1.0	5.0	2.5	4.0	0.0	1.0	**3.0**	**14**	**23**	**24**	**58**	**96**
34	RP Biopatho-3	*Pi2*	4.5	6.0	7.0	6.0	3.5	5.0	2.0	5.0	3.5	4.0	3.0	3.0	**3.9**	**11**	**20**	**24**	**46**	**83**
33	RP Biopatho-2	*Pi54*	6.0	4.0	5.0	4.0	4.5	4.0	2.0	6.0	4.0	5.0	4.0	3.0	**3.9**	**9**	**20**	**24**	**38**	**83**
12	Raminad -STR -3	-	4.5	4.0	7.0	4.0	7.5	4.0	2.0	4.5	3.0	7.0	6.0	1.0	**3.9**	**9**	**19**	**24**	**38**	**79**
13	Zenith	*Pi-z + Pi-a + Pi-i*	4.5	3.0	5.0	5.0	4.5	4.0	3.0	3.5	1.5	5.0	3.0	1.0	**3.9**	**8**	**22**	**24**	**33**	**92**
14	NP - 125	-	4.0	4.0	5.0	5.0	6.5	4.0	3.0	5.0	2.5	5.0	6.0	1.5	**4.0**	**9**	**20**	**24**	**38**	**83**
16	Dular	*Pi-ka+*	4.5	-	5.0	-	4.5	7.0	1.0	5.0	2.5	-	6.0	1.5	**4.0**	**10**	**14**	**20**	**50**	**70**
20	Tadukan	*Pi-ta*	4.0	6.0	5.0	7.0	7.0	3.0	1.0	4.0	2.5	9.0	5.0	1.0	**4.0**	**10**	**19**	**24**	**42**	**79**
19	Calaro	*Pi-ks*	5.5	-	5.0	-	6.5	-	3.0	4.5	6.5	-	8.0	1.0	**4.1**	**5**	**14**	**19**	**26**	**74**
21	IR - 64	Resistant	6.0	6.0	7.0	7.0	4.0	3.0	3.0	4.5	3.5	5.0	2.0	1.0	**4.1**	**9**	**17**	**24**	**38**	**71**
36	RP 6619(PRS-17)	*(Pi9+Pi54)*	3.5	6.0	7.0	7.0	6.5	4.0	2.0	5.0	3.5	7.0	3.0	2.0	**4.2**	**10**	**16**	**24**	**42**	**67**
5	RIL - 10	*Pi-12*	6.0	-	7.0	-	5.0	8.0	3.0	6.0	7.5	-	5.0	1.5	**4.2**	**7**	**13**	**21**	**33**	**62**
35	RP Biopatho-4	*Pi54*	5.0	6.0	5.0	6.0	4.0	4.0	3.0	4.0	3.5	5.0	4.0	5.0	**4.3**	**6**	**20**	**24**	**25**	**83**
28	RP Patho-3	*Pi54*	6.0	5.0	5.0	5.0	4.0	6.0	3.0	4.0	3.0	4.0	6.0	2.0	**4.3**	**7**	**20**	**24**	**29**	**83**
32	RP Biopatho-1	*Pi2*	5.5	5.0	7.0	4.0	4.0	7.0	3.0	4.0	7.0	3.0	4.0	2.0	**4.4**	**8**	**18**	**24**	**33**	**75**
29	RP Patho-7	*Pi1*	6.0	5.0	5.0	7.0	4.5	4.0	2.0	3.5	3.5	5.0	7.0	1.0	**4.4**	**7**	**18**	**24**	**29**	**75**
38	RP 6617-58(PRS-58)	*Pi9*	5.5	5.0	5.0	5.0	5.0	6.0	3.0	6.0	4.5	7.0	4.0	1.5	**4.4**	**7**	**18**	**24**	**29**	**75**
8	BL-122	*Pi-1 + Pi-2*	6.0	5.0	7.0	5.0	3.5	6.0	2.0	4.0	6.0	5.0	6.0	0.5	**4.4**	**8**	**16**	**24**	**33**	**67**
2	C101 A51	*Pi-2*	4.0	5.0	7.0	4.0	4.0	8.0	3.0	3.0	5.0	7.0	4.0	4.5	**4.5**	**6**	**19**	**24**	**25**	**79**
30	RP Patho-8	*Pi2*	5.5	5.0	9.0	5.0	6.5	6.0	2.0	3.0	3.5	5.0	5.0	3.0	**4.5**	**8**	**17**	**24**	**33**	**71**
37	RP 6618(PRS-50)	*Pi54*	5.0	7.0	7.0	7.0	6.5	6.0	3.0	3.0	4.5	6.0	4.0	3.0	**4.5**	**8**	**16**	**24**	**33**	**67**
27	RP Patho-2	*Pi2*	5.0	6.0	7.0	6.0	4.0	4.0	3.0	3.0	4.0	5.0	5.0	2.0	**4.5**	**5**	**19**	**24**	**21**	**79**
15	USEN	*Pi-a+*	7.0	-	7.0	-	4.5	-	3.0	4.0	7.0	-	7.0	1.5	**4.5**	**5**	**11**	**18**	**28**	**61**
39	RP 6617-59(PRS-59)	*Pi9*	5.5	6.0	7.0	6.0	7.0	6.0	3.0	4.0	4.5	9.0	4.0	3.0	**4.6**	**9**	**15**	**24**	**38**	**63**
6	RIL - 29	*Pi-7*	5.5	6.0	7.0	6.0	5.0	5.0	2.0	5.0	7.0	5.0	5.0	1.5	**4.6**	**5**	**16**	**24**	**21**	**67**
11	C101 PKT	*Pi-3*	5.0	5.0	5.0	5.0	4.5	5.0	3.0	5.0	3.5	5.0	7.0	1.0	**4.6**	**4**	**19**	**24**	**17**	**79**
26	RP Patho-1	*Pi1*	5.0	6.0	7.0	6.0	4.0	4.0	3.0	4.0	3.5	5.0	5.0	2.0	**4.7**	**4**	**16**	**24**	**17**	**67**
7	O. minuta	*Pi-9*	6.5	6.0	5.0	6.0	6.0	8.0	3.0	5.0	3.0	-	5.0	0.5	**4.7**	**8**	**13**	**23**	**35**	**57**
31	RP Patho-9	*Pi54*	7.0	5.0	5.0	5.0	4.0	7.0	3.0	4.0	6.5	5.0	6.0	2.0	**4.8**	**4**	**18**	**24**	**17**	**75**
17	Kanto - 51	*Pi-k*	4.5	5.0	7.0	4.0	7.5	7.0	2.0	4.5	3.5	9.0	7.0	1.0	**4.8**	**6**	**18**	**24**	**25**	**75**
10	A 57	*Pi-1 + Pi-2 + Pi-4*	5.5	5.0	7.0	6.0	7.0	4.0	3.0	6.0	3.5	5.0	4.0	1.0	**4.8**	**4**	**16**	**24**	**17**	**67**
9	BL-245	*Pi-2 + Pi-4*	5.5	6.0	7.0	6.0	7.5	5.0	3.0	5.0	3.5	5.0	4.0	1.5	**4.9**	**5**	**13**	**23**	**22**	**57**
1	C101 LAC	*Pi-1*	5.5	6.0	7.0	6.0	4.0	8.0	2.0	3.0	6.5	-	6.0	3.5	**5.0**	**5**	**11**	**23**	**22**	**48**
4	C101 TTP	*Pi-4b*	7.5	6.0	7.0	6.0	5.0	5.0	2.0	3.0	7.0	7.0	7.0	4.5	**5.0**	**5**	**15**	**24**	**21**	**63**
24	Rasi	Resistant	8.5	5.0	7.0	6.0	6.0	7.0	3.0	4.5	8.0	4.0	4.0	1.5	**5.0**	**6**	**13**	**24**	**25**	**54**
18	Shi-tia-tao	*Pi-ks*	8.5	5.0	5.0	7.0	9.0	8.0	5.0	3.0	9.0	6.0	5.0	1.0	**5.6**	**5**	**12**	**24**	**21**	**50**
3	C104 PKT	-	7.5	6.0	5.0	7.0	5.0	9.0	3.0	3.5	8.5	7.0	6.0	6.5	**5.7**	**4**	**10**	**24**	**17**	**42**
23	HR - 12	Susceptible	6.0	7.0	9.0	8.0	9.0	8.0	7.0	3.5	8.5	7.0	7.0	1.0	**6.4**	**3**	**7**	**24**	**13**	**29**
25	Co - 39	Susceptible	6.5	8.0	9.0	8.0	7.5	9.0	7.0	3.0	8.5	5.0	7.0	3.0	**6.4**	**3**	**8**	**24**	**13**	**33**
		Min Score	**3.5**	**3.0**	**5.0**	**4.0**	**2.0**	**3.0**	**1.0**	**3.0**	**1.5**	**3.0**	**0.0**	**0.5**						
		Max score	**8.5**	**8.0**	**9.0**	**8.0**	**9.0**	**9.0**	**7.0**	**6.0**	**9.0**	**9.0**	**8.0**	**6.5**						
LSI			**5.6**	**5.4**	**6.4**	**5.7**	**5.4**	**5.7**	**2.8**	**4.2**	**4.8**	**5.7**	**5.0**	**2.0**						

(Contd.) Table 8.1: Reaction of rice differentials to *Pyricularia oryzae* at across the locations in India during *Kharif* -2023

P.No	Differentials	Locations	LNV	MGD	MND	MTU	NLR	NVS	NWG	PNP	PTB	PTN	USG	WBL	SI	<=3*	<=5*	Total	PI 3	PI 5
		Genes/Screening	N	N	N	N	A	N	A	N	N	N	N	N						
22	Tetep	*Pi-kh+*	3.0	1.0	2.5	2.0	3.5	3.0	3.0	2.5	4.0	5.0	4.0	2.0	**3.0**	**14**	**23**	**24**	**58**	**96**
34	RP Biopatho-3	*Pi2*	6.5	3.0	1.5	2.0	2.5	4.5	5.0	4.5	3.0	2.0	3.0	3.0	**3.9**	**11**	**20**	**24**	**46**	**83**
33	RP Biopatho-2	*Pi54*	7.5	3.0	2.5	1.0	3.0	6.5	4.0	3.5	3.0	2.0	2.0	4.0	**3.9**	**9**	**20**	**24**	**38**	**83**
12	Raminad -STR -3	-	8.5	1.0	1.5	1.0	5.0	3.5	4.0	3.5	3.0	2.0	4.0	2.0	**3.9**	**9**	**19**	**24**	**38**	**79**
13	Zenith	*Pi-z + Pi-a + Pi-i*	9.0	3.0	4.5	1.0	4.0	3.5	4.5	4.5	6.0	5.0	4.0	2.0	**3.9**	**8**	**22**	**24**	**33**	**92**
14	NP - 125	-	7.5	3.0	1.5	1.0	4.0	5.0	3.5	3.0	4.0	7.0	3.0	2.0	**4.0**	**9**	**20**	**24**	**38**	**83**
16	Dular	*Pi-ka+*	9.0	3.0	2.5	1.0	3.0	5.5	5.5	2.0	3.0	6.0	-	3.0	**4.0**	**10**	**14**	**20**	**50**	**70**
20	Tadukan	*Pi-ta*	7.0	3.0	1.5	2.5	4.0	3.5	3.5	3.0	3.5	5.0	3.0	3.0	**4.0**	**10**	**19**	**24**	**42**	**79**
19	Calaro	*Pi-ks*	0.0	3.0	4.0	-	3.5	4.0	6.5	3.5	4.0	5.0	4.0	0.0	**4.1**	**5**	**14**	**19**	**26**	**74**
21	IR - 64	Resistant	7.5	1.0	4.5	1.5	3.0	6.5	5.0	3.5	4.0	7.0	2.0	2.0	**4.1**	**9**	**17**	**24**	**38**	**71**
36	RP 6619(PRS-17)	*(Pi9+Pi54)*	7.0	3.0	2.5	2.0	2.0	5.5	4.0	3.0	3.5	7.0	3.0	2.0	**4.2**	**10**	**16**	**24**	**42**	**67**
5	RIL - 10	*Pi-12*	6.5	1.0	1.5	1.0	5.0	5.5	4.0	4.0	3.5	2.0	6.0	0.0	**4.2**	**7**	**13**	**21**	**33**	**62**
35	RP Biopatho-4	*Pi54*	8.0	5.0	1.5	1.5	2.5	5.5	5.0	4.5	3.5	5.0	3.0	3.0	**4.3**	**6**	**20**	**24**	**25**	**83**
28	RP Patho-3	*Pi54*	9.0	3.0	4.5	1.0	3.0	3.0	5.0	3.5	5.0	5.0	4.0	4.0	**4.3**	**7**	**20**	**24**	**29**	**83**
32	RP Biopatho-1	*Pi2*	7.0	3.0	6.5	2.5	4.0	5.0	5.0	2.0	5.0	4.0	3.0	2.0	**4.4**	**8**	**18**	**24**	**33**	**75**
29	RP Patho-7	*Pi1*	9.0	5.0	2.5	1.5	3.0	7.0	3.5	2.0	3.5	5.0	6.0	3.0	**4.4**	**7**	**18**	**24**	**29**	**75**
38	RP 6617-58(PRS-58)	*Pi9*	8.0	3.0	3.5	1.0	2.0	6.0	5.0	4.5	3.0	5.0	4.0	2.0	**4.4**	**7**	**18**	**24**	**29**	**75**
8	BL-122	*Pi-1 + Pi-2*	7.0	3.0	4.5	3.0	4.0	5.0	5.5	2.5	5.5	3.0	3.0	3.0	**4.4**	**8**	**16**	**24**	**33**	**67**
2	C101 A51	*Pi-2*	5.5	1.0	4.5	2.5	5.0	4.5	4.0	2.5	5.0	4.0	8.0	2.0	**4.5**	**6**	**19**	**24**	**25**	**79**
30	RP Patho-8	*Pi2*	9.0	3.0	3.5	1.5	3.0	6.0	4.5	3.5	3.0	6.0	5.0	2.0	**4.5**	**8**	**17**	**24**	**33**	**71**
37	RP 6618(PRS-50)	*Pi54*	7.0	3.0	4.5	1.5	2.0	4.5	4.5	5.5	3.0	3.0	4.0	4.0	**4.5**	**8**	**16**	**24**	**33**	**67**
27	RP Patho-2	*Pi2*	8.0	5.0	3.5	2.5	4.5	5.0	5.0	3.5	5.5	4.0	5.0	3.0	**4.5**	**5**	**19**	**24**	**21**	**79**
15	USEN	*Pi-a+*	0.0	3.0	4.0	-	3.5	6.0	6.5	3.5	4.0	7.0	-	3.0	**4.5**	**5**	**11**	**18**	**28**	**61**
39	RP 6617-59(PRS-59)	*Pi9*	7.0	3.0	2.5	2.0	2.0	5.5	5.0	4.5	3.0	3.0	4.0	3.0	**4.6**	**9**	**15**	**24**	**38**	**63**
6	RIL - 29	*Pi-7*	6.0	1.0	2.5	4.0	3.5	6.0	4.5	5.5	5.0	5.0	5.0	2.0	**4.6**	**5**	**16**	**24**	**21**	**67**
11	C101 PKT	*Pi-3*	9.0	5.0	3.5	2.0	4.0	6.0	4.5	3.5	5.0	6.0	6.0	3.0	**4.6**	**4**	**19**	**24**	**17**	**79**
26	RP Patho-1	*Pi1*	9.0	5.0	4.5	1.5	4.5	5.5	4.5	3.5	6.0	6.0	6.0	2.0	**4.7**	**4**	**16**	**24**	**17**	**67**
7	O. minuta	*Pi-9*	7.0	3.0	2.5	3.0	4.5	7.0	5.5	2.5	5.5	6.0	5.0	3.0	**4.7**	**8**	**13**	**23**	**35**	**57**
31	RP Patho-9	*Pi54*	9.0	5.0	4.5	3.0	4.0	4.5	5.5	4.5	5.0	5.0	5.0	0.0	**4.8**	**4**	**18**	**24**	**17**	**75**
17	Kanto - 51	*Pi-k*	9.0	3.0	4.5	3.0	4.0	5.0	5.0	4.5	3.0	5.0	3.0	4.0	**4.8**	**6**	**18**	**24**	**25**	**75**
10	A 57	*Pi-1 + Pi-2 + Pi-4*	9.0	5.0	3.5	2.5	5.0	6.0	7.0	4.5	4.0	5.0	5.0	2.0	**4.8**	**4**	**16**	**24**	**17**	**67**
9	BL-245	*Pi-2 + Pi-4*	8.0	5.0	6.5	3.0	-	4.5	5.5	5.5	6.0	5.0	3.0	2.0	**4.9**	**5**	**13**	**23**	**22**	**57**
1	C101 LAC	*Pi-1*	6.5	3.0	5.5	1.5	5.0	6.0	4.5	3.5	7.0	4.0	7.0	3.0	**5.0**	**5**	**11**	**23**	**22**	**48**
4	C101 TTP	*Pi-4b*	7.0	3.0	3.5	3.5	5.0	4.5	4.5	2.5	6.0	5.0	5.0	3.0	**5.0**	**5**	**15**	**24**	**21**	**63**
24	Rasi	Resistant	8.0	1.0	7.5	1.5	4.0	7.5	6.0	3.5	4.5	6.0	3.0	3.0	**5.0**	**6**	**13**	**24**	**25**	**54**
18	Shi-tia-tao	*Pi-ks*	9.0	5.0	9.0	2.5	3.0	6.5	5.0	5.5	3.5	6.0	6.0	2.0	**5.6**	**5**	**12**	**24**	**21**	**50**
3	C104 PKT	-	7.0	3.0	8.0	3.0	4.0	6.0	5.5	2.5	8.0	5.0	6.0	4.0	**5.7**	**4**	**10**	**24**	**17**	**42**
23	HR - 12	Susceptible	8.0	3.0	9.0	5.0	6.5	7.0	8.0	4.0	7.5	5.0	7.0	2.0	**6.4**	**3**	**7**	**24**	**13**	**29**
25	Co - 39	Susceptible	9.0	5.0	8.0	3.0	6.0	7.0	7.0	4.5	7.0	7.0	5.0	4.0	**6.4**	**3**	**8**	**24**	**13**	**33**
		Min Score	**0.0**	**1.0**	**1.5**	**1.0**	**2.0**	**3.0**	**3.0**	**2.0**	**3.0**	**2.0**	**2.0**	**0.0**						
		Max score	**9.0**	**5.0**	**9.0**	**5.0**	**6.5**	**7.5**	**8.0**	**5.5**	**8.0**	**7.0**	**8.0**	**4.0**						
LSI			**7.3**	**3.2**	**4.1**	**2.1**	**3.8**	**5.3**	**5.0**	**3.7**	**4.5**	**4.9**	**4.4**	**2.5**						

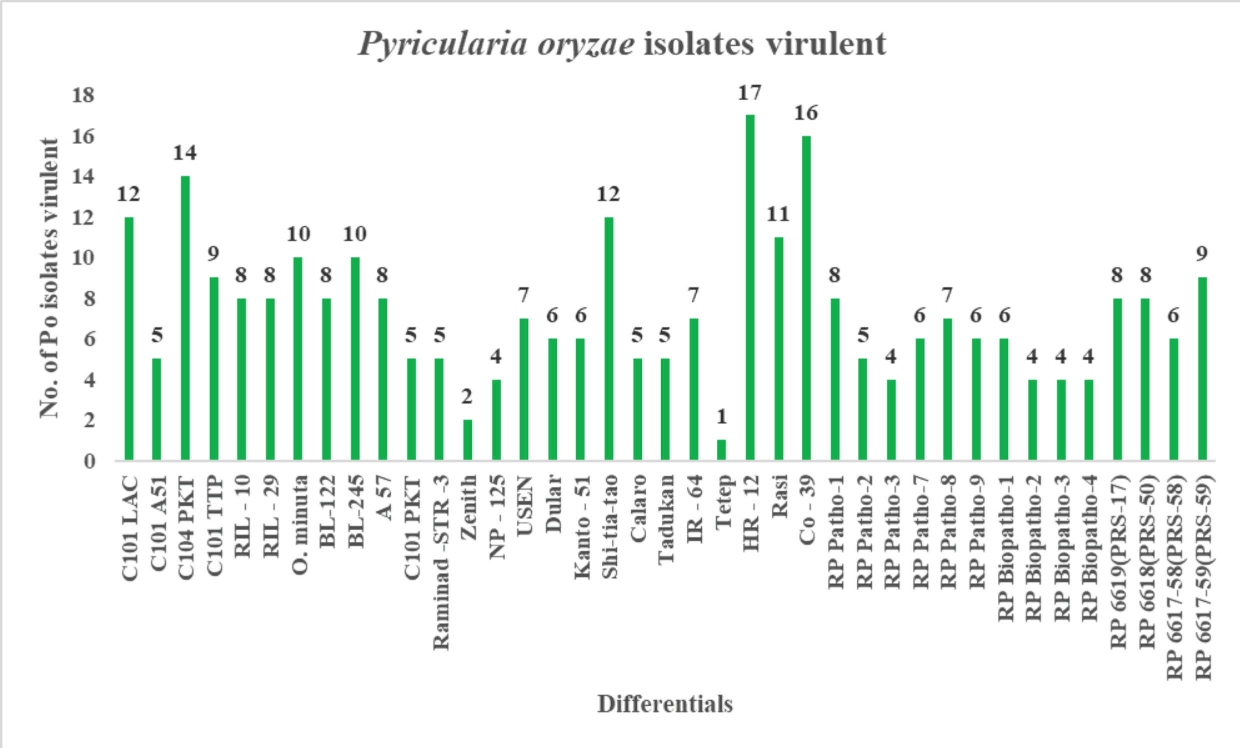

Figure 8.1A: Differential reaction of hosts to rice blast pathogen (*Pyricularia oryzae)* at different locations - *Kharif* 2023

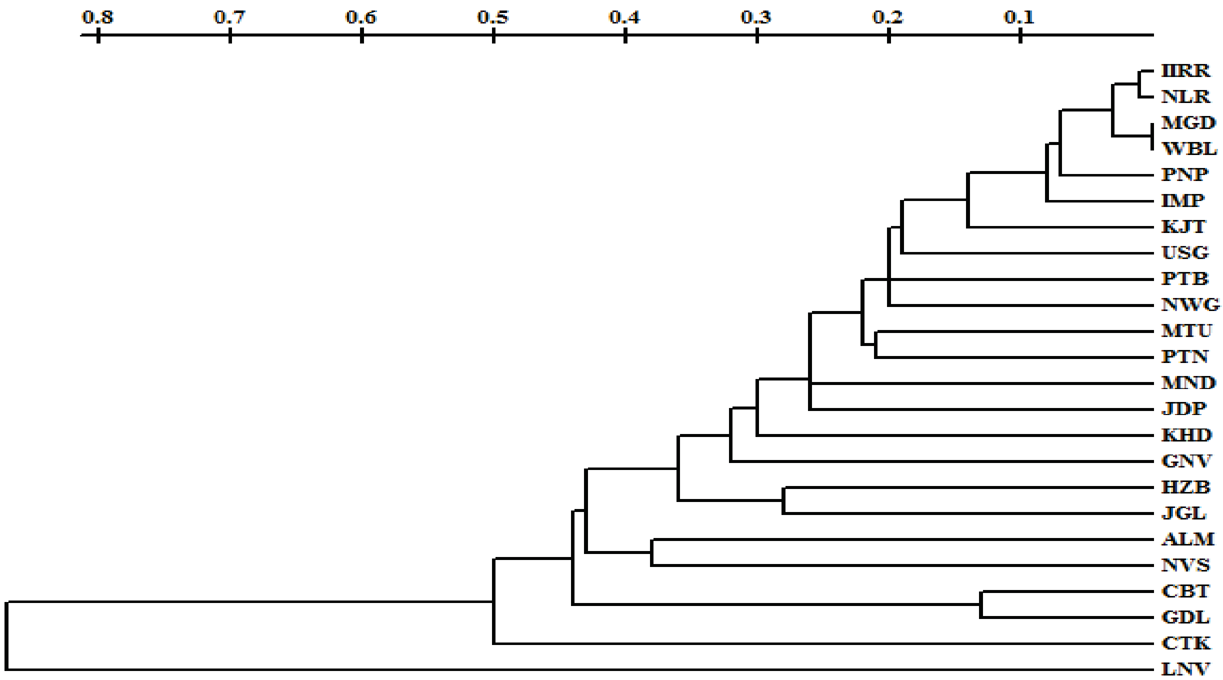

Figure 8.1B: Dendrogram showing relatedness of different reactions of *P. oryzae* at different locations during *Kharif* -2023

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 25 hot spot locations across India during *Kharif* season of 2023. However, data were received from 24 locations. At Ludhiana, the trial was conducted with five isolates. 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 Cuttack, IIRR, Raipur, Maruteru and Chiplima 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. These isolates produced susceptible reactions on 11-13 differentials out of 13 differentials. These isolates produced moderate to highly susceptible reactions on IRBB21 possessing BB resistance gene *Xa21*. The isolates from Cuttack, Maruteru and Raipur produced highly susceptible reaction on IRBB 13 possessing BB resistance gene xa13. The isolate from Raipur and Maruteru also produced susceptible reaction (score 7) on resistant check Improved Samba Mahsuri possessing three BB resistance genes viz., *Xa21, xa13* and *xa5*.

The isolates from Navsari, Pattambi, Nellore, Ludhiana (LXo # 1, 4, 7, 8 and 10), Patna, Gangavathi, Masodha, Nawagam, Chinsurah, Aduthurai, Coimbatore, Karjat, Pantnagar, Chatha, Jagadalpur, Rajendranagar and Titabar were categorized as moderately virulent and these isolates produced an LSI ranging from 5-7. These isolates produced susceptible reactions on 2-11 differentials. Majority of these isolates (except isolates from Masodha, Nawagam, Aduthurai and Ludhiana-Strain LDN Xo-8) showed moderate to high level of resistance to IRBB13. Similarly, most of these isolates (except isolates from Nellore, Ludhiana Strain 7 & 8, Aduthurai and Karjat) showed moderate to high level of resistance to IRBB21. The isolates from Moncompu was categorized as less virulent as they produced an LSI of below 3 and produced BB disease score of less than 3 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. The isolate from Maruteru showed highly susceptible reactions (BB score of 7-9) on all the differentials possessing various combinations of BB resistance genes including Improved Samba Mahsuri. In general, most of the gene combinations except IRBB 50, IRBB 51, IRBB 61 and IRBB 62 showed a broad spectrum resistance (Fig 9.1A). Cluster analysis of *Xoo* reaction on differentials possessing different single BB resistance genes at various locations was done and is presented in Fig 9.1B. The isolates from Maruteru and Raipur were quite different from other isolates and from each other and formed separate clusters. The isolates showing less virulence like isolates from Moncompu, Chatha, Titabar, Pantnagar, Rajendranagar and Jagadalpur grouped nearby. Most of the isolates from moderately virulent category 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*'2023

Differentials	Highly virulent					Moderately virulent								
IR-24	9	9	7	7	6	7	7	7	7	9	7	9	5	6
IRBB-1	9	9	7	7	8	7	7	7	7	9	7	9	7	8
IRBB-3	9	9	9	7	9	8	7	6	7	9	6	5	6	7
IRBB-4	5	9	7	7	7	8	7	7	7	5	7	4	7	5
IRBB-5	9	9	5	7	8	9	6	6	7	5	6	4	7	6
IRBB-7	9	9	7	7	8	7	7	6	7	7	5	6	7	7
IRBB-8	9	9	9	7	6	6	7	7	7	9	7	8	5	4
IRBB-10	9	9	7	7	8	7	7	6	7	9	8	6	6	5
IRBB-11	9	9	7	7	8	8	6	7	7	5	7	5	5	6
IRBB-13	9	3	7	7	6	5	6	5	3	3	5	6	7	7
IRBB-14	9	9	9	-	8	7	7	6	7	5	6	8	6	5
IRBB-21	-	5	7	7	5	6	6	7	7	3	5	5	4	3
ISM	5	3	7	7	3	3	5	7	3	3	5	3	3	5
TN1	9	9	9	9	9	8	9	9	9	9	9	8	9	9
LSI	**8.38**	**7.86**	**7.43**	**7.15**	**7.07**	**6.86**	**6.71**	**6.64**	**6.57**	**6.43**	**6.43**	**6.14**	**6.00**	**5.93**
Min Score	**5**	**3**	**5**	**7**	**3**	**3**	**5**	**5**	**3**	**3**	**5**	**3**	**3**	**3**
Max Score	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**
# of entries>5	**11**	**11**	**13**	**13**	**12**	**12**	**13**	**13**	**12**	**7**	**10**	**8**	**9**	**8**

(Contd.,) Table 9.1: Reaction of rice differentials possessing different single BB resistance genes to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif'* 2023

Differentials	Moderately virulent													Less Vir
	LXo-8	**CHN**	**ADT**	**CBT**	**KJT**	**PNT**	**LXo-10**	**LXo-4**	**LXo-1**	**CHT**	**JGL**	**RNR**	**TTB**	**MNC**
IR-24	7	5	7	6	5	9	7	7	7	6	7	5	6	0
IRBB-1	-	5	5	6	5	9	-	-	-	4	6	5	5	2
IRBB-3	5	5	7	3	5	5	5	5	7	5	7	5	5	1
IRBB-4	3	5	7	6	5	7	3	5	5	3	5	5	4	1
IRBB-5	3	5	3	6	5	5	7	5	3	5	8	6	3	2
IRBB-7	5	5	3	7	6	5	-	-	-	2	4	5	5	0
IRBB-8	7	9	1	6	6	5	7	5	3	6	6	5	5	1
IRBB-10	7	9	5	4	5	5	-	5	7	4	5	5	7	1
IRBB-11	7	7	3	7	5	3	7	7	7	7	5	5	5	2
IRBB-13	7	3	7	6	6	5	3	3	3	5	4	5	5	0
IRBB-14	7	7	3	5	6	3	7	7	7	7	2	5	6	2
IRBB-21	7	5	7	4	7	3	3	5	3	5	2	5	4	2
ISM	3	3	9	3	5	3	3	3	3	5	2	3	4	0
TN1	9	9	9	7	5	9	7	7	7	8	9	7	7	8
LSI	**5.92**	**5.86**	**5.43**	**5.43**	**5.43**	**5.43**	**5.36**	**5.33**	**5.17**	**5.14**	**5.14**	**5.07**	**5.07**	**1.57**
Min Score	**3**	**3**	**1**	**3**	**5**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**0**
Max Score	**9**	**9**	**9**	**7**	**7**	**9**	**7**	**7**	**7**	**8**	**9**	**7**	**7**	**8**
# of entries>5	**8**	**5**	**7**	**9**	**5**	**4**	**6**	**4**	**6**	**5**	**6**	**2**	**4**	**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'* 2023

Differentials	High Vir	Moderately virulent												
	MTU	CTK	ADT	NWG	KJT	RPR	PTB	RNR	CHT	GNV	CBT	SBR	CHN	MSD
IRBB-50	7	9	5	5	7	5	6	5	4	3	6	7	5	5
IRBB-51	7	5	5	4	4	5	6	6	6	5	7	7	7	6
IRBB-52	7	5	7	6	4	5	6	5	5	4	4	5	3	5
IRBB-53	7	9	5	5	6	3	5	5	5	4	5	5	5	5
IRBB-54	7	5	7	5	4	5	5	6	3	5	4	5	5	5
IRBB-55	7	5	5	6	3	5	6	5	5	6	3	5	5	4
IRBB-56	7	3	7	5	5	5	5	5	7	4	4	5	5	5
IRBB-57	7	9	5	5	7	5	5	6	5	6	5	5	5	5
IRBB-58	5	1	7	7	5	5	5	5	3	5	3	3	5	5
IRBB-59	9	9	5	5	7	7	4	5	3	5	4	3	3	4
IRBB-60	9	9	3	5	7	5	4	5	3	7	6	3	5	3
IRBB-61	7	7	5	4	3	5	6	5	6	5	6	7	5	5
IRBB-62	7	9	3	6	5	5	5	5	5	3	6	5	7	5
IRBB-63	7	7	7	5	6	5	5	5	6	5	5	7	3	4
IRBB-64	7	3	5	6	7	3	4	5	4	7	3	5	3	4
IRBB-65	7	9	5	6	5	5	3	5	5	5	5	1	3	4
IRBB-66	7	9	3	3	6	5	3	3	5	3	5	1	3	3
ISM	7	5	9	5	5	7	5	3	5	3	3	3	3	3
TN1	9	9	9	9	5	9	9	7	8	8	7	9	9	9
LSI	**7.2**	**6.7**	**5.6**	**5.4**	**5.3**	**5.2**	**5.1**	**5.1**	**4.9**	**4.9**	**4.8**	**4.8**	**4.7**	**4.7**
Min Score	**5**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**
Max Score	**9**	**9**	**9**	**9**	**7**	**9**	**9**	**7**	**8**	**8**	**7**	**9**	**9**	**9**
# of entries>5	**18**	**11**	**7**	**7**	**8**	**3**	**6**	**4**	**5**	**5**	**6**	**5**	**3**	**2**

(Contd.,) Table 9.2: Reaction of rice differentials possessing different combinations of BB resistance genes to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif'* 2023

Differentials	Moderately virulent													Low Vir
	CHP	NLR	PTN	NVS	JGL	IIRR	LXo-7	LXo-4	PNT	TTB	LXo-1	LXo10	LXo-8	MNC
IRBB-50	6	5	5	6	3	7	3	3	1	3	3	3	3	0
IRBB-51	4	5	4	5	4	3	3	3	5	3	-	-	3	0
IRBB-52	6	4	5	6	3	5	5	-	3	2	-	-	3	0
IRBB-53	7	5	6	3	3	3	5	3	2	3	3	3	3	0
IRBB-54	7	7	6	4	4	5	5	5	2	3	3	3	3	1
IRBB-55	4	6	3	2	4	1	3	5	3	3	3	3	7	1
IRBB-56	5	7	4	3	6	1	3	3	5	4	3	3	3	1
IRBB-57	6	5	5	4	2	3	3	3	3	4	3	3	3	3
IRBB-58	3	4	3	3	4	3	3	3	1	2	3	3	3	0
IRBB-59	3	4	3	4	4	1	3	3	1	2	3	3	5	0
IRBB-60	2	1	4	3	4	1	3	3	1	3	3	3	3	2
IRBB-61	5	3	3	6	3	9	3	3	5	5	-	-	1	0
IRBB-62	3	4	3	7	4	7	3	3	7	4	3	3	1	2
IRBB-63	4	3	4	5	5	1	3	3	1	4	3	3	3	2
IRBB-64	3	2	4	4	4	3	3	-	3	4	-	-	1	0
IRBB-65	3	2	3	2	3	1	3	3	5	3	3	3	1	1
IRBB-66	3	1	3	3	3	3	3	3	5	2	3	3	3	0
ISM	3	7	5	3	2	3	3	3	3	4	3	3	3	0
TN1	9	9	9	8	9	9	9	7	9	7	7	7	9	8
LSI	**4.5**	**4.4**	**4.3**	**4.3**	**3.9**	**3.6**	**3.6**	**3.5**	**3.4**	**3.4**	**3.3**	**3.3**	**3.2**	**1.1**
Min Score	**2**	**1**	**3**	**2**	**2**	**1**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**0**
Max Score	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**7**	**9**	**7**	**7**	**7**	**9**	**8**
# of entries>5	**6**	**5**	**3**	**5**	**2**	**4**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**1**

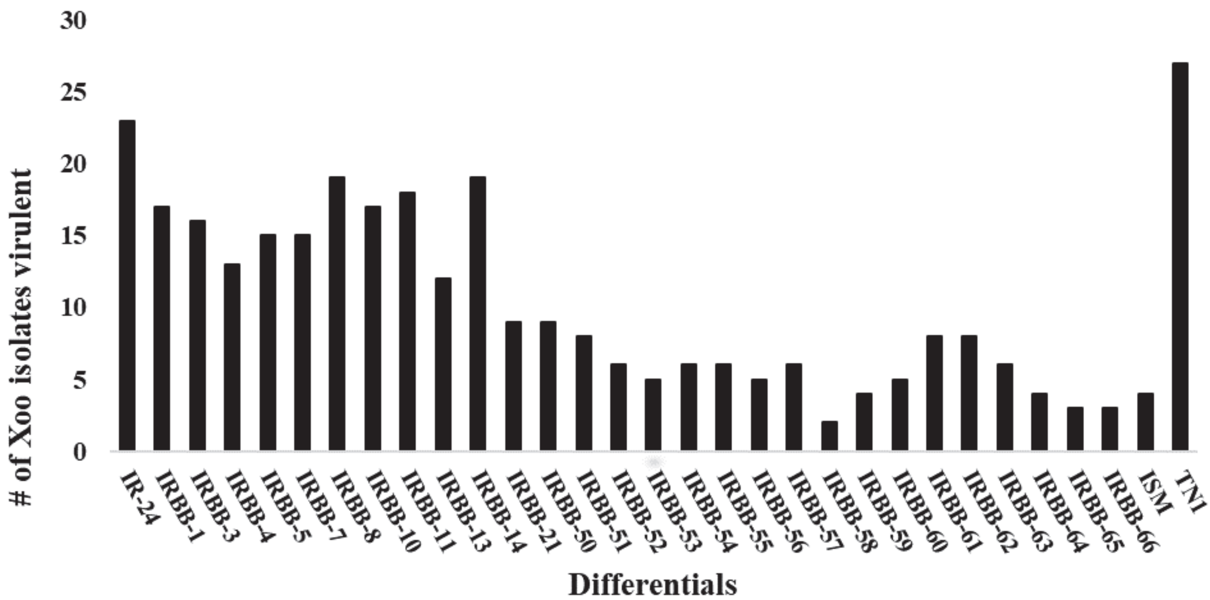

Figure 9.1A: Number of *Xoo* isolates showing moderate to high virulence on different BB resistance genes and their combinations during *Kharif* - 2023

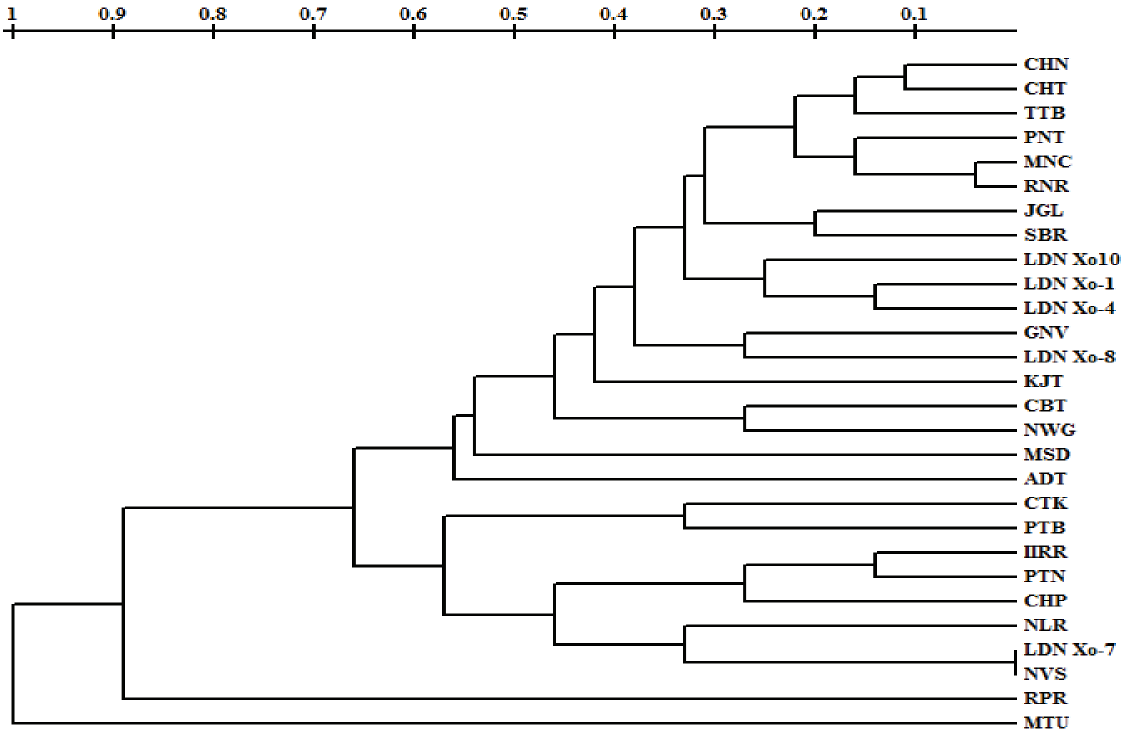

Figure 9.1B: Dendrogram (based on reactions of differentials possessing single BB resistance genes) showing the relatedness of different *Xanthomonas oryzae* pv. *oryzae* isolates from various locations during *Kharif* - 2023

TRIAL No.10: III. DISEASE OBSERVATION NURSERY – *Kharif*-2023

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. Chinsurah and Moncompu centres were conducted both 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 8 centres for this trial. The salient features of this study are presented on location-wise below.

BANKURA

Three different sowing dates i.e., 01.07.2023 (early), 15.07.2023 (normal) and 02.08.2023 (late) were followed to study the effect of date of sowings on the progression of the leaf blast, brown spot and bacterial leaf blight diseases by using the susceptible varieties of this region *i.e.,* TN-1 and Danaguri. The variety Danaguri showed tolerance to blast (28.25% PDI) as compared to the variety TN-1 (36.61%) in this particular center (Table 10.1). The early sown crop showed more disease development and progression compared to the normal sown and late sown crops in the variety TN-1 (1.90 to 36.61% PDI). Leaf blast was more in early sown crop of variety TN 1 (1.90 to 36.61% PDI) followed by the normal sown crop of Danaguri variety (28.25% PDI). Lowest incidence of blast was observed in case of late sown crop of Danaguri (0.50-21.95% PDI) followed by the late sown crops of TN-1 (1.90-27.13% PDI. The Table 10.1 showed that in Bankura center, early sown crop is very much prone to leaf blast incidence.

In case of brown spot disease, the late sown crop showed more disease progression in both the varieties TN 1 and Danaguri (1.90-67.5% PDI and 1.70-64.85% PDI respectively) and least disease observed in the case of normal sown crop of both the varieties TN 1 and Danaguri (23.15% and 18.55% PDI respectively). similarly, the bacterial blight was more in early sown crop of both the both the varieties TN 1 and Danaguri (53.85% and 50.95% PDI respectively) and the least incidence of bacterial blight observed in normal sown crop.

TABLE 10.1: Occurrence of different rice diseases in disease observation nursery at Bankura, *Kharif* – 2023

Location/ Date of sowing	DAT	Percentage of Disease Severity								
		Blast			Brown spot			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
TN 1	30 DAT	1.90	0.00	1.90	1.10	2.20	1.90	0.00	0.00	1.60
E: 01.07.23	40 DAT	4.35	3.20	12.55	23.45	13.35	13.55	1.90	0.60	9.95
N: 15.07.23	50 DAT	16.15	18.50	20.15	41.95	18.60	28.25	20.95	8.55	27.15
L: 02.08.23	60 DAT	36.61	29.15	27.13	57.80	23.15	56.95	53.85	24.00	53.55
	70 DAT	-	-	-	-	-	67.5	-	-	-
	80 DAT	-	-	-	-	-	-	-	-	-
	90 DAT	-	-	-	-	-	-	-	-	-
	100 DAT	-	-	-	-	-	-	-	-	-
	110 DAT	-	-	-	-	-	-	-	-	-
Danaguri	30 DAT	0.50	0.00	0.50	0.50	1.15	1.70	0.00	0.00	1.20
E: 01.07.23	40 DAT	2.70	0.50	7.10	19.85	10.80	10.90	3.40	1.00	9.15
N: 15.07.23	50 DAT	15.05	17.35	15.95	38.65	13.25	26.15	20.00	5.85	23.85
L: 02.08.23	60 DAT	23.00	28.25	21.95	51.10	18.55	53.60	50.95	21.85	49.20
	70 DAT	-	-	-	-	-	64.85	-	-	-
	80 DAT	-	-	-	-	-	-	-	-	-
	90 DAT	-	-	-	-	-	-	-	-	-
	100 DAT	-	-	-	-	-	-	-	-	-
	110 DAT	-	-	-	-	-	-	-	-	-

(E=Early; N=Normal; L=Late)

CHINSURAH

At Chinsurah, three different sowing dates viz., 01.07.23, 15.07.23 and 02.08.23 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 79% PDI and 2.5 to 68 % PDI respectively) and significantly less incidence was observed during the late sown crop i.e., 2.5 to 19 % 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 (11.0 to 42.5% and 9.0 to 32.5% PDI respectively), when compared to the early sown crop (5.0 to 21% PDI) (Table 10.2).

Brown spot disease incidence was generally less in all the sowings, and it was observed at the tillering to grain filling stages (70 to 100 DAT) and more in the late sown crop (2.5 to 31.0% PDI) when compared to early sown crop (2.5 to 9.0% PDI). Similarly, BLB severity more in normal sown crop (5.5% PDI) as compared to the early sown crop (5% PDI) (Table 10.2).

TABLE 10.2: Occurrence of different rice diseases in disease observation nursery at Chinsurah under Transplanted conditions, *Kharif* – 2023

Location/ Date of sowing	DAT	Percentage of Disease Severity								
		Sheath blight			Sheath rot			Brown spot		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
MTU 7029	30 DAT	2.5	-	-	-	-	-	-	-	-
E: 03.07.23	40 DAT	5.0	4.5	-	-	-	-	-	-	-
N: 15.07.23	50 DAT	10.0	8.0	2.5	-	-	-	-	-	-
L: 01.08.23	60 DAT	13.5	10.5	7.0	-	-	-	-	-	-
	70 DAT	19.0	29.0	12.0	-	-	-	-	-	2.5
	80 DAT	43.5	57.5	19.0	-	-	11.0	2.5	4.5	7.5
	90 DAT	59.0	66.5	-	5.0	9.0	26.5	4.0	8.0	11.0
	100 DAT	68.0	79.0	-	19.0	27.5	33.5	9.0	11.0	19.0
	110 DAT	-	-	-	21.0	32.5	42.5	-	-	31.0

(E=Early; N=Normal; L=Late)

Similarly, the sheath blight and sheath rot disease incidence 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 late sown crop (41% PDI) followed by the normal sown crop (33.5% PDI). In case of sheath rot disease, the early sown crop showed highest disease severity (66.5% PDI) followed by the normal sown crop (35.5% PDI) and the least disease severity was observed (14.5% PDI) in late sown crop (Table 10.3). The late sown crop showed less disease may be the cool temperatures prevail during the maturity stage during November in the North Eastern region of the country.

TABLE 10.3: Occurrence of different rice diseases in disease observation nursery at Chinsurah- Direct Seeded Conditions, *Kharif* – 2023

Location/ Date of sowing	DAT	Percentage of Disease Severity					
		Sheath blight-DSR			Sheath rot-DSR		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
MTU 7029	30 DAT	-	-	-	-	-	-
E: 29.06.23	40 DAT	-	-	-	5.0	-	-
N: 08.07.23	50 DAT	-	-	-	9.0	2.0	-
L: 24.07.23	60 DAT	-	-	-	19.0	5.5	9.0
	70 DAT	-	-	-	32.5	5.5	11.0
	80 DAT	-	6.0	13.5	51.5	29.0	14.5
	90 DAT	5.0	19.0	20.0	59.0	29.0	-
	100 DAT	24.0	26.5	33.5	66.5	35.5	-
	110 DAT	31.0	33.5	41.0	-	-	-

(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 (05.07.2023), normal (20.07.2023) and late (05.08.2023) 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 (10.0 to 31.89% PDI) and normal (16.67 to 27.09% PDI) and comparatively low incidence was observed from 60 to 100 DAT in early sowing periods (5 to 19.13% PDI). Among the three sowing periods, the incidence of Sheath rot was found to be maximum in the late sown crop (31.89% PDI). The disease was significantly less in the variety P-203 compared to Gurjari, with the initial symptoms started to appear about 90 DAT in the early and at 70 DAT in normal sown crops, progressing gradually thereafter. But in case of late sown crop, symptoms appear at 60 DAT. Further, the percentage disease index was relatively less in the case of the variety P-203 (maximum of 26.09% PDI) when compared to the variety Gurjari (maximum of 31.89% PDI). (Table 10.4). 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.

TABLE 10.4: Occurrence of different rice diseases in disease observation nursery at Nawagam, *Kharif* – 2023

Location/ Date of sowing	Percent Disease Index								
	Nawagam								
	Sheath rot								
V/DOS	DAT	(E)	(N)	(L)	V/DOS	DAT	(E)	(N)	(L)
Gurjari	30 DAT	-	-	-	P-203	30 DAT	-	-	-
E:05-07-2023	40 DAT	-	-	-	E:05-07-2023	40 DAT	-	-	-
N:20-07-2023	50 DAT	-	-	-	N:20-07-2023	50 DAT	-	-	-
L:05-08-2023	60 DAT	5.00	-	10.00	L:05-08-2023	60 DAT	-	-	10.00
	70 DAT	13.33	16.67	30.00		70 DAT	-	15.00	16.66
	80 DAT	19.33	18.80	32.22		80 DAT	-	17.67	21.20
	90 DAT	28.29	24.10	35.42		90 DAT	11.67	21.11	24.78
	100 DAT	19.13	27.09	31.89		100 DAT	8.88	23.57	23.79
	110 DAT	-	-	-		110 DAT	18.02	25.68	26.09

(E=Early; N=Normal; L=Late)

MANDYA

The progression of two diseases (blast and sheath blight) were studied at three different sowing dates i.e., 08-08-2023 (early), 08.09.2023 (normal) and 06.10.2023 (late) by using two different susceptible varieties like MTU-1001 and IR-64. MTU 1001showed better tolerance for blast disease and late sown crop effected much (17%PDI) compared to early (11.0%PDI) and normal sown crop (9%PDI) in the variety IR 64. In case of MTU 1001, the late sown crop showed more leaf blast disease severity (14% PDI) compared to early (9.50% PDI) and normal sown crops (5.50% PDI). Similarly, the late sown crop of variety MTU 1001 showed more sheath blight disease severity (75% PDI) as compared to early and normal sown crops (Table 10.5).

TABLE 10.5: Occurrence of different rice diseases in disease observation nursery at Mandya, *Kharif* – 2023

Location/ Date of sowing	DAT	Percentage of Disease Index					
		BLAST			Sheath blight		
		(E)	(N)	(L)	(E)	(N)	(L)
MTU 1001	30 DAT	-	-	-	-	-	-
E:08-08-2023	40 DAT	-	-	-	-	-	-
N:08-09-2023	50 DAT	-	-	-	-	-	-
L:06-10-2023	60 DAT	4.50	-	-	19.00	20.00	-
	70 DAT	4.00	4.50	-	19.00	20.00	15.50
	80 DAT	7.00	4.00	4.00	25.00	21.00	20.00
	90 DAT	5.50	4.00	6.50	26.00	26.00	38.50
	100 DAT	5.50	6.50	8.00	40.00	37.50	55.00
	110 DAT	9.50	5.50	14.00	53.50	55.00	75.00
IR 64	30 DAT	-	-	-	-	-	-
E:08-08-2023	40 DAT	-	-	-	-	-	-
N:08-09-2023	50 DAT	-	-	-	-	-	-
L:06-10-2023	60 DAT	5.00	-	-	18.00	19.00	-
	70 DAT	6.50	4.00	-	20.00	24.50	18.00
	80 DAT	8.50	6.00	5.00	29.00	25.50	25.00
	90 DAT	9.00	5.00	9.50	38.50	38.00	53.00
	100 DAT	9.50	9.00	12.00	50.50	53.50	63.50
	110 DAT	11.00	9.00	17.00	77.50	77.50	77.50

(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, 22.07.2023 (early), 02.08.2023 (normal) and 21.08.2023 (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 BPT5204 was found to be more susceptible to BLB viz., BLB (45.37% PDI), when compared to the variety Swarna 29.61% PDI. Sheath blight severity was more in early sown crop (60.52 % in swarna & 45.78% PDI in BPT 5204) compared to normal and late sown crops. The bacterial leaf blight severity was more in early sown crop (29.61 PDI in swarna & 45.37% PDI in BPT 5204) compared to early and normal sown crops (Table 10.6).

Table 10.6: Occurrence of different rice diseases in disease observation nursery at Maruteru, *Kharif* – 2023

Location/ Date of sowing		Percentage of Disease Index					
		Sheath blight			BLB		
V/DOS	DAT	(E)	(N)	(L)	(E)	(N)	(L)
	30 DAT	-	-	-	-	-	-
Swarna	40 DAT	-	-	1.37	-	-	-
E:22-07-2023	50 DAT	12.99	0.80	43.36	-	-	-
N:02-08-2023	60 DAT	20.86	6.97	37.46	-	-	-
L:21-08-2023	67 DAT	55.62	28.69	57.96	-	-	-
	74 DAT	42.35	43.79	48.00	-	-	-
	80 DAT	44.94	18.94	61.83	-	-	-
	90 DAT	60.44	26.51	48.20	-	-	-
	100 DAT	63.46	36.17	-	29.61	22.55	
	118 DAT	60.52	48.56	-	16.7	12.63	2.22
BPT 5204	30 DAT	-	-	-	-	-	-
E:22-07-2023	40 DAT	-	-	0	-	-	-
N:02-08-2023	50 DAT	0.77	0.00	1.12	-	-	-
L:21-08-2023	60 DAT	1.67	4.30	4.09	-	-	-
	67 DAT	14.64	35.68	4.73	-	-	-
	74 DAT	12.76	17.30	0.00	-	-	20.89
	80 DAT	24.32	17.53	29.77	-	-	-
	90 DAT	5.05	38.57	30.72	-	-	-
	100 DAT	26.29	34.65	-	14.61	35.55	7.41
	118 DAT	45.78	38.30	-	45.37	21.62	-

(E=Early; N=Normal; L=Late)

MONCOMPU-TP

Four different varieties i.e., Uma, Shreyas, Prathyasa and Pournami were sown on different dates i.e, 24.07.2023 (early), 08.08.2023 (normal) and 23.08.2023 (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, both 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 (23.61% and 9.90% PDI). Sheath blight was more in the normal sown crop of varieties Prathyasa and Shreyas (44.93% and 30.21 % PDI).

The incidence of BLB was very less this year and normal sown crop effected much compared to early and late sown crops (Table 10.7). BLB severity was more in varieties Uma, Shreays and Pournami in the normal sown crop (51.12%, 21.36% and 23.83% PDI respectively).

TABLE 10.7: Occurrence of different rice diseases in disease observation nursery at Moncompu, *Kharif* – 2023

Location/ Date of sowing	DAT	Percentage of Disease Index					
		Sheath blight			BLB		
		(E)	(N)	(L)	(E)	(N)	(L)
Uma	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	2.80	7.13	9.21	8.10	24.04	23.06
	100 DAT	4.45	15.94	17.02	16.75	42.98	36.56
	110 DAT	7.94	20.56	23.61	21.61	51.12	42.47
Shreyas	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	1.78	8.92	9.52	0.16	9.06	4.20
	100 DAT	3.67	23.28	17.78	1.83	16.89	8.00
	110 DAT	7.34	30.21	24.51	3.42	21.36	16.90
Prathyasa	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	11.90	21.66	3.11	2.00	2.05	3.59
	100 DAT	25.55	34.49	5.68	4.35	5.34	9.65
	110 DAT	33.56	44.93	9.75	9.15	14.02	14.17
Pournami	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	0.00	1.00	1.91	1.47	6.84	1.35
	100 DAT	1.50	3.12	6.44	4.36	15.08	6.85
	110 DAT	2.92	6.89	9.90	6.08	23.83	12.15

(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 conditions. Sheath blight disease severity was more in Prathyasa and Pournami in late sown crop of DSR (19.10% and 22.82% PDI respectively) and in the case of BLB, late sown crop of Uma and Prathyasa showed the more disease severity compared to the early and normal sowings (45.83% and 6.78% PDI respectively) (Table 10.8).

TABLE 10.8: Occurrence of different rice diseases in disease observation nursery at Moncompu-under DSR Conditions, *Kharif* – 2023

Location/ Date of sowing	DAT	Percentage of Disease Index					
		Sheath blight			BLB		
V/DOS		(E)	(N)	(L)	(E)	(N)	(L)
Uma	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	9.23	5.02	3.33	10.15	14.01	22.75
	100 DAT	15.86	12.71	9.07	20.10	22.73	33.89
	110 DAT	21.56	17.14	15.92	24.83	32.51	45.83
Shreyas	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	0.00	1.18	0.00	2.06	3.05	0.00
	100 DAT	3.00	3.67	1.07	5.45	6.58	3.08
	110 DAT	5.93	7.04	5.78	7.24	12.92	7.29
Prathyasa	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	5.09	0.35	7.12	1.65	0.00	0.74
	100 DAT	8.25	1.14	10.44	2.54	1.45	2.64
	110 DAT	9.55	2.12	19.10	3.72	4.12	6.78
Pournami	30 DAT	-	-	-	-	-	-
E:24-07-2023	40 DAT	-	-	-	-	-	-
N:08-08-2023	50 DAT	-	-	-	-	-	-
L:23-08-2023	60 DAT	-	-	-	-	-	-
	70 DAT	-	-	-	-	-	-
	80 DAT	-	-	-	-	-	-
	90 DAT	8.84	0.00	7.90	4.50	1.17	3.00
	100 DAT	14.96	1.28	13.14	6.65	4.54	7.79
	110 DAT	21.67	2.78	22.82	13.62	9.25	12.83

(E=Early; N=Normal; L=Late)

RAIPUR

Two varieties viz., Swarna and Rajeshwari were tested in Raipur under three different sowing dates i.e.,10-06-2023 (early), 05-07-2023 (normal) and 30-07-2023 (late), for the variation in the percent disease incidence of the major rice disease of this region i.e., Sheath blight under direct seeded rice (DSR) conditions.

The variety Rajeshwari was more tolerant to sheath blight disease compared to the variety Swarna. Sheath blight disease severity was more in early and late sown crop of variety

Rajeshwari (39.70% and 39.95% PDI) than normal sown crop. in case of variety rajeshwari the late sown crop showed more sheath blight disease severity (18.99% PDI) (Table 10.9).

TABLE 10.9: Occurrence of different rice diseases in disease observation nursery at Raipur-under DSR Conditions, *Kharif* – 2023

Location/ Date of sowing	Percent Disease Index								
	Raipur								
	Sheath blight								
V/DOS	**DAT**	**(E)**	**(N)**	**(L)**	**V/DOS**	**DAT**	**(E)**	**(N)**	**(L)**
Swarna	30 DAT	8.89	0.00	10.00	**Rajeshwari**	30 DAT	6.93	2.28	6.51
E:10-06-2023	40 DAT	15.95	8.11	17.61	**E:10-06-2023**	40 DAT	11.95	5.31	10.51
N:05-07-2023	50 DAT	18.00	9.27	19.30	**N:05-07-2023**	50 DAT	12.78	6.55	11.73
L:30-07-2023	60 DAT	22.44	10.16	23.33	**L:30-07-2023**	60 DAT	13.33	8.33	13.41
	70 DAT	27.78	11.61	29.78		70 DAT	14.21	9.95	13.62
	80 DAT	35.01	15.30	35.22		80 DAT	14.73	12.78	13.83
	90 DAT	37.05	17.60	37.33		90 DAT	16.00	15.45	14.90
	100 DAT	38.40	19.05	38.95		100 DAT	16.02	17.10	15.73
	110 DAT	39.70	22.01	39.95		110 DAT	17.69	18.99	16.33

(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., 11.07.2023 (early), 25.07.2023 (normal) and 12.08.2023 (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 (37% PDI) compared to normal (12% PDI) and early sown crops (17.5% PDI) (Table 10.10).

TABLE 10.10: Occurrence of different rice diseases in disease observation nursery at PUSA *Kharif* – 2023

BROWN LEAF SPOT				
Location/date of sowing	**Percentage of Disease severity**			
V/DOS	**DAT**	**(E)**	**(N)**	**(L)**
Sugandha	**30 DAT**	-	-	-
E:11-07-2023	**40 DAT**	-	-	-
N:25-07-2023	**50 DAT**	-	-	4
L:12-08-2023	**60 DAT**	-	-	8.5
	70 DAT	-	-	18
	80 DAT	1.5	1	24
	90 DAT	4	3.5	28.5
	100 DAT	9	6	33
	110 DAT	17.5	12	37

(E=Early; N=Normal; L=Late)

INFLUENCE OF WEATHER PARAMETERS AND DATE OF SOWING ON DIFFERENT DISEASES AT DIFFERENT LOCATIONS

To study the impact of weather parameters (temperature, relative humidity and rainfall) in the progress of the disease, the area under disease progress curve was measured and analysed. Accordingly, at the center Bankura, blast, brown spot and BLB diseases were analysed and correlated with the weather parameters. Two highly susceptible varieties i.e., TN 1 and Danaguri were used for this study. With decreasing rainfall, the intensity of the brown spot is increasing and vice versa (Table 10.11).

Table 10.11: Disease Progression with respect to weather factors at Bankura

Sowing time	Bankura					AUDPC					
	Temperature		Relative Humidity		Rain Fall	Blast		Brown spot		BLB	
	max	min	max	min		V1	V2	V1	V2	V1	V2
Early	31.55	22.61	78.71	-	228.57	407	297	954	845	498	489
Normal	31.20	22.20	78.69	-	210.27	363	320	457	345	211	178
Late	30.86	21.58	78.18	-	158.84	482	345	1334	1239	655	588

(V1= TN 1; V2= Danaguri)

NAWAGAM

At the centre Nawagam, the sheath rot disease was analysed with the data obtained from two verities viz., Gurjari and P-203. The results indicating that sheath rot disease progression was more rapid in Gurjari compared to the P-203. With increasing rainfall, the sheath rot disease was decreased in the case of both the varieties Gurjari and P-203 (1236 and 1095) (Table 10.12). the early sown crop which received the more rainfall showed the least disease progress compared to the normal and late sown crops which received the least rainfall (Table 10.12).

Table 10.12: Disease Progression with respect to weather factors at Nawagam

Sowing time	Nawagam					AUDPC	
	Temperature		Relative Humidity		Rain Fall	Sheath rot	
	max	min	max	min		V1	V2
Early	32.3	21.7	80.3	59.4	690.0	755	296
Normal	32.2	21.5	80.5	59.0	480.0	731	902
Late	32.15	21.24	80.31	58.10	347.8	1236	1095

(V1=Gurjari; V2=P-203)

MANDYA

At Mandya centre, the leaf blast and sheath blight diseases were analysed with the data obtained for two varieties viz., MTU1001 and IR64. The results indicated that the leaf blast disease was more rapidly progressing in MTU 1001 (312) when compared to IR 64 (440). The results shows that with increasing rainfall, the progression of the leaf blast disease was more (Table 10.13). The highest AUDPC of leaf blast disease was noticed in the early sowings of the both the varieties i.e., MTU 1001 and IR 64 (312 and 440). Incase of sheath blight disease, the late sown crop showed more disease progress compared to the early and normal sown crops in both the varieties tested i.e., MTU 1001 and IR 64. It was also observed that the Leaf blast disease was more favored by rainfall, this may be due to the fact that rainfall would have helped the pathogen mycelia and spores to spread more easily to the surrounding plants. (Table 10.13).

Table 10.13: Disease Progression with respect to weather factors at Mandya

Sowing time	Mandya			AUDPC			
	Temperature		Rain Fall	Blast		Sheath blight	
	max	min		V1	V2	V1	V2
Early	30.3	19.4	820.5	312	440	1557	1947
Normal	29.8	19.3	751.5	217	285	1520	1992
Late	30.2	18.9	567.0	255	350	1665	1982

(V1= MTU 1001; V2= IR 64)

MONCOMPU

The AUDPC of BLB was observed to differ among the four varieties tested at Moncompu centre. The AUDPC was highest (808) in the lowest rainfall season (late sown with lowest rainfall (1346 mm) in the variety Uma. in the variety Prathyasa, the intensity of the BLB incidence was increasing with the decreasing rainfall (Table 10.14). comparatively the variety Uma found tolerant to BLB than the remaining varieties tested. there is no much correlation was observed in case of sheath blight disease incidence with the rainfall received during the year in the Moncompu region in transplanted conditions.

Table 10.14: Disease Progression with respect to weather factors at Moncompu

Sowing time	Moncompu					AUDPC							
	Temperature		Relative Humidity		Rain Fall	SHB				BLB			
	Max	Min	Max	Min		V1	V2	V3	V4	V1	V2	V3	V4
Early	32.48	24.79	87.11	78.45	1463.10	112	91	542	30	357	37	109	89
Normal	32.52	24.84	87.17	78.26	1389.00	334	473	786	76	926	366	144	338
Late	32.53	24.80	87.51	78.41	1346.80	380	396	137	133	808	206	203	143

(V1=Uma; V2= Shreyas; V3= Prathyasa; V4=Pournami)

MONCOMPU-DSR

In this center, direct seeded rice also tested for the prevalence of sheath blight and bacterial leaf blight diseases. the is a significant correlation was observed in the varieties Uma, Prathyasa and Pournami, with increased rainfall the intensity of the sheath blight disease was increasing (Table 10.15). the highest AUDPC was reported in early sown variety of Uma (359) which was received the more rainfall (1463) compared normal and late sown crops (Table 10.15). same trend is followed in the variety Pournami, with increased rainfall, the intensity of the disease increased.

Table 10.15: Disease Progression with respect to weather factors at Moncompu-DSR

Sowing time	Moncompu					AUDPC							
	Temperature		Relative Humidity		Rain Fall	SHB				BLB			
	Max	Min	Max	Min		V1	V2	V3	V4	V1	V2	V3	V4
Early	32.48	24.79	87.11	78.45	1463.10	359	60	181	346	427	111	60	180
Normal	32.52	24.84	87.17	78.26	1389.00	263	84	25	27	530	161	35	103
Late	32.53	24.80	87.51	78.41	1346.80	204	40	271	323	796	67	68	172

(V1=Uma; V2= Shreyas; V3= Prathyasa; V4=Pournami)

RAIPUR

The AUDPC of sheath blight disease of two varieties (Swarna and Rajeshwari) were studied in relation to the weather factors. The variety Swarna was more susceptible to sheath blight (2315) compared to the variety Rajeshwari (1084). the variety Rajeshwari showed increased progression of the sheath blight disease with increased rainfall, as the early sown crop received more rainfall (1591) showed the highest AUDPC (1148). but in case variety Swarna, the late sown crop showed highest AUDPC (2315) which received the least rainfall (866) as compared to the early and normal sown crops (Table 10.16).

Table 10.16: Disease Progression with respect to weather factors at Raipur

Sowing time	Raipur					AUDPC	
	Temperature		Relative Humidity		Rain Fall	SHB	
	max	min	max	min		V1	V2
Early	31.70	21.96	86.35	56.38	1591.1	2234	1148
Normal	30.91	21.23	88.74	56.98	1364.70	1021	872
Late	30.72	20.55	88.54	54.12	866.5	2315	1084

(V1=Swarna, V2=Rajeshwari)

IV. DISEASE MANANGMENT TRIALS-2023

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. 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 comprises of different formulations such as suspension concentrates (SC), wettable powder (WP), wettable granules (WG) and emulsifyable concentrates (EC). The trail was conducted during *Kharif*-2023 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, Gangavathi, 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. About 32 centres had conducted the experiment. 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 Gangavathi and Ponnampet, where sowing was done in the month of August. At Aduthurai sowing was done late in the month of September. 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 intravel of 15 days in all the test centres except Aduthurai and Moncompu where one spray was given. The fungicides were evaluated against leaf blast (11 locations), neck blast (10 locations), sheath blight (15 locations), brown spot (eight locations), sheath rot (four locations), grain discoloration (two locations) and stem rot (one location).

Leaf blast: The fungicides were evaluated against leaf blast disease at eleven locations cross the rice growing region of the country. In all the centres uniformly two sprays of fungicides were applied. Disease severity was recorded at all the test locations except Ghaghraghat where only disease incidence was observed.

Table 11.1: Experimental details of fungicidal evaluation against location-specific diseases of rice during, *Kharif*-2023

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-54	Natural	18.09.2023/ 18.10.2023	-	18.12.2023	1	18.12.2023	02.01.2024	22.01.2024
2	Bankura	Brown spot/ Sheath blight	Swarna (MTU7029)	Artificial	13.06.2023/ 15.07.2023	03.09.2023	10.09.2023	2	10.09.2023 24.09.2023	09.09.2023 23.09.2023 21.10.2023	31.10.2023
3	Chatha	Brown spot	Basmati-370	Natural	20.06.2023/ 15.07.2023	-	23.09.2023	2	28.09.2023 13.10.2023	-	20.11.2023
4	Coimbatore	Leaf blast	CO39	Natural	14.07.2023/ 02.08.2023	-	14.09.2023	2	19.09.2023 01.10.2023	27.09.2023 08.10.2023	02.11.2023
5	Chinsurah	Sheath blight	Swarna (MTU 7029)	Artificial	16.06.2023/ 11.07.2023	22.08.2023	28.08.2023	2	01.09.2023 11.09.2023	-	07.11.2023
6	Chiplima	Sheath blight/ Neck blast	Swarna	Artificial/ Natural-Nb	05.07.2023/ 05.08.2023	14.09.2023	30.09.2023 18.10.2023	2	06.10.2023 20.10.2023	20.10.2023 06&21.11.2023	11.12.2023
7	Cuttack (ICAR-NRRI)	Sheath blight	Tapaswini	Artificial	12.06.2023/ 26.07.2023	06.09.2023	16.09.2023	2	26.09.2023 04.10.2023	15.10.2023 24.10.2023	06.11.2023
8	ICAR-IIRR	Leaf blast	HR-12	Artificial	08.07.2023/ 13.08.2023	20.10.23	-	2	05.09.2023/ 16.09.2023	18.09.2023/ 28.09.2023	05.12.2023
		Sheath blight	BPT-5204	Artificial	08.07.2023/ 13.08.2023	17.10.23	20.10.23	2	20.10.2023 30.10.2023	10.11.23	05.12.2023
9	Faizabad (Masodha)	Sheath blight	Pusa Basmati 1	Artificial	28.06.2023/ 26.07.2023	26.09.2023	03.10.2023	2	04.10.2023 19.10.2023	17.10.2023 09.11.2023	18.11.2023
10	Gangavathi	Sheath blight	GNV-1089	Artificial	30.08.2023/ 06.09.2023	08.10.2023	15.10.2023	2	16.10.2023 27.10.2023	15&23.10.2023 05.11.2023	22.12.2023
11	Ghagraghat	Leaf Blast/ Neck Blast	Jalpriya	Natural	25.06.2023/ 24.07.2023	-	-	2	20.09.2023 19.10.2023	20.12.2023	25.12.2023
12	Hazaribagh	Leaf blast	CO39	Natural	01.08.2023	-	11.09.2023	2	11.09.2023 22.09.2023	18&29.09.2023 05.10.2023	23.10.2023
		Brown spot	Sahbhagidhan	Artificial		-	06.09.2023	2	07.09.2023 19.09.2023	13&26.09.2023 03.10.2023	10.11.2023
13	Jagadalpur	Leaf blast/ Neck blast	Swarna	Natural	05.07.2023/ 31.07.2023	-	22.08.2023	3	03&17.09.23 02.10.2023	4&18.09.2023 02.10.2023	11.12.2023
14	Kaul	Neck blast	PB1121	Natural	- 25.07.2023	-	07.10.2023	2	11.10.2023 26.10.2023	10.11.2023	20.11.2023
15	Lonavala	Leaf Blast/ Neck blast	EK-70	Natural	28.06.2023/ 21.07.2023	-	08.09.2023	2	09.09.2023 25.09.2023	09.09.2023 27.09.2023 / 27.09.2023 10.10.2023	31.10.2023
16	Ludhiana	Sheath blight	PR114	Artificial	07.06.2023/ 01.07.2023	11.09.2023	-	2	13.09.2023 22.09.2023	07.10.2023	25.10.2023

S. No	Location	Disease Recorded	Test Variety	Screening	Date of activities						
					Sowing/ Transplanting	Inoculation	Initial symptom	No of Spray	Spraying	Observation	Harvesting
17	Mandya	Leaf blast/ Sheath blight/ Neck blast	Penna super	Artificial- Bl, Shb Natural-Nb	11.08.2023/ 12.09.2023	05.11.2023 06.11.2023 06.12.2023	28.10.2023 15.11.2023 30.11.2023	2	15.11.2023 01.12.2023 30.11.2023	13.11.2023 28.11.2023 10&12.12.2023	01.01.2024
18	Maruteru	Sheath blight Neck blast	Swarna (MTU 7029)	Artificial Natural-Nb	10.07.2023/ 10.08.2023	07.09.2023	16.09.2023	2	20.09.2023 05.10.2023	21 & 28.09.2023 06 & 25.10.2023 23.11.2023	02.12.2023
19	Moncompu	Sheath blight/ Grain discolouration	Uma	Natural	07.06.2023/ 28.07.2023 13.06.2023/ 28.07.2023	-	10.08.2023	1	6.10.2023	4.10.2023 2.11.2023	11.11.2023
20	Navasari	Sheath rot	GR-11	Natural	03.07.2023/ 29.07.2023	-	16.09.2023	2	27.09.2023 08.10.2023	03.10.2023 14.10.2023	27.11.2023
21	Nawagam	Leaf blast/ Sheath rot	Gurjari	Artificial/ Natural- Shrt	21.07.2023/ 29.08.2023	30.09.2023 -	12.10.2023/ 10.10.2023	2	12.10.2023 27.10.2023	12.10.2023 27.10.2023 10.11.2023	05.12.2023
22	Pantnagar	Sheath blight	Pant Dhan-4	Artificial	15.06.2023/ 06.07.2023	18.08.2023	28.08.2023	2	08.09.2023 18.09.2023	03.10.2023 10.10.2023	16.11.2023
23	Pattambi	Brown Spot/ Sheath blight	Uma	Natural	13.07.2023/ 02&03.08.2023	-	15.10.2023	2	20.10.2023 02.11.2023	17.10.2023	30.11.2023
24	Ponnampet	Leaf blast/ Neck blast	Intan	Natural	05.08.2023/ 29.08.2023	-	19.09.2023/ 02.12.2023	2	17.09.2023 10.12.2023	14.09.2023 06.01.2024	25.01.2024
25	Pusa	Brown spot	Pankaj (HS)	Artificial	15.06.2023/ 24.07.2023	27.09.2023	11.09.2023	2	10.10.2023 27.10.2023	-	28.11.2023
26	Raipur	Sheath blight	Swarna	Artificial	- 08.06.2023	13.10.2023	-	2	15.10.2023 23.10.2023	24.10.2023	27.11.2023
27	Rajendranagar	Neck blast/ Sheath blight/ Grain discolouration	Tellahamsa	Artificial- shb Nat-Nb,Gd	11.07.2023/ 31.07.2023	05.10.2023 28.09.2023	01.10.2023	2	03.10.2023 17.10.2023	02 & 11 & 17 & 26.10.2023 & 03 & 06.11.2023	29.11.2023
28	Ranchi	Leaf blast/ Neck blast	Pusa sugandha-3	Artificial	15.07.2023/ 11.08.2023	25.09.2023	28.09.2023	2	27.09.2023 07.10.2023	17.10.2023 29.11.2023	10.12.2023
29	Rewa	Leaf blast	PS4	Artificial	18.07.2023/ 01.08.2023	10.09.2023	20.09.2023	3	27.09.2023 05.10.2023	01.10.2023 18.10.2023	25.11.2023
30	Sabour	Brown spot	RajendraShweta	Natural	27.06.2023/ 29.07.2023	-	16.08.2023	2	25.08.2023 05.09.2023	30.08.2023	25.11.2023
31	Titabar	Sheath rot	Gitesh	Artificial	15.07.2023/ 19.08.2023	20.09.2023	01.10.2023	2	05.10.2023 20.10.2023	15.11.2023	28.12.2023
		Stem rot	Basundhara	Artificial	15.07.2023/ 21.08.2023	28.09.2023	10.10.2023	2	14.10.2023 30.10.2023	21.11.2023	30.12.2023
32	Varanasi	Brown spot	HUR4-3	Natural	21.06.2023/ 29.07.2023	-	06.09.2023	2	21.09.2023 06.10.2023	18.11.2023	22.11.2023

Both disease severity and incidence were observed at Lonavala, and Nawagam. The test fungicidal products were evaluated against the disease under artificial inoculation of blast pathogen at IIRR, Mandya, Nawagam, Ranchi and Rewa and natural infection at Coimbatore, Ghaghraghat, Hazaribagh, Jagdalpur, Lonavala, Mandya and Ponnampet. Disease severity at test locations in check plots varied from 25.5% (Rewa) to 75.6% (IIRR). Severity on check plot was very high (>50%) at IIRR (75.6%), Jagdalpur (73.3%) and Hazaribagh (71.9%); high (>30-50%) at and Ponnampet (44.8%), Ranchi (43.2%), Lonavala (40.3%), Mandya (38.5%), Nawagam (37.9%), Coimbatore (31.5%) and moderate (20-30%) at Rewa (25.4%). Disease incidence at Rewa in check plot was about 32.5%. Disease incidence was very high at Nawagam (83.6%) and Ghaghraghat (79.9%); and low at Lonavala (15.8%) in check plots.

All eight 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 significantly reduced the severity at four locations *viz*., Lonavala (13.8%), Nawagam (18.8%), Ponnampet (17.5%), and Rewa (10.8%). Besides, other combi-product azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) also significantly reduced the severity at three locations *viz*., Hazaribagh (22.9%), Jagdalpur (28.3%), and Ranchi (6.6%) and also on par with other fungicides at three locations viz., Coimbatore (11.6%), IIRR (12.6%) and Mandya (6.7%). Besides, the same treatment (T3) showed low mean disease severity (16.5%) from all the test centres followed by tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) (Mean DI: 20.6%). Regarding disease incidence, treatment (T7) trifloxystrobin 25% + tebuconazole 50% WG (0.4g/l) was significantly reduced the incidence at Ghaghraghat (20%), Lonavala (8.2%) and on par with other fungicides at Nawagam (60.8%). The average minimum disease incidence from three locations was observed at tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) treatment (29.7%) followed by azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) (DI: 33.3) (Fig.11.1A and Table 11.2).

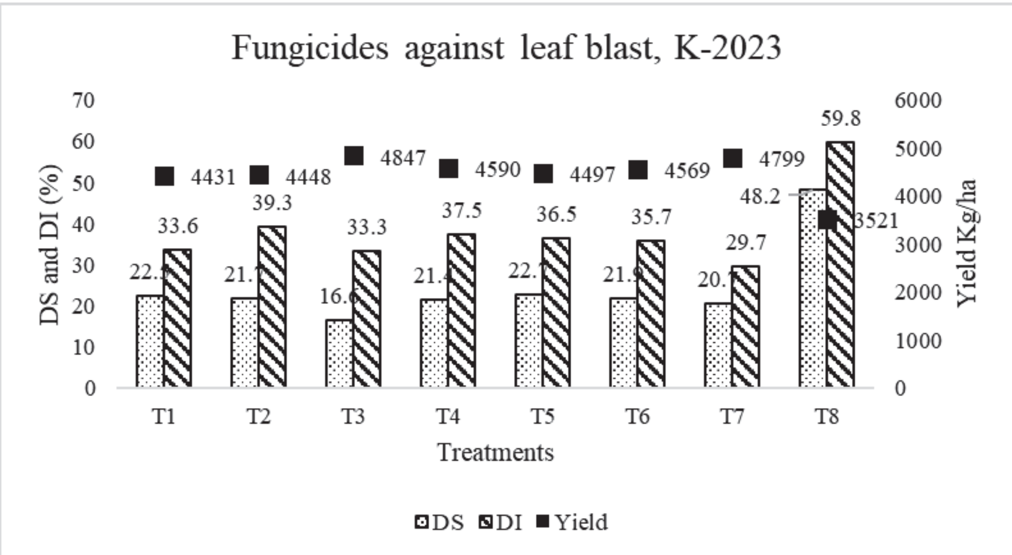

Figure 11.1A: Fungicides against Leaf blast, K-2023

The grain yield data was recorded at all eleven test locations and observed that all treated plots was superior to check plot (3784 Kg/ha). Treatment (T7) tebuconazole 50%+

trifloxystrobin 25% w/w WG (0.4 g/l) was superior in increasing the yield (4191 Kg/ha) compared to the other treatments (Table 11.3).

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 centres. Disease incidence was very high (>50%) at Jagdalpur (64.4%), Ghaghraghat (60.3%), and Kaul (51%); High at Ponnampet (41.2%), Chiplima (37.5%) and Mandya (35%); moderate (20-30%) at Ranchi (23.3%), Rajendranagar (18.2%); and low (>20%) at Maruteru (13.4%) and Lonavala (11.8%) in check plot. The performance of all the six fungicidal treatments were superior in reducing the neck blast incidence at all the test locations compare to control plot (DI: 35.6%).

The formulations *viz.,* tebuconazole 50% + trifloxystrobin 25% w/w WG (0.4g/l) was significantly reduced the incidence of the neck blast at four locations viz., Ghaghraghat (18.1%), Lonavala (4.3%), Ponnampet (12.1%) and Rajendranagar (4.7%) when compared to other treatments. Besides, the same combination fungicide was statistically on par with the best treatments at Chiplima (15.3%) and Ranchi (7%) for minimising the neck blast incidence. However, in two locations viz., Chiplima (17.5%) and Mandya (8.2%) showed significantly less incidence in azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 g/l) sprayed (T3) plots compared to other fungicidal treatments. However, low mean disease incidence (13%) was observed from the treatment (T3) azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 g/l) applied plots from test locations followed by tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) where mean disease incidence was 14%. (Fig. 11.1B; Table 11.4). In Maruteru, all eight treatments were non-significant with each other in controlling the neck blast incidence.

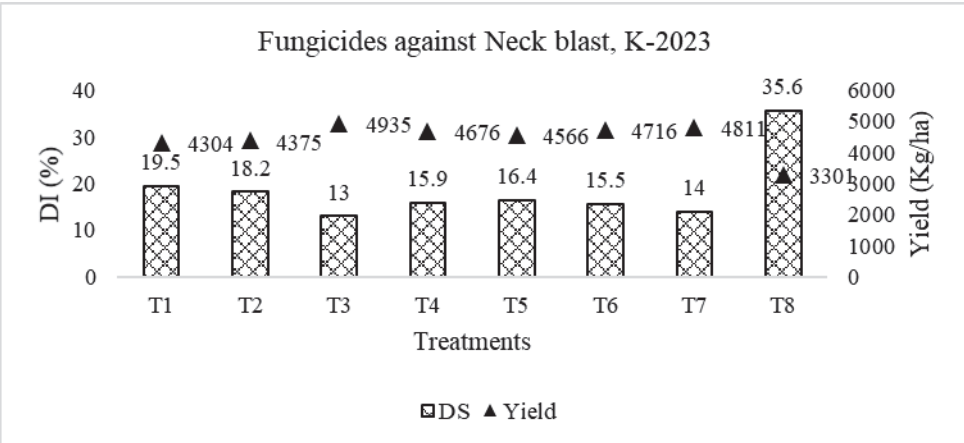

Figure 11.1B: Fungicides against Neck blast, K-2023

All the locations were recorded the grain yield except Maruteru and Rajendranagar. The mean yield across the locations in check plot was 3301 kg/ha. Among eight fungicidal treatments, azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 g/l) sprayed plot produced highest yield (4935 Kg/ha) followed by tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) (4811 Kg/ha), when compared to other combination fungicidal treatments (Table 11.5).

Table 11.2: Evaluation of fungicides against leaf blast disease of rice, *Kharif,* 2023

Treatments	Dosage/L	Leaf blast disease severity											LB - DI			
		CBT	HZB	JDP	LNV	IIRR	MND	NWG	PNP	RCI	REW	Mean	GGT	LNV	NWG	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	15.4 (23)	29.6 (32.9)	39.4 (38.8)	22.8 (28.4)	22.2 (28)	9.6 (18)	21 (27.2)	24.5 (29.6)	21.1 (27.1)	19.3 (4.5)	22.5	25 (29.9)	13.2 (3.7)	62.5 (52.2)	**33.6**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	17.1 (24.3)	26.1 (30.7)	36.1 (36.9)	20.8 (27)	13.7 (21.6)	13.3 (20.8)	32.8 (34.8)	26.8 (31.1)	13.5 (21.3)	16.9 (4.2)	21.7	28.4 (32.2)	12 (3.6)	77.4 (61.6)	**39.3**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	11.6 (19.8)	22.9 (28.5)	28.3 (32.1)	18.8 (25.6)	12.2 (20.4)	6.7 (14.9)	24.1 (29.3)	19.7 (26.2)	6.6 (14.5)	15 (3.9)	16.6	26 (30.6)	9.2 (3.1)	64.8 (53.6)	**33.3**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	16.5 (23.9)	24.9 (29.9)	37.8 (37.9)	17.8 (24.9)	12.6 (20.7)	8.1 (16.4)	29.7 (32.8)	22.4 (28.2)	30.1 (33.1)	14.4 (3.9)	21.4	31.7 (34.2)	8.4 (3)	72.4 (58.4)	**37.5**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	16.9 (24.2)	50.5 (45.2)	32.8 (34.8)	22.8 (28.4)	15.2 (22.8)	9.6 (17.9)	26.3 (30.7)	21.6 (27.6)	19 (25.6)	12.9 (3.7)	22.7	27.4 (31.5)	12 (3.6)	70.1 (56.9)	**36.5**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/liter	16.7 (24.1)	49.3 (44.5)	32.2 (34.5)	20.8 (27)	15.6 (23.2)	6.7 (14.9)	30.1 (33.2)	20.5 (26.8)	15.2 (22.7)	12.4 (3.6)	21.9	24.1 (29.3)	10.4 (3.3)	72.7 (58.5)	**35.7**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	13 (21)	49.9 (44.8)	38.9 (38.5)	13.8 (21.7)	27 (31.3)	8.1 (16.5)	18.8 (25.5)	17.5 (24.6)	9.1 (17.3)	10.8 (3.4)	20.7	20 (26.5)	8.2 (3)	60.8 (51.3)	**29.7**
T8 - Untreated control	-	31.5 (34)	71.9 (57.9)	73.3 (58.9)	40.3 (39.3)	75.6 (60.3)	38.5 (38.2)	37.9 (37.9)	44.8 (42)	43.2 (41)	25.5 (5.1)	48.2	79.9 (63.3)	15.8 (4.1)	83.6 (66.4)	**59.8**
General Mean	-	**17.3**	**40.6**	**39.9**	**22.2**	**24.3**	**12.6**	**27.6**	**24.7**	**19.7**	**15.9**	**-**	**32.8**	**89.2**	**70.5**	-
LSD @ 5% *(P=0.05)*	-	1.4	0.9	3.8	0.9	1.5	6.0	3.6	2.1	4.9	0.3	-	0.7	0.2	5.9	-
C.V.	-	4.0	1.5	6.5	2.3	2.9	17.3	7.8	4.8	13.0	4.3	-	1.4	3.1	6.9	-
Transformation	-	AT	AT	AT	AT	AT	AT	AT	AT	AT	ST	-	AT	ST	AT	-
Screening		N	N	N	N	A	A	A	N	A	N	-	N	N	A	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation; N/A- natural or artificial screening)

Table 11.3: Effect of fungicides on grain yield with respect to rice leaf blast, *Kharif*-2023

Treatments	Dosage/L	Leaf blast grain yield											
		CBT	GGT	HZB	IIRR	JDP	LNV	MND	NWG	PNP	RCI	REW	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	4919	2263	2666	4970	4850	3933	4761	8136	3512	5208	3527	**4431**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	4865	2175	2924	4910	5018	4068	4564	7302	3769	5720	3610	**4448**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	5091	2025	3306	4907	5453	4170	6765	7551	4197	6050	3805	**4847**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	4789	1975	3037	4897	5113	4275	5813	7701	4087	4965	3842	**4590**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	4869	2138	2410	4940	5270	4038	5120	7558	3712	5503	3912	**4497**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/l	4868	2413	2461	4907	5260	4065	5396	7374	3893	5599	4028	**4569**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	5019	2663	2511	4833	4908	4268	5732	8490	4311	5868	4192	**4799**
T8 - Untreated control	-	4284	1844	2094	3960	3453	3738	2490	6720	2164	4618	3364	**3521**
General Mean	-	**4838**	**2187**	**2676**	**4790**	**4915**	**4069**	**5080**	**7604**	**3706**	**5442**	**3785**	-
LSD @ 5% *(P=0.05)*	-	144.2	58.3	55.1	72.1	384.4	86.3	254.8	845.2	195.9	857.2	115.7	-
C.V.	-	2.0	1.8	1.4	0.9	5.3	1.4	2.8	7.5	3.6	10.6	1.7	-

Table 11.4: Evaluation of fungicides against neck blast disease of rice, *Kharif*, 2023

Treatments	Dosage/L	Neck blast disease incidence											DS
		CHP	GGT	JDP	KUL	LNV	MND	MTU	PNP	RNR	RCI	Mean	LNV
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	23.9 (29.1)	23.9 (29.2)	35 (36.2)	33.8 (35.4)	10.5 (3.3)	10.5 (3.3)	13 (3.7)	21.9 (27.8)	8.1 (2.8)	14.3 (22.7)	**19.5**	10.5 (18.8)
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	21.4 (27.5)	30.7 (32.5)	26.3 (30.7)	36.4 (37.1)	9.3 (3.1)	11.4 (3.5)	9.1 (3)	22.4 (28.1)	6.6 (2.7)	8 (16.3)	**18.2**	9.3 (17.6)
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	17.5 (24.6)	25.6 (31.9)	19.4 (26)	16.5 (23.9)	7.3 (2.8)	8.2 (3)	7.9 (2.7)	14.5 (22.2)	8.9 (3)	4.5 (12.1)	**13.0**	7.3 (15.5)
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	12.8 (20.6)	28.8 (30.8)	28.1 (32)	21.6 (27.6)	6.3(2.6)	8 (2.9)	8. 9 (3.1)	16.4 (23.5)	10.3 (3.3)	18.3 (25)	**15.9**	6.3 (14.4)
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	22.8 (28.3)	25 (32.4)	25 (29.9)	23.8 (29.1)	10.3 (3.3)	10.9 (3.4)	6.4 (2.7)	18.4 (25.3)	6.9 (2.7)	14.5 (22.1)	**16.4**	10.3 (18.5)
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/liter	15.8 (23.3)	21.9 (29.9)	22.5 (28.2)	30 (33.1)	9.3 (3.1)	8.9 (3)	9.4 (3.1)	17.7 (24.8)	8.7 (3)	10.8 (18.8)	**15.5**	9.3 (17.6)
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	15.3 (22.9)	18.1 (28.4)	29.4 (32.6)	27.2 (31.3)	4.3 (2.2)	11.3 (3.5)	10.4 (3.3)	12.1 (20.3)	4.7 (2.3)	7 (15.2)	**14.0**	4.3 (11.8)
T8 - Untreated control	-	37.5 (37.7)	60.3 (26.4)	64.4 (53.4)	51 (45.5)	11.3 (3.5)	35 (5.9)	13.4 (3.7)	41.2 (39.9)	18.2 (4.3)	23.3 (28.5)	**35.6**	11.8 (20)
General Mean	-	**20.9**	**29.3**	**31.3**	**30.0**	**8.6**	**13.0**	**9.8**	**20.6**	**9.1**	**12.6**	-	8.6
LSD @ 5% *(P=0.05)*	-	4.2	2.0	4.9	2.8	0.2	0.6	N/A	2.9	0.8	5.2	-	1.1
C.V.	-	10.5	4.4	9.9	5.8	4.0	9.8	20.7	7.3	16.5	17.3	-	4.6
Transformation	-	AT	AT	AT	AT	ST	AT	ST	AT	AT	AT		ST
Screening	-	N	N	N	N	N	N	N	N	N	N	-	N

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation; N/A- natural or artificial screening)

Table 11.5: Effect of fungicides on grain yield with respect to rice neck blast, *Kharif*-2023

Treatments	Dosage/L	Neck blast grain yield								
		CHP	GGT	JDP	KUL	LNV	MND	PNP	RCI	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	5803	2263	4850	4102	3933	4761	3512	5208	**4304**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	5645	2175	5018	4042	4068	4564	3769	5720	**4375**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	6218	2025	5453	4601	4170	6765	4197	6050	**4935**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	6683	1975	5113	4500	4275	5813	4087	4965	**4676**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	6310	2138	5270	4435	4038	5120	3712	5503	**4566**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/l	6898	2413	5260	4206	4065	5396	3893	5599	**4716**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	6443	2663	4908	4298	4268	5732	4311	5868	**4811**
T8 - Untreated control	-	4710	1844	3453	3391	3738	2490	2164	4618	**3301**
General Mean	-	**6088**	**2187**	**4915**	**4197**	**4069**	**5080**	**3706**	**5442**	-
LSD @ 5% *(P=0.05)*	-	556.6	58.3	384.4	274.6	86.3	254.8	195.9	857.2	-
C.V.	-	6.2	1.8	5.3	4.4	1.4	2.8	3.6	10.6	-

Sheath blight: Commercially available combination fungicides were evaluated against sheath blight disease at 15 hot spot locations. The experiment was conducted under artificial inoculation at all the test locations except Moncompu and Pattambi. Both disease severity and incidence was observed at seven locations *viz.,* Bankura, Cuttack, Faizabad (Masodha), Ludhiana, Mancompu, Maruteru, and Pantnagar. Only disease severity was observed at seven locations viz., Chinsurah, Chiplima, Gangavathi, IIRR, Mandya, Pattambi, Moncompu and Raipur. Only disease incidence was observed at Rajendranagar. 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 42.3% (Raipur) and 86.3% (Gangavathi). Disease severity on untreated plot was very high (>50%) at Gangavathi (86.3%), Ludhiana (78.3%), Masodha (74.5%), IIRR (70.5%), Chinsurah (70.3%), Pantnagar (70.1%), Cuttack (69.6%), Pattambi (69.4%), Chiplima (60.8%), Moncompu (60.8%) and Bankura (60%), Maruteru (59.9%), Mandya (52.6%); and high (30-50%) at Raipur (42.3%). Disease incidence was varied between 39.2% (Moncompu) and 100% (Ludhiana). It was very high at Ludhiana (100%), Bankura (98.8%), Pantnagar (92%), Rajendranagar (92%), Maruteru (89.3%) and Cuttack (78.7%), and Masodha (52.6%).

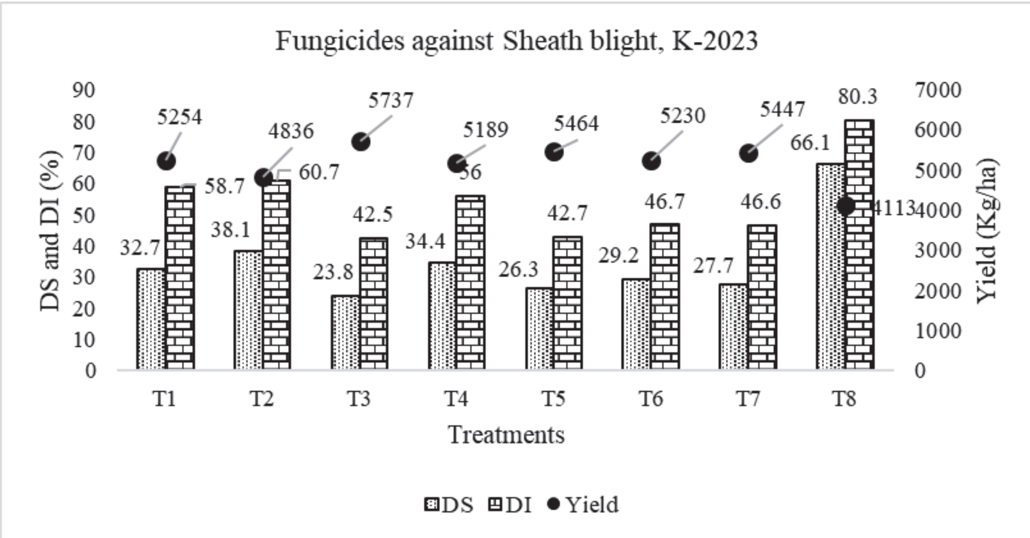

Figure 11.1C: Fungicides against sheath blight, K-2023

All fungicidal applications significantly reduced the disease compared to control (DS: 66.1%; DI: 80.3%) across the test locations. The combination fungicide azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) maximum reduced the severity at five locations *viz.,* Bankura (18.7%), Cuttack (16.4%), Pattambi (22.4%), Moncompu (5.3%) and Raipur (12.6%) and on par with other best treatment at five other locations viz., Chiplima, Gangavathi, IIRR, Mandya, and Maruteru. On the other side, treatments *viz.,* Azoxystrobin 14 % + Epoxiconazole 9 % SC (1.5 ml/l) maximum reduced the severity at four locations viz., Maruteru (15%), Chiplima (21.1%), IIRR (29.8%) and Masodha (21.1%) and on par with other fungicides at two locations viz., Cuttack and Moncopmpu. Another treatment tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4g/l) also maximum reduced severity at four locations namely, Gangavathi (27.4%), Ludhiana (13.3%), Mandya (10.4%) and Pant Nagar (32.3%). The mean disease severity (23.8%) was low at azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) treatment followed by azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l) (26.3%) (Fig. 11.1C and Table 11.6).

Among all the fungicidal treatments tricyclazole 18 % + mancozeb 62 % WP (2.5g/l) showed highest mean disease severity (41.8%) compared to other treatments followed by zineb 68% + hexaconazole 4% WP (2.5g/l). Combination fungicide azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) significantly reduced the intensity at three locations viz., Bankura (66.9%), Cuttack (14.5%), and Moncompu (5.9%) followed by Azoxystrobin 14 % + Epoxiconazole 9 % SC (1.5 ml/l) at two locations Masodha and Marateru, and Tebuconazole 50%+ Trifloxystrobin 25% w/w WG (0.4 g/l) at Pantnagar and Rajendranagar. The average disease incidence was very low (42.5%) 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 (4113 Kg/ha). Highest yield was recorded in the plots where azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) sprayed (5737 Kg/ha) plot followed by azoxystrobin 14 % + epoxiconazole 9 % SC (1.5 ml/l) sprayed plot (5464 Kg/ha) (Table 11.8).

Brown spot: Test fungicidal products were evaluated against brown spot at eight different locations. Both disease incidence and severity was recorded at Bankura, and remaing seven centres only disease severity was recorded. Disease severity in control plot was very high (>50%) at Pattambi (76.1%), Bankura (68%), Hazaribagh (57.9%), Aduthurai (57.8%), Chatha (52.5%), Sabour (51.6%), and high at Varanasi (49.8%); and moderate at Pusa (29%). The very high disease incidence (100%) was noticed at Bankura. Bio-efficacy of the fungicides was tested under artificial inoculation of brown spot pathogen at three centres viz., Bankura, Hazaribagh, and Pusa. All eight combi-products were performed better in reducing the brown spot at all the centres compared to untreated control.

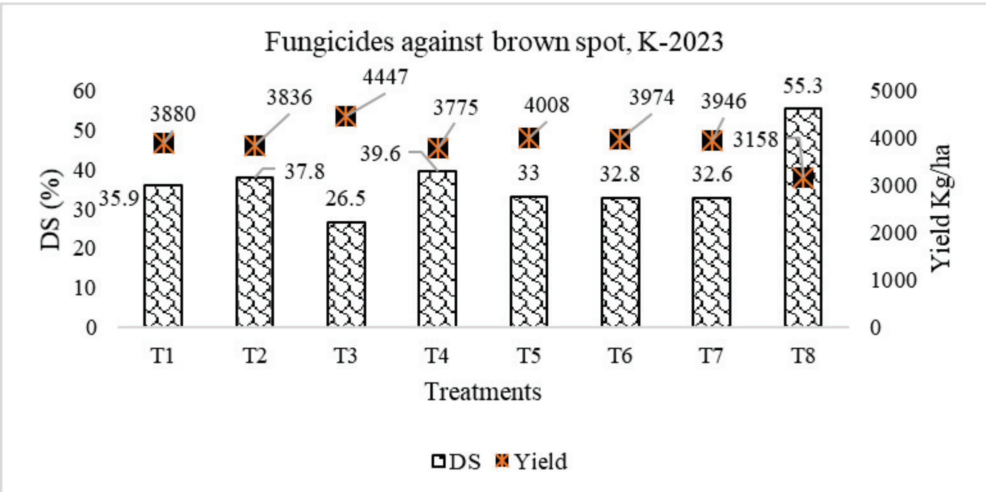

Figure 11.1D: Fungicides against Brown spot, K-2023

Among all the treatment, combination fungicide azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) was significantly reduced the disease severity at six locations viz., Aduthurai (27.4%), Bankura (18.4%), Pattambi (59.4%), Pusa (11.3%), Sabour (16.7%) and Varanasi (16.9%). The same treatment (T3) showed minimum average disease severity (26.5%) from all eight-test locations. Besides, treatments viz., tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) showed less disease severity (14.5%) at Chatha and mancozeb 50% + thiophanate methyl 25% WG (3.0 g/l) showed less disease severity (27.3%) at Hazaribagh. The low disease incidence (72.1%) was observed from the treatment azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) at Bankura (Fig. 11.1D and Table 11.9). Yield data was recorded at all eight centres. Fungicide sprayed plots showed significantly higher yield compared to control plot (3158 Kg/ha). Highest yield (4447 Kg/ha) was obtained from plots where azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) sprayed (Table 11.10).

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 Navasari and Nawagam. Only disease was observed at Aduthurai and Titabar. The test fungicidal products were evaluated against the disease under natural infestation at most of the locations except Titabar where disease was augmented through artificial inoculation. Disease severity in check plots was high (30-50%) at both Navasari (35.7%) and Nawagam (36%). Incidence in check plots was varied from 83.6% to 43%. Incidence was very high at Nawagam (83.6%), Titabar (76.2%) and Aduthurai (64.2%); high at Navasari (43.0%). In all the centres uniformly two sprays of fungicides. All the combination fungicides were significantly reduced the disease incidence (66.8%) and severity (35.8%) when compared to check.

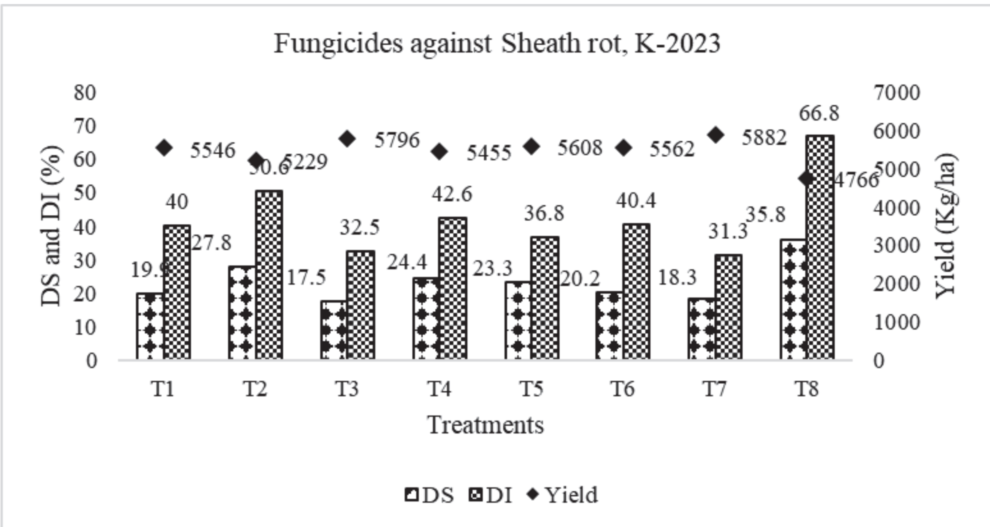

Figure 11.1E: Fungicides against sheath rot, K-2023

The combination fungicide *ie.,* azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) significantly reduced the sheath rot severity at Nawagam (20.6%) and incidence at Titabar (15.1%). The same treatment (T3) showed minimum average disease severity of 17.5% and minimum average disease incidence of 32.5% from the test locations. On the other side, treatment tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) significantly reduced disease severity at Navasari (20.6%) and disease incidence at two locations *viz.,* Aduthurai (21.4%) and Nawagam (54.2%). The same treatment (T7) showed minimum average disease severity of 18.3% and minimum average disease incidence of 31.3% from the test locations. However, these two test products *viz.,* azoxystrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) and tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) was found better in reducing the disease incidence as well as severity and on par with each other (Fig.11.1E and Table 11.11). The mean yield across the experimental locations in check plot was 4766 Kg/ha. Among the treatments, tebuconazole 50%+ trifloxystrobin 25% w/w WG (0.4 g/l) yielded more (5882 Kg/ha) when compare to other treatments (Table 11.11).

Glume/grain discolouration: The fungicides were evaluated against glume discoloration at Mancompu and Rajendranagar. Disease incidence at control plot was moderate (25.3%) at Rajendranagar. At Mancompu very low level of panicle (25.8%) and spikelet (13.5%) incidence were recorded in the control plot. All the fungicides reduced the grain dicoloration incidence compared to check. Treatment (T3) azoxysrobin 5.1% + tebuconazole 9.1% + prochloraz 18.2% EC (3.5 ml/l) showed less mean disease incidence (11%) at both the centres when compared over other treatments. However the same treatment (T3) produced highest grain yield (6104 Kg/ha) compared to all other treatments and check (4555 Kg/ha) (Table 11.12).

Stem rot: The chemicals were evaluated against stem rot disease through natural incidence at Titabar and recorded the disease incidence. 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 incidence at 8.8% and produced the highest yield (4595 Kg/ha) (Table 11.12).

Table 11.6: Evaluation of fungicides on sheath blight severity of rice, *Kharif,* 2023

Treatment	Dosage/L	Sheath blight disease severity														
		BNK	**CHN**	**CHP**	**CTK**	**GNV**	**IIRR**	**LDN**	**MND**	**PTB**	**MSD**	**MTU**	**MNC**	**PNT**	**RPR**	**Mean**
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	35.6 (36.6)	23.5 (28.9)	27.8 (31.7)	38.2 (38.1)	40.4 (39.4)	37.6 (39.2)	25.3 (30.1)	9.6 (17.9)	44.4 (41.5)	39.4 (38.8)	55.7 (55.6)	21.5 (26.3)	43.8 (41.3)	15.5 (23.0)	**32.7**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	33.2 (35.1)	43.8 (41.3)	35.3 (36.4)	29 (32.4)	46.4 (42.9)	36.7 (39)	45.7 (42.4)	20 (26.2)	49.1 (44.3)	36.6 (37.2)	50.8 (50.8)	34.5 (35.9)	48.0 (43.8)	24.4 (29.5)	**38.1**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	18.7 (25.5)	39.8 (39.0)	21.9 (27.8)	16.4 (23.7)	27.5 (31.6)	30.4 (34.8)	34.0 (35.6)	10.4 (18.6)	22.5 (27.8)	29.1 (32.6)	31.2 (31.1)	5.3 (12.7)	33.9 (35.6)	12.6 (20.7)	**23.8**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	28.9 (32.4)	48.3 (43.9)	34.4 (35.8)	22.6 (28.2)	37.0 (37.4)	33.6 (38.1)	30.8 (33.6)	16.3 (23.6)	45.0 (41.8)	34.6 (36.0)	52.4 (52.3)	31.7 (34.0)	47.1 (43.2)	18.5 (25.0)	**34.4**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	21.4 (27.5)	30.8 (33.6)	21.1 (27.2)	19.8 (26.1)	39.8 (39.0)	29.8 (33.7)	42.8 (40.8)	19.3 (25.3)	35.0 (36.1)	21.1 (27.2)	15.0 (15.0)	13.3 (20.6)	35.6 (36.6)	23.0 (28.5)	**26.3**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/liter	25.3 (30.1)	42.5 (40.6)	16.7 (23.9)	23.2 (28.6)	47.6 (43.5)	34.1 (40.5)	16.0 (23.5)	14.8 (22.3)	31.7 (34.0)	27.5 (31.5)	41.5 (41.5)	33.9 (35.5)	41.8 (40.3)	12.6 (20.7)	**29.2**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	23.7 (29.1)	36 (36.8)	26.1 (30.6)	36.4 (37.0)	27.4 (31.5)	36.8 (41.2)	13.3 (21.3)	10.3 (18.6)	38.8 (38.2)	22.5 (28.3)	43.7 (43.6)	20.3 (26.5)	32.3 (34.6)	20.0 (26.4)	**27.7**
T8 - Untreated control	-	60.0 (50.7)	70.3 (57.0)	60.8 (51.2)	69.6 (56.5)	86.3 (68.3)	70.5 (67.1)	78.3 (62.4)	52.6 (46.4)	69.4 (56.3)	74.5 (59.6)	59.9 (59.8)	60.8 (51.6)	70.1 (56.8)	42.3 (40.5)	**66.1**
General Mean	-	**30.9**	**41.8**	**30.5**	**31.9**	**44.1**	**38.7**	**35.8**	**19.2**	**42.0**	**35.7**	**43.8**	**27.7**	**44.1**	**21.1**	-
LSD @ 5% *(P=0.05)*	-	2.4	3.8	4.3	4.5	6.2	2.9	4.0	7.5	14.1	2.7	14.8	12.4	0.9	4.8	-
C.V.	-	4.8	6.4	8.7	9.0	8.3	4.4	6.3	17.0	23.8	5.0	22.8	27.6	1.3	10.2	-
Transformation	-	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	-
Screening	-	A	A	A	A	A	A	A	A	N	A	A	N	A	A	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation; N/A- natural or artificial screening)

Table 11.7: Evaluation of fungicides on sheath blight incidence of rice, *Kharif,* 2023

Treatment	Dosage/L	Sheath blight disease incidence								
		BNK	CTK	LDN	MSD	MNC	MTU	PNT	RNR	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	89.5 (71.3)	41 (42.9)	68.2 (55.6)	37.4 (37.6)	23 (28.5)	74.1 (60.6)	68.4 (55.7)	68.4 (34.3)	**58.7**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	85.5 (67.6)	29.1 (35.8)	92.4 (74.7)	33.9 (35.5)	28.2 (32.0)	70.5 (58.5)	72.9 (58.6)	72.9 (40.7)	**60.7**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	67.0 (54.9)	14.5 (26.5)	74.1 (59.4)	31.1 (33.8)	5.9 (13.4)	32.5 (34.2)	57.6 (49.3)	57.6 (26.3)	**42.5**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	853 (67.4)	25 (31.0)	68.5 (55.8)	33.4 (35.2)	27.7 (31.7)	66.1 (55.2)	71.1 (57.4)	71.1 (42.5)	**56.0**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	80.8 (64.0)	16.8 (28.8)	77.1 (61.4)	20.2 (26.6)	12.4 (20.3)	12.9 (19.8)	60.6 (51.0)	60.6 (32.0)	**42.7**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/l	73.8 (59.3)	24.2 (33.7)	33.2 (35.1)	29.6 (33.2)	30.1 (33.2)	53.6 (47.0)	64.6 (53.4)	64.6 (35.7)	**46.7**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	84.3 (66.8)	37.8 (38.8)	42.7 (40.7)	21.4 (27.4)	18.9 (25.5)	56.1 (48.6)	55.7 (48.2)	55.7 (35.5)	**46.6**
T8 - Untreated control	-	98.8 (86.7)	78.7 (57.7)	100 (90)	52.6 (46.4)	39.2 (37.3)	89.3 (76.2)	92.0 (73.5)	92.0 (46.3)	**80.3**
General Mean	-	**83.1**	**33.4**	**69.5**	**32.4**	**23.2**	**56.9**	**67.9**	**67.9**	-
LSD @ 5% *(P=0.05)*	-	5.5	5.9	5.3	2.5	10.6	16.7	1.2	5.5	-
C.V.	-	5.6	10.9	5.0	4.9	25.9	22.5	1.2	10.1	-
Transformation	-	AT	AT	AT	AT	AT	AT	AT	AT	-
Screening	-	A	A	A	A	N	A	A	N	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation; N/A- natural or artificial screening)

Table 11.8: Effect of fungicides on grain yield with respect to rice sheath blight, *Kharif*-2023

Treatments	Dosage/L	Sheath blight grain yield															
		BNK	CHN	CHP	CTK	GNV	IIRR	LDN	MND	PTB	MSD	MTU	MNC	PNT	RPR	RNR	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	5165	5545	5803	3950	5436	3765	6217	4828	3865	3000	5601	5913	5658	8100	5968	**5254**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	5288	4028	5645	4060	5215	2885	5883	4489	2985	3025	5701	4735	5108	7650	5844	**4836**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	6110	4433	6218	5170	6259	3700	6011	7450	3800	3300	6399	5935	6160	8833	6272	**5737**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	5377	3719	6683	4450	5108	3363	6250	6541	3463	3088	6092	4538	5119	8083	5960	**5189**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	5833	5181	6310	4780	5348	3808	5883	5677	3908	3775	6948	4400	6117	7867	6121	**5464**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/liter	5508	4459	6898	4190	5250	3523	6211	5399	3623	3325	6256	3875	5715	8233	5982	**5230**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	5615	4575	6443	4040	6234	3663	6606	5732	3763	3713	6231	4625	6286	8083	6100	**5447**
T8 - Untreated control	-	3683	3055	4710	3640	4194	3263	5689	3466	3363	2175	4753	2895	4864	7317	4629	**4113**
General Mean	-	**5322**	**4374**	**6088**	**4285**	**5381**	**3496**	**6094**	**5448**	**3596**	**3175**	**5998**	**4614**	**5628**	**8021**	**5860**	-
LSD @ 5% *(P=0.05)*	-	151.4	553.9	556.6	N/A	638.8	115.7	353.8	716.5	468.6	215.7	740.5	1332.1	139.9	750.0	562.5	-
C.V.	-	1.9	8.6	6.2	15.8	6.7	4.6	3.3	7.4	8.8	4.6	8.3	19.5	1.4	5.3	6.5	-

Table 11.9: Evaluation of fungicides on brown spot of rice, *Kharif*, 2023

Treatments	Dosage/L	Brown spot disease severity									DI
		ADT	BAN	CHA	HZA	PTB	PSA	SAB	VAR	Mean	BAN
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	30.2 (33.3)	31.8 (34.3)	31.8 (34.2)	27.3 (31.4)	68.9 (56)	23 (28.6)	35.5 (36.5)	38.9 (38.5)	**35.9**	73.8 (59.2)
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	35.7 (36.6)	34.0 (35.6)	36.5 (37.1)	48.4 (44)	68.1 (55.6)	16.5 (23.8)	23.4 (28.8)	40.1 (39.2)	**37.8**	80.8 (64.1)
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	27.4 (31.5)	18.4 (25.3)	19.8 (26.3)	42 (40.3)	59.4 (50.5)	11.3 (19.5)	16.7 (24.1)	16.9 (24.2)	**26.5**	72.2 (58.2)
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	42.2 (40.4)	23.9 (29.2)	37 (37.4)	48.9 (44.3)	75.4 (60.2)	21.3 (27.4)	33.7 (35.4)	34.2 (35.7)	**39.6**	89.4 (71.3)
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	31.6 (34)	19.5 (26.1)	27.5 (31.5)	49.8 (44.8)	65.6 (54)	16 (23.5)	30.9 (33.7)	23.1 (28.7)	**33.0**	69.8 (56.6)
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/l	37.3 (37.5)	23 (28.6)	24.4 (29.5)	46.4 (42.8)	61.1 (51.4)	14.3 (22)	30.7 (33.6)	25.6 (30.3)	**32.8**	79.3 (63.1)
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	26.7 (31)	22.0 (27.8)	14.5 (22.2)	48.6 (44.1)	70.8 (57.3)	17.3 (24.4)	41.6 (40.1)	19.1 (25.8)	**32.6**	76.6 (61.1)
T8 - Untreated control	-	57.8 (49.4)	68.0 (55.5)	52.5 (46.4)	57.9 (49.5)	76.1 (60.7)	29 (32.5)	51.6 (45.8)	49.8 (44.8)	**55.3**	100 (90)
General Mean	-	**36.9**	**29.8**	**30.3**	**48.9**	**68.1**	**17.9**	**32.7**	**29.8**	-	80.2
LSD @ 5% *(P=0.05)*	-	4.8	2.9	3.4	1.1	5.1	2.4	2.7	3.5	-	5.3
C.V.	-	8.8	5.9	6.9	1.7	6.2	6.4	4.4	5.9	-	5.5
Transformation	-	AS	AS	AS	AS	AS	AS	AS	AS	-	AS
Screening		N	A	N	A	N	A	N	N		A

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation; N/A- natural or artificial screening)

Table 11.10: Effect of fungicides on grain yield with respect to rice brown spot, *Kharif*-2023

Treatments	Dosage/L	Brown spot grain yield								
		ADT	**BNK**	**CHT**	**HZB**	**PTB**	**PSA**	**SBR**	**VRN**	**Mean**
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	**3.0 g/l**	4894	5408	2456	3390	3865	3525	4227	3277	**3880**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	**1.5 g/l**	4702	5305	2329	2700	2985	4150	5367	3148	**3836**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	**3.5 ml/l**	4997	6171	2676	3179	3800	4750	6137	3867	**4447**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	**2 ml/l**	4527	5744	2436	2658	3463	3775	4275	3324	**3775**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	**1.5 ml/l**	4768	5983	2484	2655	3908	4400	4413	3455	**4008**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	**2 ml/l**	4671	5624	2535	2932	3623	4575	4467	3367	**3974**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	**0.4 g/l**	5250	5717	2983	2678	3763	3913	3727	3538	**3946**
T8 - Untreated control	-	4560	3432	2301	2513	3363	3463	2620	3013	**3158**
General Mean	-	**4796**	**5423**	**2525**	**2838**	**3596**	**4069**	**4404**	**3374**	-
LSD @ 5% *(P=0.05)*	-	164.4	152.6	74.0	55.7	468.6	218.7	586.8	237.7	-
C.V.	-	2.3	1.9	2.0	1.3	8.8	3.6	7.5	4.0	-

Table 11.11: Evaluation of fungicides on sheath rot of rice, *Kharif,* 2023

Treatments	Dosage/L	Sheath rot DS			Sheath rot disease incidence					Sheath rot grain yield				
		NVS	NWG	Mean	ADT	NVS	NWG	TTB	Mean	ADT	NVS	NWG	TTB	Mean
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	22.9 (28.5)	16.9 (24.2)	**19.9**	29.5 (32.7)	36.2 (36.9)	57.9 (49.5)	36.4 (37.0)	**40.0**	4894	5078	8136	4078	**5546**
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	24.1 (29.3)	31.6 (34.1)	**27.8**	37.7 (37.7)	36.5 (37.1)	81.7 (64.7)	46.5 (42.9)	**50.6**	4702	4986	7302	3925	**5229**
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	14.4 (22.1)	20.7 (26.9)	**17.5**	24.3 (29.4)	23.0 (28.5)	67.5 (55.3)	15.1 (22.8)	**32.5**	4997	6173	7551	4462	**5796**
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	22.12 (27.9)	26.7 (30.9)	**24.4**	40.2 (39.3)	32.2 (34.5)	78.1 (62.2)	20.0 (26.5)	**42.6**	4527	5224	7701	4370	**5455**
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	18.9 (25.7)	27.7 (31.7)	**23.3**	30.5 (33.3)	30.4 (33.3)	77.0 (61.3)	9.3 (17.6)	**36.8**	4768	5530	7558	4577	**5608**
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/l	15.7 (23.2)	24.7 (29.7)	**20.2**	38.2 (38.1)	27.2 (31.3)	72.2 (58.2)	23.8 (29.1)	**40.4**	4671	6028	7374	4174	**5562**
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	20.7 (26.9)	16.0 (23.4)	**18.3**	21.4 (27.4)	30.7 (33.4)	54.2 (47.4)	18.8 (25.5)	**31.3**	5250	5392	8490	4395	**5882**
T8 - Untreated control	-	35.7 (36.6)	36.0 (36.7)	**35.8**	64.3 (53.3)	43.1 (40.9)	83.6 (66.6)	76.3 (60.8)	**66.8**	4560	4006	6720	3778	**4766**
General Mean	-	**21.8**	**25.0**	**-**	**35.8**	**32.4**	**71.5**	**30.8**	**-**	**4796**	**5302**	**7604**	**4220**	-
LSD @ 5% *(P=0.05)*	-	2.6	3.2	-	5.7	4.5	6.2	2.0	-	164	708	845	115	-
C.V.	-	6.5	7.3	-	10.6	8.9	7.2	4.2	-	2	9	8	2	-
Transformation	-	AT	AT	-	AT	AT	AT	AT	-	-	-	-	-	-
Screening	-	N	N	-	N	N	N	A	-	-	-	-	-	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation; N/A- natural or artificial screening)

Table 11.12: Evaluation of fungicides on grain discolouration and stem rot of rice, *Kharif,* 2023

Treatments	Dosage/L	Grain discoloration							Stem rot	
		MNC	MNC	RNR	Mean	MNC	RNR	Mean	Titabar	
		Panicle	Spikelet	DI	DI	Grain yield		yield	DI	Yield
T1 - Mancozeb 50% + Thiophanate methyl 25% WG	3.0 g/l	8.8 (3.1)	8.6 (3)	18.8 (4.4)	**12**	5913	5968	**5940**	28.3 (31.9)	4194
T2 - Kasugamycin 5% + copper oxychloride 45% WP	1.5 g/l	12.7 (3.6)	8.1 (2.9)	14.5 (3.9)	**12**	4735	5844	**5290**	36 (36.6)	4000
T3 - Azoxysrobin 5.1% + Tebuconazole 9.1% + Prochloraz 18.2% EC	3.5 ml/l	8.5 (3)	13 (3.7)	10.3 (3.3)	**11**	5935	6272	**6104**	14.8 (22.2)	4478
T4 - Fenoxanil 5% + Isoprothiolane 30% EC	2 ml/l	11.5 (3.5)	11 (3.4)	16.5 (4.1)	**13**	4538	5960	**5249**	22.5 (28.2)	4258
T5 - Azoxystrobin 14% + Epoxiconazole 9% SC	1.5 ml/l	11.9 (3.5)	12.0 (3.5)	13.3 (3.7)	**12**	4400	6121	**5261**	8.8 (17)	4595
T6 - Picoxystrobin 7.05% + Propiconazole 11.7% SC	2 ml/liter	10.4 (3.3)	9.8 (3.2)	17.8 (4.3)	**13**	3875	5982	**4929**	24.8 (29.6)	4217
T7 - Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.4 g/l	13.7 (3.8)	12.0 (3.5)	14.8 (3.9)	**13**	4625	6100	**5363**	18.5 (25.3)	4325
T8 - Untreated control	-	25.8 (5.1)	13.5 (3.7)	25.3 (5.1)	**22**	2895	4629	**3762**	64 (53.2)	3805
General Mean	-	**12.9**	**11.0**	**16.4**	-	**4614**	**5860**	-	**27.2**	**4234**
LSD @ 5% *(P=0.05)*	-	0.4	N/A	0.6	-	1332.1	562.5	-	3.2	132.3
C.V.	-	6.9	13.4	10.3	-	19.5	6.5	-	7.0	2.1
Transformation	-	ST	ST	ST	-	-	-	-	AS	-
Screening	-	N	N	N	-	N	N	-	A	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation; ST- Square root transformation; N/A- natural or artificial screening)

TRIAL No. 12: EVALUATION OF BIO-CONTROL FORMULATIONS AGAINST FUNGAL DISEASES

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 strain has been characterised, whole genome sequenced and tested both on farm and in station trials over a period of 4 years to establish its 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 rice in about seven centres.

The experiment was conducted with the following 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 10 centers and results were obtained from seven centres, 5 centres viz., Maruteru, Moncompu, Navsari, Pantnagar and IIRR reporting on sheath blight disease; false smut, sheath rot and neck blast from Karaikal, leaf blast from Rewa and brown spot from Maruteru. Trials were not conducted at Gudalur and Hazaribagh. Results obtained from different centres are discussed below.

Sheath blight: Among the different centres that has reported sheath blight percent disease severity (DS), Pantnagar has reported the highest DS of 97.12% followed by Varanasi at 69.60% in the untreated plots (Control). 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 when compared to the fungicide treatment alone.

Among all the treatments and across the centres, treatment T6 = Seed treatment followed by seedling dip @ 10 g/l of liquid Formulation+ fungicide for the respective disease (21.54%) was the most effective in controlling the disease. Treated plants (T6) had less disease as compared to the all the treatments tested, followed by the treatment T5 (24.11%) (Table 12.1 to 12.6). In case of biocontrol formulations alone, the treatment T4 is the best in controlling the disease (30.81%). For effective control of sheath blight disease, a combination of biocontrol seed treatment and fungicide spray, such as hexaconazole, is necessary. Notably, treatment T6 demonstrated superior performance in disease reduction and yield enhancement, particularly evident in plant growth parameters like increased tiller count, shoot and root length, and 1000-grain weight. The biocontrol agent exhibits the greater ability to enhance plant growth characteristics by stimulating host mechanisms. Since *R. solani* is a soil-borne pathogen, seed treatment with the biocontrol agent prevents the initial establishment of the pathogen during the seedling stage.

Among the all the treatments applied for the management of sheath blight disease, Moncompu reported the highest percentage control over the disease (DC) viz., 93.36% followed by IIRR (90.54) 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). With respect to plant yield, Moncompu reported the highest percent increase in grain yield over control (125%) with treatment T6 followed by the plants treated with the treatment T5 (Table 12.5).

TABLE 12.1: Evaluation of bio control formulations against Sheath Blight at Maruteru and Moncompu

S.No	Treatments	Sheath blight								
		Maruteru				Moncompu				
		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)	39.59 (59.00)	23.95	4057	6.10	44.95 (42.09)	48.43 (44.08)	37.40	4300	44.98
T2	ST + SD @ (10 g/l) Liquid Formulation)	43.82 (41.43)	15.83	4491	17.43	48.01 (43.84)	56.27 (48.58)	27.27	4433	49.46
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	46.11 (42.75)	11.43	4595	20.16	38.58 (38.39)	34.77 (36.12)	55.06	4016	35.40
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	45.33 (42.30)	12.93	4569	19.47	12.09 (20.34)	12.17 (20.41)	84.27	4383	47.77
T5	T1+ Fungicide for the respective disease	35.22 (36.39)	32.35	4641	21.36	6.86 (15.17)	5.87 (14.01)	92.42	6083	105.09
T6	T2+ Fungicide for the respective disease	35.21 (36.38)	32.37	4681	22.40	5.16 (13.13)	5.13 (13.09)	93.36	6700	125.89
T7	Fungicide for the respective disease	26.29 (30.83)	49.50	4781	25.04	18.81 (25.70)	22.53 (28.33)	70.87	5716	92.72
T8	T8=Control	52.06 (46.16)		3824		70.81 (57.27)	77.37 (31.57)		2966	
C.D.		10.84		N/A		11.64	8.78		385.36	
SE(m)		3.66		219.6		3.80	2.87		125.83	
SE(d)		5.18		310.6		5.37	4.05		177.95	
C.V.		18.10		9.86		21.47	15.14		4.52	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

TABLE 12.2: Evaluation of bio control formulations against Sheath Blight at Navasari

S.No	Treatments	Sheath blight							
		DS (%)	% Decrease over control (DS)	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)	30.97 (33.80)	28.03	16.20	86.33	9.52	20.19	4779	22.51
T2	ST + SD @ (10 g/l) Liquid Formulation)	29.47 (32.87)	31.51	17.67	90.67	10.27	20.60	4963	27.22
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	26.17 (30.76)	39.18	18.30	94.00	10.55	21.19	5065	29.84
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	24.23 (29.48)	43.69	18.94	95.67	11.03	23.03	5249	34.56
T5	T1+ Fungicide for the respective disease	16.80 (24.19)	60.96	21.33	100.33	12.97	26.77	5821	49.22
T6	T2+ Fungicide for the respective disease	15.40 (23.10)	64.21	23.03	103.00	13.67	28.13	6127	57.06
T7	Fungicide for the respective disease	20.83 (27.14)	51.59	19.27	98.67	12.27	25.13	5372	37.71
T8	T8=Control	43.03 (40.98)		14.40	79.33	7.93	18.10	3901	
C.D.		4.01		4.89	9.52	2.00	3.21	731.63	
SE(m)		1.31		1.60	3.11	0.65	1.04	238.89	
SE(d)		1.85		2.25	4.39	0.92	1.48	337.84	
C.V.		8.77		14.84	5.76	10.28	7.93	8.01	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

TABLE 12.3: Evaluation of bio control formulations against Sheath Blight at Pantnagar

S.No	Treatments	Sheath blight								
		DI (%)	DS (%)	% Decrease over control (DS)	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)	77.73 (61.82)	50.99 (45.55)	28.12	8.15	117.91	50.67	26.08	5591	14.71
T2	ST + SD @ (10 g/l) Liquid Formulation)	73.72 (59.13)	49.24 (44.54)	30.59	8.40	118.52	53.00	26.54	5715	17.26
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	69.49 (56.45)	45.35 (42.32)	36.06	9.37	119.10	56.67	26.85	6044	24.00
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	65.78 (54.17)	42.69 (40.78)	39.82	19.60	119.38	58.00	27.00	6062	24.37
T5	T1+ Fungicide for the respective disease	63.31 (52.70)	40.60 (39.56)	42.77	9.64	119.66	59.67	27.10	6176	26.71
T6	T2+ Fungicide for the respective disease	60.85 (51.25)	36.56 (37.19)	48.45	10.09	121.53	63.00	27.58	6266	28.57
T7	Fungicide for the respective disease	67.58 (55.27)	44.64 (41.90)	37.07	9.58	118.75	54.67	26.74	5841	19.85
T8	T8=Control	97.12 (80.20)	70.93 (57.35)		7.71	115.74	49.33	24.98	4874	
C.D.		1.69	1.62		N/A	1.81	3.42	1.17	147.45	
SE(m)		0.55	0.53		3.70	0.59	1.11	0.38	48.14	
SE(d)		0.78	0.75		5.23	0.83	1.57	0.54	68.08	
C.V.		1.33	1.93		62.15	0.86	3.47	2.51	1.43	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

TABLE 12.4: Evaluation of bio control formulations against Sheath Blight at IIRR, Hyderabad

S.No	Treatments	Sheath blight						
		DS (%)	% Decrease over control (DS)	Root length	Shoot length	1000 grain weight	Grain yield (Kg/ha)	% Increase in Grain Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	18.30 (25.31)	67.61	45.50	81.59	18.59	5919	15.55
T2	ST + SD @ (10 g/l) Liquid Formulation)	17.64 (24.82)	68.77	49.75	81.64	16.87	6028	17.69
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	12.40 (20.61)	78.05	54.78	91.87	19.35	6540	27.68
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	10.90 (19.27)	80.70	54.93	66.60	21.20	6405	25.03
T5	T1+ Fungicide for the respective disease	6.51 (14.77)	88.48	34.91	72.60	15.84	5432	6.04
T6	T2+ Fungicide for the respective disease	5.34 (13.36)	90.54	32.35	73.25	15.48	5838	13.98
T7	Fungicide for the respective disease	11.49 (19.80)	79.66	34.65	66.13	13.55	5371	4.86
T8	T8=Control	56.48 (48.71)		32.33	82.61	12.55	5122	
C.D.		0.17		1.19	1.38	0.488	14.593	
SE(m)		0.06		0.39	0.45	0.159	4.765	
SE(d)		0.081		0.55	0.64	0.225	6.739	
C.V.		0.567		1.59	1.01	1.655	0.142	

(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 Varanasi

S.No	Treatments	Sheath blight			
		DS (%)	% Decrease over control (DS)	Grain Yield	% Increase in Grain Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	60.23 (50.88)	13.46	3289	13.45
T2	ST + SD @ (10 g/l) Liquid Formulation)	56.70 (48.83)	18.53	3734	28.80
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	51.47 (45.82)	26.05	3697	27.53
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	43.60 (41.31)	37.36	3971	36.98
T5	T1+ Fungicide for the respective disease	31.73 (34.27)	54.41	4838	66.89
T6	T2+ Fungicide for the respective disease	23.67 (29.10)	65.99	4876	68.20
T7	Fungicide for the respective disease	30.93 (33.78)	55.56	4472	54.26
T8	T8=Control	69.60 (56.52)		2899	
C.D.		5.02		459.54	
SE(m)		1.639		150.05	
SE(d)		2.318		212.20	
C.V.		6.172		6.543	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Table 12.5: Comparison of the effect of bio formulations against Sheath Blight in different centres

S.No	Treatments	Maruteru		Moncompu		Navsari		Pantnagar		IIRR		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	% Decrease over control (DC)	% Increase in Grain Yield
T1	ST + SD @ (10 g/l) (Solid Formulation)	23.95	6.10	37.40	44.98	28.03	22.51	28.12	14.71	67.61	15.55	13.46	13.45
T2	ST + SD @ (10 g/l) Liquid Formulation)	15.83	17.43	27.27	49.46	31.51	27.22	30.59	17.26	68.77	17.69	18.53	28.80
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	11.43	20.16	55.06	35.40	39.18	29.84	36.06	24.00	78.05	27.68	26.05	27.53
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	12.93	19.47	84.27	47.77	43.69	34.56	39.82	24.37	80.70	25.03	37.36	36.98
T5	T1+ Fungicide for the respective disease	32.35	21.36	92.42	105.09	60.96	49.22	42.77	26.71	88.48	6.04	54.41	66.89
T6	**T2+ Fungicide for the respective disease**	**32.37**	**22.40**	**93.36**	**125.89**	**64.21**	**57.06**	**48.45**	**28.57**	**90.54**	**13.98**	**65.99**	**68.20**
T7	Fungicide	49.50	25.04	70.87	92.72	51.59	37.71	37.07	19.85	79.66	4.86	55.56	54.26

Table 12.6: Evaluation of bio control formulations against sheath disease severity of rice, *Kharif*, 2023

T. No.	Treatment	Sheath blight diseases severity ()						
		Maruteru	Moncompu	Navasari	Pantnagar	Varanasi	IIRR	Mean
T1	ST + SD @ (10 g/l) (Solid Formulation)	39.59	44.10	30.97	50.99	60.23	18.30	40.70
T2	ST + SD @ (10 g/l) Liquid Formulation)	43.82	48.62	29.47	49.24	56.7	17.64	40.91
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	46.11	36.05	26.17	45.35	51.47	12.40	36.26
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	45.33	18.13	24.23	42.69	43.6	10.90	30.81
T5	T1+ Fungicide for the respective disease	35.22	13.82	16.8	40.60	31.73	6.51	24.11
T6	**T2+ Fungicide for the respective disease**	**35.21**	**13.03**	**15.4**	**36.56**	**23.67**	**5.34**	**21.54**
T7	Fungicide for the respective disease	26.29	27.98	20.83	44.64	30.93	11.49	27.03
T8	Control	52.06	61.62	43.03	70.93	69.6	56.48	58.95

False smut:

In the study of IDM package against falsesmut disease using the bioagent *T.asperellum* Strain TAIK1, Karaikal centre reported the highest percent decrease in disease severity over control (95.40%) when the plants 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) (85.75% decrease over control). Interestingly, application of the 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., 30.87 % and 25.50% respectively (Table 12.7). This indicates that the bioagent elicits plant growth in rice with highest number of tillers (17.33) and the higher 1000 grain weight (20 g) in the treatment T4 (Table 12.7)

Table 12.7: Evaluation of bio control formulations against False smut at Karaikal

S.No	Treatments	False smut						
		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)	12.60 (20.78)	56.49	12.67	15.00	5810	16.98	13.21 (21.30)
T2	ST + SD @ (10 g/l) Liquid Formulation)	11.61 (19.92)	59.90	12.67	16.00	6057	21.95	11.92 (20.19)
T3	T1+ Foliar Spray @ 5g/l	4.13	85.75	14.33	17.67	6233	25.50	4.37

S.No	Treatments	False smut						
		DS (%)	% Decrease over control (DS)	No of tillers	1000 grain weight	Grain yield (Kg/ha)	% Increase in Grain Yield	DI (%)
	(Solid Formulation)	(11.72)						(12.07)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	1.33 (6.63)	95.40	17.33	20.00	6500	30.87	1.81 (7.74)
T5	T1+ Fungicide for the respective disease	6.35 (14.59)	78.06	13.67	16.33	5430	9.33	8.77 (17.22)
T6	T2+ Fungicide for the respective disease	5.55 (13.62)	80.82	12.33	17.33	5700	14.77	6.24 (14.16)
T7	Fungicide for the respective disease	16.59 (24.02)	42.73	11.00	16.33	5267	6.04	18.23 (25.27)
T8	T8=Control	28.96 (32.54)		10.00	15.00	4967		30.50 (33.51)
C.D.		1.398		1.476	1.789	318.41		2.196
SE(m)		0.456		0.482	0.584	103.97		0.717
SE(d)		0.645		0.681	0.826	147.03		1.014
C.V.		7.259		6.419	6.056	3.13		10.453

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

NECK BLAST

Karaikal centre has reported the effectivity of *T.asperellum* Strain TAIK1 on neck blast disease, either alone or in combination of the fungicide Isoprothiolane @ 1.5ml/l applied at panicle emergence stage. Highest percent decrease in disease severity over control (88.42%) was achieved when the plants 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 followed by foliar spray @ 5g/l with solid formulation (T3). Further, the application of fungicide Isoprothiolane @ 1.5ml/l at panicle emergence stage, either alone (T7) or in combination with the bioagents (T5 and T6) were not as effective as the bioagent applications. However, the bioagents were found to induce highest percent increase in grain yield over control T4 and T3 in that order viz., 30.87 % and 25.50% respectively (Table 12.8).

Table 12.8: Evaluation of bio control formulations against Neck blast at Karaikal

S.No	Treatments	NECK 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)	8.65 (17.09)	65.47	12.67	15.00	5810	16.98	10.29 (18.71)
T2	ST + SD @ (10 g/l) Liquid Formulation)	7.21 (15.57)	71.22	12.67	16.00	6057	21.95	8.77 (17.22)
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	4.69 (12.50)	81.28	14.33	17.67	6233	25.50	6.38 (14.62)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	2.90 (9.80)	88.42	17.33	20.00	6500	30.87	4.03 (11.57)
T5	T1+ Fungicide for the respective disease	9.34 (17.79)	62.70	13.67	16.33	5430	9.33	7.27 (15.64)
T6	T2+ Fungicide for the respective disease	10.85 (19.23)	56.66	12.33	17.33	5700	14.77	10.97 (19.34)
T7	Fungicide for the respective disease	15.43 (23.12)	38.37	11.00	16.33	5267	6.04	14.67 (22.51)
T8	T8=Control	25.04 (30.01)		10.00	15.00	4967		31.85 (34.35)
C.D.		3.027		1.476	1.789	318.41		3.71
SE(m)		0.988		0.482	0.584	103.97		1.21
SE(d)		1.398		0.681	0.826	147.03		1.71
C.V.		16.282		6.419	6.056	3.13		17.84

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

SHEATH ROT

Karaikal reported the effectivity of *T.asperellum* Strain TAIK1 in terms of controlling the sheath rot disease and improving the plant growth characteristics. Complete suppression of disease reported as 100% percent decrease in disease severity over control was achieved 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) (93.90% decrease over control). 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., 30.87 % and 25.50% respectively (Table 12.9).

Table 12.9: Evaluation of bio control formulations against Sheath rot at Karaikal

S.No	Treatments	SHEATH ROT						
		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)	2.64 (9.35)	75.85	12.67	15.00	5810	16.98	2.93 (9.86)
T2	ST + SD @ (10 g/l) Liquid Formulation)	2.50 (9.09)	77.13	12.67	16.00	6057	21.95	2.84 (9.70)
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	0.67 (4.68)	93.90	14.33	17.67	6233	25.50	0.67 (4.68)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	0.00 (0.00)	100.00	17.33	20.00	6500	30.87	0.00 (0.00)
T5	T1+ Fungicide for the respective disease	2.15 (8.43)	80.30	13.67	16.33	5430	9.33	2.25 (8.62)
T6	T2+ Fungicide for the respective disease	2.11 (8.34)	80.73	12.33	17.33	5700	14.77	2.21 (8.54)
T7	Fungicide for the respective disease	4.77 (12.61)	56.40	11.00	16.33	5267	6.04	4.87 (12.75)
T8	T8=Control	10.93 (19.30)		10.00	15.00	4967		11.82 (20.10)
C.D.		1.22		1.476	1.789	318.41		1.10
SE(m)		0.398		0.482	0.584	103.97		0.36
SE(d)		0.562		0.681	0.826	147.03		0.51
C.V.		21.38		6.419	6.056	3.13		18.07

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

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, suppressing 59% of the disease, when compared to the untreated control (T8) (Table 12.10). This was followed by the treatment T5 (53% decrease over control) and T4 (47% 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.,* 20.33 and 20.52% respectively (Table 12.10).

Table 12.10: 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)	12.87 (6.36)	13.84	8.80	25.93	4053	15.71	14.33 (6.71)
T2	ST + SD @ (10 g/l) Liquid Formulation)	10.40 (5.72)	30.36	8.83	26.30	4047	15.53	14.10 (6.66)
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	8.77 (5.25)	41.29	8.87	27.33	4158	18.71	12.50 (6.27)
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	7.87 (4.97)	47.32	8.93	27.67	4182	19.37	10.10 (5.63)
T5	T1+ Fungicide for the respective disease	7.03 (4.70)	52.90	9.77	26.87	4222	20.52	10.03 (5.61)
T6	T2+ Fungicide for the respective disease	6.13 (4.39)	58.93	10.37	27.80	4215	20.33	8.47 (5.16)
T7	Fungicide for the respective disease	7.97 (5.00)	46.65	9.83	27.17	4582	30.80	12.65 (6.23)
T8	T8=Control	14.93 (6.85)		8.30	25.27	3503		24.97 (8.86)
C.D.		1.521		0.657	1.117	356.22		1.792
SE(m)		0.497		0.214	0.365	116.31		0.582
SE(d)		0.702		0.303	0.516	164.49		0.823
C.V.		9.06		4.033	2.36	4.89		7.543

(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. Treatment T7 viz., fungicide alone has better control of neck blast disease (49.36% decrease over control) which is giving a higher grain yield (4781kg/ha) with 25% increase over the untreated control (Table 12.11). The biocontrol and fungicide treatment combinations T5 (42.65% decrease over control) and T4 (41.80% decrease over control) are on par in controlling the neck blast disease incidence in Maruteru centre (Table 12.11).

Table 12.11: 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)	19.41 (26.13)	7.70	4057	6.10
T2	ST + SD @ (10 g/l) Liquid Formulation)	18.26 (25.29)	13.17	4491	17.43
T3	T1+ Foliar Spray @ 5g/l (Solid Formulation)	14.71 (22.54)	30.05	4595	20.16
T4	T2 + Foliar Spray @ 5g/l (Liquid Formulation)	12.24 (20.47)	41.80	4569	19.47
T5	T1+ Fungicide for the respective disease	12.06 (20.31)	42.65	4641	21.36
T6	T2+ Fungicide for the respective disease	12.76 (20.92)	39.32	4681	22.40
T7	Fungicide for the respective disease	10.65 (19.04)	49.36	4781	25.04
T8	T8=Control	21.03 (27.28)		3824	
C.D.		N/A		N/A	
SE(m)		2.639		219.62	
SE(d)		3.732		310.59	
C.V.		34.86		9.86	

(DS – Disease Severity; DI – Disease Incidence; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

TRIAL No.13: INTEGRATED PEST MANAGEMENT-SPECIAL TRIAL

The special integrated pest management trial was conducted against rice diseases at five different zones *viz*., Zone II (Northern zone - Ludhiana, Pantnagar, Kaul); Zone III (Eastern zone - Chiplima, Masodha); Zone V (Central zone – Jagdalpur); Zone VI (Western zone – Nawagam, Navsari) and Zone VII (Southern zone – Aduthurai, Mandya, Gangavathi, Rajendranagar). According to the existence of specific problems of each zone, Integrated Pest Management (IPM) module was designed and tested along with the Farmer Practices (FP). The detailed treatments can be referred from the AICRIP Plant Pathology Technical Programme, 2023. 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 - Pantnagar, Kaul and Ludhiana)

Under Northern zone, the trial was conducted at Pantnagar, Kaul and Ludhiana. At Pantnagar, the trial was evaluated for the management of sheath blight, brown spot, bacterial blight and false smut in three different locations. Data was recorded as disease severity for the all the diseases except false smut, wherein the data was recorded as disease incidence. Spraying of specific fungicide (hexaconazole 5% EC) for sheath blight disease effectively reduced the disease progression of (377-317 AUDPC units) when compared to Farmers practices (730 to 670 AUDPC units). Spraying of propiconazole 25% EC at correct stage of the crop effectively reduced the false smut disease incidence (IPM - 22.56 % to 13.63 %) as against farmers practice (20.20% to 22. 56%). Similarly, adoption of IPM practices reduced the disease progress of brown spot and bacterial blight, as compared to the farmer practices. At Kaul the trial was conducted for the management of leaf blast, neck blast, bacterial blight and sheath blight in two different locations. Adoption of IPM practices, significantly reduced the progress of the leaf blast (L1= IPM-116; FP-189, L2= IPM-117; FP-159) and sheath blight (L1= IPM-85; FP-104, L2= IPM-58; FP-105) in terms of AUDPC value as compared to the farmer management practices. In case of neck blast disease there was no much variation between the IPM and Farmer management practices. At Ludhiana, the trial was conducted for the management of sheath blight, brown spot and false smut at one location. Results revealed that, adoption of IPM practices reduced the false smut disease incidence (Table 13.1).

Table 13.1: AUDPC values based on disease severity (%) of rice diseases at different dates at Zone II (Pantnagar, Ludhiana and Kaul), *Kharif* – 2023

		DI (%)	AUDPC Values									DI (%)
	Treat-ment	Pantnagar				Kaul				Ludhiana		
		FS	SHB	BS	BB	LB	NB	BB	SHB	SHB	BS	FS
L1	IPM	15.90	354	28	0	116	20	12	85	114	152	18.18
	FP	22.56	728	90	16	189	20	21	104	60	72	20.00
L2	IPM	13.71	377	28	0	117	10	15	58	-	-	
	FP	20.20	730	91	15	159	15	22	105	-	-	
L3	IPM	13.63	317	29	0	-	-	-	-	-	-	
	FP	21.39	670	94	16	-	-	-	-	-	-	

(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 III (Eastern zone - Chiplima, Masodha)

Trials were conducted at Chiplima and Masodha. At Chiplima, adoption of IPM Practices like seed treatment with *Trichoderma* @10g/kg and spraying of carbendazim + mancozeb reduced the leaf blast disease progress (IPM- 27; FP- 141) as compared to farmer practices. The diseases *viz*., neck blast and bacterial blight progress was low in the IPM practices adopted field as compared with the farmer practices (NB = IPM – 177; FP-225, BB = IPM-295, FP-350). Similarly, reduction of false smut incidence (8.0%) was recorded in the IPM practices adopted field as against farmer practices (11.76%). In case of brown spot disease, IPM practice adopted field recorded the AUDPC value of 132 as against 108 in farmer practice adopted field. At Masodha the trial was conducted for the management of leaf blast, neck blast and bacterial blight and the data was recorded in terms of disease severity. Significant reduction in the disease development of leaf blast, neck blast and bacterial blight was recorded. Adoption of IPM practices, completely reduced the disease severity of leaf blast (0) as compared to farmer practices (25.98%). With respect to neck blast and bacterial blight, the disease severity was reduced from 37.25% to 16.36% and from 36.58 % to 11.11% respectively (Table 13.2).

Table 13.2: AUDPC values based on disease severity (%) of rice diseases recorded at different dates at Chiplima and Masodha, *Kharif* – 2023

	Treatment	Chiplima					Masodha		
		AUDPC				FS (DI %)	Disease Severity (%)		
		LB	NB	BS	BB		LB	NB	BB
L1	IPM	27	177	132	295	8.0	0	16.36	11.11
	FP	141	225	108	350	11.76	25.98	37.25	36.58

(L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices; LB- Leaf Blast; NB- Neck Blast; BB- Bacterial blight; DI- Disease Incidence)

Zone VI (Western zone – Nawagam, Navsari)

Under this zone, the trial was conducted at Nawagam at 3 locations for the management of sheath rot. At all the three locations, spraying of carbendazim 12% + mancozeb 63 % effectively reduced the disease progress as compared to farmer practices, wherein no fungicide spray was taken up. At Navsari, the trial was conducted at one location on diseases viz., sheath blight and brown spot. In the IPM field, application of hexaconazole 5 EC (2 ml/lit) at 60 DAT effectively reduced the sheath blight disease development (AUDPC value 416) as compared to farmer practice (AUDPC value 852). Similarly, AUDPC value of brown spot was reduced from 930 to 626 due to adoption of IPM practices (Table 13.3).

Table 13.3: AUDPC values based on disease severity (%) of rice diseases recorded at different dates at Nawagam and Navsari- *Kharif* '2023

Treatment	AUDPC Values		
	Nawagam	Navsari	
	Sheath rot	Sheath blight	Brown spot
L1 - IPM	563	416	626
L1- FP	705	852	930
L2- IPM	416	-	-
L2 - FP	539	-	-
L3 - IPM	404	-	-
L3 - FP	574	-	-

(L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices)

Zone V (Central zone – Jagdalpur)

Under Central zone, the trial was conducted only at Jagdalpur, wherein IPM practices and farmer practices were compared for the management of leaf blast, neck blast, sheath blight and brown spot. With respect to leaf blast and neck blast, in the IPM field, the disease progress in terms of AUDPC values were reduced from 412 to 164 and from 248 to 167 respectively. Similarly, sheath blight and brown spot diseases were managed using the IPM practices and wherein the disease progress was reduced from 421 to 173 and from 125 to 78 respectively. Similar trend was also observed in case of false smut disease incidence, wherein the disease was nil in the IPM practices adopted field as compared to the farmer adopted practices (56.71%) (Table 13.4)

Table 13.4: AUDPC values based on disease severity (%) of rice diseases recorded at different dates at Jagdalpur, *Kharif* '2023

	Treatment	AUDPC Values				False smut
		Leaf Blast	Neck blast	Sheath blight	Brown spot	(DI %)
L1	IPM	164	167	173	78	0
	FP	412	248	421	125	56.71

(L- Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices)

Zone VII (Southern zone – Aduthurai, Gangavathi, Mandya, Rajendranagar)

At Aduthurai, the trial was conducted for the management of false smut and bacterial blight. Adoption of IPM practices reduced the disease progress of false smut and bacterial blight. AUDPC values of bacterial blight disease was significantly low compared to farmer practices (L1 = IPM - 88; FP-288; L2 = IPM – 78; FP – 229; L3 = IPM – 105; FP – 295). In case of false smut disease, application of IPM practices were effective at all the three locations, wherein the AUDPC values were ranged from 22 to 27 in the IPM field and the values were ranged from 89 to 124 in the farmer practices. At Mandya, the IPM practices were evaluated against only for leaf blast wherein the disease progress values reduced significantly as compared to farmer practices (L1= IPM-90, FP-234; L2 = IPM-94, FP-227; IPM-63, FP-165). At Rajendranagar, the trial was conducted for the management of neck blast in three locations and brown spot in one location. Application of IPM practices viz., seed treatment with *Trichoderma viride* @ 10 g per kg seed, application of carbendazim 25% + mancozeb 50% WS @ 100 g per acre, spraying of carbendazim + mancozeb @ 500 g per acre at PI to booting stage effectively reduced the percentage disease severity of neck blast (L1 = IPM - 0.9%; FP-5.9%. L2 = IPM - 0.1%; FP -3.9%; L3 = IPM - 4.0%; FP- 7.7%) and brown spot (L1 = IPM – 16.8%; FP – 52.2%) disease progress in the IPM practices as compared to the farmer practices adopted field (Table 13.5).

Table 13.5: AUDPC values based on disease severity (%) of rice diseases recorded at different dates at Aduthurai, Mandya, Rajendranagar -*Kharif* '2023

AUDPC Values					DS (%)	
	Treatment	Aduthurai		Mandya	RNR	
		FS	BB	LB	NB	BS
L1	IPM	22	88	90	0.9	16.8
	FP	124	288	234	5.9	52.2
L2	IPM	24	78	94	0.1	-

AUDPC Values					DS (%)	
	Treatment	Aduthurai		Mandya	RNR	
		FS	BB	LB	NB	BS
	FP	89	229	227	3.9	-
L3	IPM	27	105	63	4.0	-
	FP	105	295	165	7.7	-

(L= Location; IPM – Integrated Pest Management Practices; FP- Farmer Practices)

At Gangavathi, adoption of IPM practices reduced the disease progress of leaf blast (IPM-16, FP-30), Neck blast (IPM-16, FP-30), brown spot (IPM-434, FP-545) and false smut (IPM-6.4, FP-11.02%) as compared to the farmer practices. In case of bacterial blight and sheath blight diseases, though diseases progress were reduced, the difference in the AUDPC values between the IPM and FP practices was low as compared to other diseases (Table 13.6).

Table 13.6: AUDPC values based on disease severity (%) of rice diseases recorded at different dates at Gangavathi -*Kharif* ’2023

Location	Treatment	AUDPC Values					(DI %)
		LB	NB	BB	SHB	BS	FS
L1	IPM	16	84	431	1010	434	6.4
	FP	30	111	501	1180	545	11.02

(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 MAJOR RICE DISEASES- Kharif - 2023

The yield loss trial was formulated to know the impact of the major rice diseases on the grain yield of the rice crop. The trial includes 3 different treatments, i.e. different graded levels of disease infections and one control treatment where there are no infections of the pathogen. Each treatment is replicated three times in an RBD pattern. As of now, the trial was proposed only for three major diseases *viz*., leaf blast, sheath blight, and bacterial blight. The respective pathogens were artificially inoculated by standardized method and observations were recorded as percent disease index. The trail was proposed at 11 hot spot locations and data was received from 9 locations. With respect to leaf blast, the trial was taken up at Jagdalpur, Mandya, and IIRR. In case of sheath blight, the trial was conducted at Gangavathi, Ludhiana, Mandya, Maruteru, Moncompu and IIRR. The trial on bacterial blight was taken up at Moncompu, Maruteru, Pantnagar, Pattambi and IIRR. Trail details of each location are given in the Table 14.1.

Leaf blast

The trial was conducted at 3 locations. Leaf blast susceptible varieties *viz*., Swarna (at Jagdalpur), MTU 1001 (at Mandya) and HR 12 (at IIRR) were used for yield loss assessment. In all the locations, pathogen was artificially inoculated by spraying conidial suspension or supplementing with spreading of diseased leaves and disease was recorded as percent disease index (PDI) and grain yield was recorded as kg/ha. Among the three locations, the highest Per cent disease index (PDI) of leaf blast was recorded at IIRR (62.22%) followed by Jagdalpur (60.00%) and in Mandya the PDI was 38.67% when the pathogen was inoculated thrice at interval of two days (T1). At Jagdalpur, when the inoculum sprayed twice at an interval of 2 days (T2 treatment) the PDI was recorded as 51.85% and 35.56 % when the inoculum was sprayed only once (T3 Treatment). The highest yield reduction of 26.46% was recorded when the PDI was 60.00% and it was 23.04% and 14.74% in the treatments T2 and T3 respectively. At Mandya T1, T2 and T3 treatments recorded the PDI as 38.67%, 23.55% and 16.29% respectively. The highest yield reduction of 60.29% was recorded when the PDI was 38.67%. However, at IIRR the PDI of 62.22% and 38.89% recorded the percentage of yield reduction as 24.87% and 23.42% respectively. The mean value was calculated across the locations and the results revealed that 53.63% of PDI reduced the yield up to 37.21%; 38.10% of PDI recorded 27.06% of yield reduction and 26.54% of PDI recorded the 12.20% of yield reduction (Table 14.2).

Table 14.1: Experimental details of IDM for the management of rice diseases, *Kharif*-2023

S. No	Location	Disease Recorded	Test Variety	Screening	Date of activities					
					Sowing/ Transplanting	Inoculation	Initial symptom	Spraying Date	Observation	Harvesting
1	Gangavathi	Sheath blight	GNV-10-89	Artificial	29.08.2023 05.09.2023	20.10.2023	30.10.2023	25.102023 10.11.2023	30.11.2023	21.12.2023
2	Jagdalpur	Leaf blast	Swarna	Artificial	05.07.2023 31.07.2023	-	10.08.2023	-	15.08.2023 12.10.2023	18.12.2023
3	Ludhiana	Sheath blight	PR114	Artificial	07.06.2023 01.07.2023	10.09.2023	-	-	30.09.2023	14.10.2023
4	Mandya	Leaf blast	MTU1001	Artificial	11.08.2023 12.09.2023	16.10.2023	21.10.2023	17.10.2023 04.11.2023	20.10.2023 11.11.2023 21.11.2023 09.12.2023 22.12.2023	03.01.2024
		Sheath blight	MTU1001	Artificial	11.08.2023 12.09.2023	16.10.2023	21.10.2023	17.10.2023 04.11.2023	20.10.2023 11.11.2023 21.11.2023 09.12.2023 22.12.2023	03.01.2024
5	Moncompu	Sheath blight	UMA (MO 16)	Artificial	07.07.2023 29.07.2023	25.09.2023	10.01.2023	01.10.2023	01.10.2023 02.11.2023	22.11.2023
		Bacterial leaf blight	UMA (MO 16)	Artificial	07.07.2023 29.07.2023	25.09.2023 12.10.2023	18.10.2023	19.10.2023	18.10.2023 05.11.2023	22.11.2023
6	Maruteru	Sheath blight	Swarna (MTU 7029)	Artificial	10.07.2023 10.08.2023	15.09.2023 16.09.2023	26.09.2023	01.10.2023 13.10.2023 01.11.2023	28.09.2023	15.12.2023
		Bacterial leaf blight	MTU - 2077 (Krishnaveni)	Artificial	10.07.2023 10.08.2023	30.09.2023	07.10.2023	10.10.2023 24.10.2023 08.11.2023	17.10.2023	15.12.2023
7	Pantnagar	Bacterial leaf blight	TN1	Artificial	10.07.2023 03.08.2023	21.09.2023	-	04.10.2023 14.10.2023	-	01.12.2023
8	Pattambi	Bacterial leaf blight	Jyothi	Artificial	08.07.2023 02.08.2023	06.10.2023	14.10.2023	17.10.2023	14.10.2023	04.11.2023
9	IIRR	Leaf blast	HR12	Artificial	18-06-2023 17-07-2023	25-08-2023 10-09-2023 15-09-2023	10.09.2023	05.09.2023	03.09.2023 10.09.2023 25.09.2023	25.11.2023
		Sheath blight	BPT 5204	Artificial	08.07.2023 13.08.2023	17.10.2023	20.10.2023	-	10.11.2023	05.12.2023
		Bacterial leaf blight	TN1	Artificial	08.07.2023 13.08.2023	14-09-2023	02.10.2023	-	16-10-2023	04.12.2023

Table 14.2: Leaf blast disease severity on rice grain yield, *Kharif*-2023

Leaf Blast											
T. No	**JDP**			**MND**			**IIRR**			**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 reduction over control**
T1	60.00 (50.75)	2744	26.46	38.67 (38.18)	2400	60.29	62.22 (52.05)	3443	24.87	**53.63**	**37.21**
T2	51.85 (46.04)	2872	23.04	23.55 (28.75)	3946	34.71	38.89 (38.56)	3510	23.42	**38.10**	**27.06**
T3	35.56 (36.58)	3182	14.74	16.29 (23.70)	5356	11.38	27.78 (31.77)	4103	10.47	**26.54**	**12.20**
T4	23.33 (28.85)	3732	0.00	12.40 (20.34)	6044	0.00	18.15 (25.17)	4583	0.00	**17.96**	**0.00**
C.V (%)	**2.84**	**1.35**		**18.32**	**13.52**		**4.15**	**4.12**			
LSD @ 5% *(P= 0.05)*	**1.59**	**58.33**		**7.01**	**826.26**		**3.06**	**32.21**			
Transfor-mation	**AT**			**AT**			**AT**				

(PDI- Percent disease index; Figures in the parenthesis indicates Arc sine transformed means)

Treatment details:

T1- Inoculation of all plants in a block (100% plants)
T2- Inoculation of alternate plants in a block (50% plants)
T3- Inoculation of once in three plants in a block (33% plants)
T4- Un-inoculated + fungicide treated control plot

Sheath blight: Sheath blight yield loss trail was conducted at six locations *viz*., Gangavathi, IIRR, Ludhiana, Mandya, Maruteru and Moncompu. The treatments were maintained with different level of pathogen infection *viz*., entire block (1 sq.mt) is artificially inoculated (100% infection) (T1), alternate plants in the block are inoculated (50% infection) (T2), one in each three plants of the entire block are inoculated (33% infection) (T3) and un-inoculated control (T4).

At Gangavathi, the trial was conducted in the sheath blight susceptible variety GV-10-89. The highest PDI of 83.08% was recorded in the T1 treatment and the corresponding percentage of yield reduction was 46.42%. Similarly, the lowest PDI of 54.60% reduced the yield up to 15.96%. At Ludhiana, the trial was carried with the susceptible variety PR114 and the maximum yield reduction of 33.41% was recorded with the highest PDI of 78.15%. At Mandya, MTU1001 was selected for the trial and highest PDI of 62.67% recorded the yield reduction up to 46.06% and the other treatments T2 (PDI 38.67%) and T3 (PDI 29.78%) recorded yield reduction of 31.49% and 25.55% respectively (Table 14.3). At Maruteru, the highest PDI of 70.93% (T1) recorded the yield reduction up to 22.93% in the susceptible variety MTU 7029. At Moncompu, variety Uma was selected for the trial, wherein 67.32% of PDI (T1) recorded the yield reduction as 46.11%. At IIRR, BPT 5204 was chosen for the trial and the treatment T1 recorded the PDI of 78.28% with the yield reduction of 45.86%. The mean value was calculated across the locations and the results revealed that 73.41% of PDI recorded the yield reduction of 40.13%; 53.45% of PDI recorded the yield reduction of 27.07% and 35.99% PDI recorded 16.46% of yield reduction (Table 14.3).

Bacterial blight: Yield loss trial on bacterial blight was conducted at five locations. The trial was conducted with three treatments, *viz*., artificial inoculation of *Xoo* of all the plants/hills (T1), inoculation of alternate plants/ hills (T2) and inoculation one in every three plants/ hills (T3) and uninoculated control (T4) along with 5 replications.

The bacterial blight susceptible varieties selected for the trial were TN1 at IIRR, Pantnagar; MTU 2077 at Maruteru, Uma at Moncompu and Jyothi at Pattambi. At Maruteru, T1 treatment recorded the PDI of 71.80% with 27.29% yield reduction and 6.87% yield reduction was recorded with the PDI of 41.51%. However, at Moncompu, 17.77% of PDI recorded the yield reduction of 15.45% and the 53.77% of PDI recorded 38.73% yield reduction. At Pantnagar the highest PDI of 95.59% resulted in the yield reduction of 45.19% followed by 74.83% PDI with 27.24% yield reduction (Table 14.4A). At Pattambi, 24.13% yield reduction was recorded with the PDI of 75.08% (T1); 19.97% of yield reduction with 60.97% PDI and 14.57% yield reduction with the PDI of 56.88%. At IIRR, the PDI of 38.17 % recorded the yield of loss of 21.40 %; 18.79% of PDI recorded the yield loss of 15.64% and 12.84% PDI recorded 9.05% yield loss. The overall mean values across the locations revealed that 66.88% PDI caused a yield loss of 31.35%; 47.03% of PDI caused a yield loss of 20.63% and 37.23% of PDI recorded a yield loss of 12.20% (Table 14.4).

Table 14.3: Sheath blight disease severity on rice grain yield, *Kharif*-2023

Sheath Blight									
T. No	**GNV**			**LUD**			**MND**		
	PDI (%)	**Yield (Kg/ha)**	**% yield reduction over control**	**PDI (%)**	**Yield (Kg/ha)**	**% yield reduction over control**	**PDI (%)**	**Yield (Kg/ha)**	**% yield reduction over control**
T1	83.08 (65.72)	3519	46.42	78.15 (62.12)	4043	33.41	62.67 (52.73)	3488	46.06
T2	69.42 (56.43)	4512	31.30	46.30 (42.86)	4772	21.39	38.67 (38.04)	4430	31.49
T3	54.60 (47.64)	5520	15.96	38.58 (38.36)	5314	12.47	29.78 (32.41)	4814	25.55
T4	8.78 (17.18)	6568	0.00	1.85 (6.80)	6071	0.00	18.66 (24.52)	6466	0.00
C.V (%)	**5.78**	**5.21**		**7.31**	**6.06**		**20.84**	**25.72**	
LSD @ 5% *(P= 0.05)*	**3.72**	**361**		**3.78**	**421**		**10.61**	**1700**	
Transformation	**AT**			**AT**			**AT**		

(PDI- Percent disease index; Figures in the parenthesis indicates Arc sine transformed means)

Treatment details:

T1- Inoculation of all plants in a block (100% plants)
T2- Inoculation of alternate plants in a block (50% plants)
T3- Inoculation of once in three plants in a block (33% plants)
T4- Un-inoculated + fungicide treated control plot

(Contd.,) Table 14.3: Sheath blight disease severity on rice grain yield, *Kharif*-2023

T. No	Sheath Blight										
	MTU			**MNC**			**IIRR**			**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 reduction over control**
T1	70.93 (58.16)	4470	22.93	67.32 (55.24)	4132	46.11	78.28 (62.42)	2435	45.86	**73.41**	**40.13**
T2	56.78 (48.89)	5180	10.69	39.55 (38.88)	5163	32.66	69.98 (56.85)	2928	34.89	**53.45**	**27.07**
T3	26.00 (30.63)	5444	6.14	27.55 (31.45)	6282	18.06	39.40 (38.84)	3572	20.59	**35.99**	**16.46**
T4	1.11 (2.73)	5800	0.00	9.99 (17.54)	7667	0.00	0.00 (0.00)	4498	0.00	**6.73**	**0.00**
C.V (%)	**16.96**	**17.60**		**15.88**	**2.21**		9.32	9.06			
LSD @ 5% (P=0.05)	**8.20**	**1266**		**7.83**	**177**		5.08	419			
Transformation	**AT**			**AT**			**AT**				

(PDI- Percent disease index; Figures in the parenthesis indicates Arc sine transformed means)

Treatment details:

T1- Inoculation of all plants in a block (100% plants)
T2- Inoculation of alternate plants in a block (50% plants)
T3- Inoculation of once in three plants in a block (33% plants)
T4- Un-inoculated + fungicide treated control plot

Table14.4: Impact of bacterial leaf blight incidence on grain yield - *Kharif*, 2023

Bacterial Leaf Blight									
T. No	MTU			MNC			PNT		
	PDI (%)	Yield (Kg/ha)	% yield reduction over control	PDI (%)	Yield (Kg/ha)	% yield reduction over control	PDI (%)	Yield (Kg/ha)	% yield reduction over control
T1	71.80 (57.95)	4130	27.29	53.77 (47.18)	4422	38.73	95.59 (78.00)	3420	45.19
T2	57.67 (49.40)	4694	17.36	22.89 (28.15)	5561	22.95	74.83 (59.89)	4540	27.24
T3	41.51 (39.98)	5290	6.87	17.77 (24.79)	6102	15.45	57.14 (49.09)	5300	15.06
T4	11.29 (19.29)	5680	0.00	9.55 (17.91)	7217	0.00	12.59 (20.62)	6240	0.00
C.V (%)	**10.65**	**17.72**		**13.52**	**0.89**		**4.69**	**8.65**	
LSD @ 5% *(P= 0.05)*	**6.12**	**1208**		**5.50**	**71**		**3.36**	**580**	
Transformation	**AT**			**AT**			**AT**		

(PDI – Percent Disease Index; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Treatment details:

T1 - Inoculation of all the plants/hills (disease intensity is more than 50%)
T2 – Inoculation of alternate plants/ hills (disease intensity is 30-50%)
T3 – Inoculation one in every three plants/hills (disease intensity is below 30%)
T4 - Un-inoculated + antibiotic treated control plot

(Contd.,) Table14.4B: Impact of bacterial leaf blight incidence on grain yield - *Kharif*, 2023

Bacterial Leaf Blight								
T. No	PTB			IIRR			Mean	
	PDI (%)	Yield (Kg/ha)	% yield reduction over control	PDI (%)	Yield (Kg/ha)	% yield reduction over control	PDI (%)	% yield reduction over control
T1	75.08 (60.05)	2545	24.13	38.17 (38.14)	6367	21.40	**66.88**	**31.35**
T2	60.97 (51.32)	2685	19.97	18.79 (25.66)	6833	15.64	**47.03**	**20.63**
T3	56.88 (48.96)	2866	14.57	12.84 (20.98)	7367	9.05	**37.23**	**12.20**
T4	9.50 (17.76)	3355	0.00	0.83 (5.23)	8100	0.00	**8.75**	**0.00**
C.V (%)	**6.35**	**4.63**		**5.14**	**7.71**			
LSD @ 5% *(P= 0.05)*	**3.89**	**182**		**2.30**	**1104**			
Transformation	**AT**			**AT**				

(PDI – Percent Disease Index; Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Treatment details:

T1 - Inoculation of all the plants/hills (disease intensity is more than 50%)
T2 – Inoculation of alternate plants/ hills (disease intensity is 30-50%)
T3 – Inoculation one in every three plants/hills (disease intensity is below 30%)
T4 - Un-inoculated + antibiotic treated control plot

TRIAL NO.15: SPECIAL SCREENING TRIAL ON FALSE SMUT – Kharif 2023

One hundred and twelve National Screening Nursery 1 (NSN-1) Advanced Varietal Trial entries with the duration of early and mid-early were selected for false smut screening trial. The trial was proposed at five locations *viz*., Gangavathi, Gudalur, IIRR Ludhiana, Masodha and it was conducted at all the locations except Ludhiana. The centres were advised to screen the entries either artificially or naturally and the detailed methodology of artificial screening technique standardised at IIRR, Hyderabad was given in the Technical Programme 2023-24. Observations were recorded in 10 Hills as number of smut balls per Hill. The recorded data were presented in the Table 15.1.

Gudalur: At this location, NSN-1 entries were sown on 22.08.2023, transplanted on 26.09.2023 and screened naturally against false smut disease. At this location, the data was recorded in terms of number on smut balls per Hills. Under natural infestation, the percentage of disease infection was 100% and all the entries were infected and the infection level was varied between the entries. Total of 111 entries were screened, wherein 87 entries recorded with maximum of 6 smut balls per hill. Twenty-three entries recorded with more than 6 smut balls per hill. Rainfall received during the November month (67 mm) might have favoured the disease infection (Table 15.2).

Gangavathi: The entries were sown on 28.07.2023 and transplanted on 02.09.2023 and the natural occurrence of disease was noticed on 25-11-2023. The level of disease infection was good and rainfall received in the month of November (38.5 mm) might have coincided with booting stage and favoured the natural disease infection. Among the 112 entries screened, 80 entries were infected and the number of smut balls varied from 1 to 30. Sixty-five (65) entries recorded smut ball range of 1 to 6 per Hill and 32 entries recorded no smut balls (Table 15.2).

Masodha: The entries screened naturally and the entries were sown on 04.07.2023 and transplanted on 29.07.2023. However, to augment the disease, the chlamydospore suspension was sprayed during panicle emergence stage. Symptoms were observed on 20.10.2023. Amount of rainfall in the month of October was low (11 mm) and hence the disease infection was low. Among the screened entries, the number of smut balls varied from 0 to 8 per Hill. Eighteen entries were recorded zero smut balls and 93 entries recorded 1 to 6 smut balls per Hill (Table 15.2).

IIRR, Hyderabad: The entries were sown on 16th June, 2023 and transplanted on 17th July, 2023. 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 inoculation was initiated on 18.09.2023 and ended on 20.10.2023. Number of smut balls varied from 0 to 64 per panicle. Among the 112 entries screened, 80 entries were recorded 4 to 64 smut balls per panicle. Twenty-four entries recorded 1 to 3 smut balls and 8 entries recorded zero smut ball per panicle. With respect to weather data, good amount of rainfall (271mm) was received in the month of September 2023, which might have favoured disease infection and development (Table 15.2).

Table 15.1: Disease reaction of NSN-1 entries against False smut disease under artificial/natural condition

S. No.	P. No.	Max.Smut Balls/ panicle	Max. Smut Balls/ HILL			S.No.	P. No.	Max. Smut Balls /panicle	Max. Smut Balls/Hill		
		IIRR	GDL	GNV	MSD			IIRR	GDL	GNV	MSD
N/A		Artificial	Natural					Artificial	Natural		
1	1	16	6	0	8	57	57	1	3	0	0
2	2	2	5	2	5	58	58	0	5	1	0
3	3	1	5	0	5	59	59	5	5	0	1
4	4	18	5	0	3	60	60	5	5	5	1
5	5	10	5	0	5	61	61	4	5	0	0
6	6	4	5	4	2	62	62	1	5	19	1
7	7	20	4	0	3	63	63	4	5	0	1
8	8	12	5	2	2	64	64	6	5	1	1
9	9	4	5	5	1	65	65	1	4	1	1
10	10	15	5	1	2	66	66	1	5	0	1
11	11	10	5	9	4	67	67	3	4	5	1
12	12	20	5	0	2	68	68	10	4	1	1
13	13	10	5	5	4	69	69	4	5	0	1
14	14	4	5	0	2	70	70	25	4	1	1
15	15	13	5	10	4	71	71	16	4	0	1
16	16	17	5	4	2	72	72	20	5	1	2
17	17	11	5	1	1	73	73	18	5	2	0
18	18	21	5	0	0	74	74	24	3	1	2
19	19	5	5	1	6	75	75	25	5	20	4
20	20	10	6	1	5	76	76	1	0	6	1
21	21	22	7	0	1	77	183	4	5	0	1
22	22	5	6	1	1	78	184	0	5	1	1
23	23	8	6	0	3	79	185	6	5	1	0
24	24	40	6	0	1	80	186	3	5	10	3
25	25	15	6	2	1	81	187	0	7	2	1
26	26	23	6	0	2	82	188	0	5	5	2

S. No.	P. No.	Max.Smut Balls/ panicle	Max. Smut Balls/ HILL			S.No.	P. No.	Max. Smut Balls /panicle	Max. Smut Balls/Hill		
		IIRR	GDL	GNV	MSD			IIRR	GDL	GNV	MSD
N/A		Artificial	Natural					Artificial	Natural		
27	27	13	7	1	1	83	189	10	6	0	0
28	28	10	6	2	4	84	190	11	6	1	1
29	29	30	6	6	1	85	191	3	11	5	1
30	30	10	6	4	1	86	192	4	7	1	2
31	31	0	6	2	0	87	193	3	10	1	1
32	32	5	6	1	3	88	194	32	12	10	1
33	33	5	6	15	2	89	195	4	8	3	3
34	34	15	5	30	2	90	196	1	13	1	3
35	35	1	6	15	2	91	197	5	5	2	2
36	36	4	6	6	4	92	198	3	7	4	1
37	37	3	5	4	1	93	199	0	9	0	0
38	38	20	4	1	2	94	200	2	5	10	1
39	39	3	5	0	1	95	201	2	9	5	3
40	40	12	5	4	1	96	202	35	10	20	1
41	41	4	5	3	1	97	203	11	17	20	0
42	42	2	5	1	2	98	204	2	5	15	1
43	43	9	5	6	2	99	205	6	4	10	0
44	44	20	5	0	1	100	206	15	7	6	1
45	45	22	5	0	2	101	207	15	5	2	0
46	46	12	5	1	2	102	208	0	10	2	0
47	47	21	5	0	1	103	209	5	14	15	0
48	48	RD	NG	0	4	104	210	10	13	1	1
49	49	7	5	4	5	105	211	13	4	6	1
50	50	64	5	3	1	106	212	1	9	1	0
51	51	6	5	0	0	107	213	2	7	0	0
52	52	3	5	0	1	108	214	0	3	1	0
53	53	3	5	1	2	109	215	20	9	2	2
54	54	32	5	0	1	110	216	15	4	1	2
55	55	6	5	0	2	111	217	4	10	4	3
56	56	8	5	1	1	112	218	8	8	1	2

RD- Rat Damage; NG- Non-Germinated

Table 15.2: Details of Natural / Artificial screening trial against False Smut Disease

Location	GDL	GNV	MSD	Location	IIRR
Nature of screening	Natural	Natural	Natural	Nature of Screening	Artificial
Date of Sowing	22.08.2023	28.07.2023	04.07.2023	-	16.06.2023
Date of Transplanting	26.09.2023	02.09.2023	29.07.2023	-	17.07.2023
Maximum number of smut balls observed /Hill	17	30	8	Maximum number of smut balls observed /Panicle	64
Range of smut balls produced per Hill	0-17	0-30	0-8	Range of smut balls produced per Panicle	0-64
Number of entries with zero smut balls	1	32	18	Number of entries with zero smut balls	8
Number of entries with 1 to 6 smut balls/Hill	87	65	93	Number of entries with 1 to 3 smut balls/Panicle	24
Number of entries >6 smut balls/Hills	23	15	1	Number of entries ≥4 smut balls/Panicle	80
Number of entries screened	111	112	112	Number of entries screened	112
Number of infected Entries	111	80	94	Number of infected Entries	104
Percentage of false smut infection (%)	100	71.42	83.92	Percentage of false smut infection	92.86

All the four-location data were compared based on number smut balls per panicle/Hill. Among the 112 lines screened both artificially and naturally, fourteen entries viz., 30178, CSR 36, 30078, 29536, 30032, 30029, 30020, 29405, 29549, 30240, 30270, 29284, 29290 and ADT 39 found as tolerant against false smut disease. These results are preliminary and these results must be confirmed in *Kharif* 2024 across the false smut hot spot locations to confirm the false smut disease tolerance (Table 15.3).

Table 15.3: Entries Promising against False smut disease both under Natural/Artificial screening conditions

P.No.	IET No.	Designation	Cross Combination	Maximum no.of smut ball/Hill - across the locations (up to 6 smut balls/Hill)- Natural Screening	Maximum no. of Smut balls/ Panicle (up to 3) – Artificial Screening
2	30178	NVSR 6361	NVSR 178 / IR 71907-3R-2-1-1	5	2
3	CSR 36	-	-	5	1
31	30078	MTU 1382	MTU 1075 / MTU 1001	6	0
37	29536	OR 2674-14-6-2	CRMS 32A / OR 1889-5	5	3
39	30032	BRR 0181-IR 93827-29-1-1-4	IR 81039-B-173-U 3-3 / IR 81063-B-94-U 3-1	5	3
42	30029	BRR 2183	IR 74355-CN3 / CN 6-78	5	2
52	30020	CRR 842-IR14L159	IR 10N102 / IR 86931-B-400	5	3
53	29405	RCPR 70-IR 84899-B-184-16-1-1-1	IR 78877-208-B-1-1 / IRRI 132	5	3
57	29549	RP 5977-MS-M-112-1-9-22-4-6-3	BPT 5204 Mutant	3	1
65	30240	RP 6524-MSA-16-399-16-332	Swarna / MTU 1010	4	1
67	30270	CR 4358-3-3-1-2-1	CR 3543-6-3-1-2-1-1 / CR 3510 -12-1-1-2-1-1	5	3
184	29284	MTU 1348 (MTU 2689-45-1-1)	MTU 1010 / MTU 7029	5	0
188	29290	HURS 19-3	CR 2407 / IR 64	5	0
214	ADT 39	-	-	3	0

TRIAL No.16: SPCIAL TRIAL ON SCREENING FOR BROWN SPOT RESISTANCE UNDER ARTIFICIAL SCREENING

The aim of this trial is to introduce/expand artificial inoculation method of screening against emerging diseases like brown spot in different centres and to identify promising cultures in Advanced Variety Trials (NSN-1) under artificial method of screening. During *Kharif*, 2023, the trial was proposed at five centres *viz*., Gangavathi, IIRR, Ludhiana, Pusa and Rewa; however, the trial was conducted at four centres except at Rewa.

The National Screening Nursery (NSN-1) comprised of 432 entries evaluated under artificial inoculation conditions at Gangavathi, IIRR, Ludhiana and Pusa. The frequency distribution of disease scores and the representative location severity index (LSI) are presented in the Table 16.1A. The disease pressure was very high (LSI >7.0) at Gangavathi (8.2), Pusa (7.8), IIRR (7.0); while it was high (LSI 6-7) at Ludhiana (6.3). The selection of promising entries was done based on the data of all the four locations and presented in Table 16.1B. None of the entry was found resistant (SI ≤3.0) against brown spot disease under NSN-1 based on the selection from four locations; however, a few promising entries with low SI (≤6.3) and high PI included IET#30233, 30679, 29354, 29692, 29694, 29560, 30643, 30178, 29142, 29947, 30023, 29549, 31130, 31129, 29726, 32040, 30024, 29577, 31115, 30668 and 29301.

Table 16.1A: Location severity index(LSI) and frequency distribution of brown spot scores of NSN-1, *Kharif* 2023 under artificial inoculation condition.

Score	Location/Frequency of scores (0-9)			
	GNV	IIRR	LDN	PSA
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	2	0
4	0	4	0	0
5	5	17	148	0
6	25	139	0	6
7	81	114	269	80
8	90	115	0	291
9	222	42	8	28
Total	**423**	**431**	**427**	**405**
LSI	**8.2**	**7.0**	**6.3**	**7.8**
Screening	**A**	**A**	**A**	**A**

(LSI-Location Severity Index; A-Artificial)

Table 16.1B: Promising entries with low susceptibility index (<=6.3) and high PI in NSN-1 to brown spot, *Kharif* 2023 under artificial inoculation condition

P.No.	Br. No.	IET No.	Location/Frequency of scores (0-9)				SI	Total	<=3*	PI (<-3)**	<=5*	PI (<-5)**
			GNV	IIRR	LDN	PSA						
56	5601	30233	5	6	5	6	**5.5**	**4**	**0**	**0**	**2**	**50**
142	3416	30679	6	6	5	-	**5.7**	**3**	**0**	**0**	**1**	**33**
12	5113	29354 (R)	6	6	5	6	**5.8**	**4**	**0**	**0**	**1**	**25**
21	3309	29692	6	6	5	6	**5.8**	**4**	**0**	**0**	**1**	**25**
16	3304	29694	8	5	5	6	**6.0**	**4**	**0**	**0**	**2**	**50**
114	5718	29560	8	5	5	7	**6.3**	**4**	**0**	**0**	**2**	**50**
153	3427	30643	5	6	5	9	**6.3**	**4**	**0**	**0**	**2**	**50**
2	5102	30178	7	6	5	7	**6.3**	**4**	**0**	**0**	**1**	**25**
29	3317	29142 (R)	7	6	5	7	**6.3**	**4**	**0**	**0**	**1**	**25**
30	3318	29947	6	7	5	7	**6.3**	**4**	**0**	**0**	**1**	**25**
51	4413	30023	6	5	7	7	**6.3**	**4**	**0**	**0**	**1**	**25**
57	5602	29549	5	6	7	7	**6.3**	**4**	**0**	**0**	**1**	**25**
81	6005	31130	7	6	5	7	**6.3**	**4**	**0**	**0**	**1**	**25**
83	6007	31129	7	6	5	7	**6.3**	**4**	**0**	**0**	**1**	**25**
209	3611	29726	6	4	7	8	**6.3**	**4**	**0**	**0**	**1**	**25**
391	3734	32040	9	5	5	-	**6.3**	**3**	**0**	**0**	**2**	**67**
40	4402	30024	-	6	5	8	**6.3**	**3**	**0**	**0**	**1**	**33**
72	5906	29577	7	7	5	-	**6.3**	**3**	**0**	**0**	**1**	**33**
107	5711	31115	6	8	5	-	**6.3**	**3**	**0**	**0**	**1**	**33**
158	3432	30668	-	6	5	8	**6.3**	**3**	**0**	**0**	**1**	**33**
187	3905	29301 (R)	8	6	5	-	**6.3**	**3**	**0**	**0**	**1**	**33**
90	6014	Rasi	7	4	5	8	**6.0**	**4**	**0**	**0**	**2**	**50**
425	CH 45	CH 45	7	4	7	7	**6.3**	**4**	**0**	**0**	**1**	**25**
432	Tetep	Tetep	6	4	7	8	**6.3**	**4**	**0**	**0**	**1**	**25**
76	5910	ISM	8	9	7	9	**8.3**	**4**	**0**	**0**	**0**	**0**
LSI			**8.2**	**7.0**	**6.3**	**7.8**						

(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)

AICRPR RAINFED REPORT - *Kharif* 2023

The All India Coordinated Rice Pathology Program of the ICAR-National Rice Research Institute (formerly as Central Rice Research Institute) is focused on screening the materials developed especially for the rainfed conditions. All the breeders' lines were tested to assess the advanced breeding lines over a wide range of climatic and disease epidemic conditions for identification of broad spectrum resistance to major rice diseases. This also helps in developing need-based management options for controlling major diseases of rice. During 2023, disease screening were made for five major diseases at 18 locations on host plant resistance, field monitoring of virulence of major pathogens and disease management methods. 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'.

❖ BLAST

NSN-1: Data received from 9 centres namely Cuttack, Ghagraghat, Rewa, Ponnampet, Coimbatore, Ranchi, Hazaribag, Jagdalpur, Bankura. The data of Bankura centre is having too less LSI (1.49) so not considered for further analyses. Promising lines identified are IET 30367, 30423, 31237, 31250, 32128,32129,29036, 29038, 30330, 30334, 30351, 29045, 31192, 31170, 31185, 31279, CARI Dhan 5(RP),

NSN-2: Data was received from Cuttack, Ghagraghat, Rewa, Ponnampet, Coimbatore, Ranchi, Hazaribag, Jagdalpur centres and IET Nos. 32080, 32081, 32090, 32092, 32094, 32110, 32111, 32112, 32116, 32118, 32119, 32120, 32143, 32154, 32162, 32163, 32164, 32170, 32172, 32176, 32177, 32183, 32186, 32187, 32199, 32202, 32204, 32211,32227, 32232 showed to be promising. Interestingly data from all the centres were accepted.

❖ BROWN SPOT

NSN-1: Seven centres conducted the trial out of the 7 centres the data of Bankura centre was not considered as it had less location severity index (LSI) (<3.0). As per the data received from rest 6 centres it was observed that out of 74 lines only five lines (IET 30336,29052,31259,31264 and Varshsdhan (RP) showed to be promising. The highest LSI was recorded in RPCAU, PUSA, BIHAR (7.52) and the lowest was recorded in Sabour and Bihar (4.39).

NSN-2: In case of NSN-2 a total of 160 genotypes were screened by 4 centres out of which Sabour center was not considered as the LSI was too low. Interestingly only one line (IET-32086) showed promising.

❖ SHEATH BLIGHT

NSN-1: Cuttack, Maruteru, Masodha, Chinsurah, Raipur, Titabar and Bankura conducted the trial. Data from Bankura centre was not accepted due to very low LSI (2.38). Only three lines namely IET 30367,30409(R) ,32122 were promising.

NSN-2: Cuttack, Maruteru, Masodha, Raipur and Titabar were the centres to conduct the trials. IET Nos 32081, 32138, 32140, 32142, 32143, 32146, 32147, 32148, 32157, 32159, 32160, 32164, 32175, 32177, 32188, 32192, 32193, 32204, 32205, 32206, 32209, 32211, 32213, 32220, 32224 were promising.

❖ SHEATH ROT

NSN-1: Cuttack, Chinsurah, Raipur, Pusa, Bankura, Titabar were the centres who conducted the trials but the data from PUSA, Bankura and Titabar were not accepted as they had very low LSI. 30367,30423,31245, 31242, 31253, Gayatri (RP), 30410(R),32127,32128, 32130, Pooja (RP), 29036 ,31161, 31258, 31259, 31264 ,31267, 29031, 29026 were observed to be promising.

NSN-2: Only four centres namely Cuttack, Raipur, Pusa, Titabar conducted the trial but the data from PUSA and Titabar was not accepted due to very low LSI for these centres. IETs 32081,32083,32091,32092,32098,32105,32107,32110,32132,32133,32135,32138,32139,32140,32142,32143, 32145, 32146, 32147, 32148, 32149, 32154, 32158, 32161, 32163, 32165, 31269(R), 32172, 32173, 32174, 32175, 32176, 32177, 32179, 32181, 32183, 32184, 32188, 32190, 32193, 32194, 32195, 32198, 32199,32201, 32202,32203, 32204, 32205, 32206, 32209, 32212, 32213, 32216, 32217, 32218, 32219, 32220, 32223, 32224, 32225, 32227, 32228, 32230 showed to be promising.

❖ BACTERIAL BLIGHT

NSN-1: Data were received from eight centres out of which the data from Cuttack and Bankura centres were not considered due to too high (8.36) and to low (1.27) LSI respectively. IET nos. 31279, 29031, 29026, 31258, 31259,31164,32123, 32124,32122, 31215, Pooja (RP), Varshadhan (RP)and 30367 are promising.

NSN-2: IETs 32230, 32231,32221,32213,32190,32188,32174, 32175,32164, 32165, 32159,32149, 32150,32141, 32139, 32110, 32098, and 32082 are promising as per the data received from 4 different centres. The data of Cuttack centre and Sabour centres were not accepted due to very high and low LSI respectively.

❖ Multiple Disease Resistant Lines in NSN-1

Among the screened entries under rainfed conditions, IET 30367 recorded promising reaction against four diseases viz., blast, sheath blight, sheath rot and bacterial blight. The other promising entries were IET Nos. 31264, 32122, 31258, 31279, 29031, 29026, 30423, 32128 and 29036.

Multiple Disease Resistant Lines in NSN-1 under Rainfed conditions - *Khairf* 2023

IET No.	BS	BB	LB	SHR	SHBL
31264	+			+	
31259	+	+		+	
30367		+	+	+	+
32122		+			+
31258		+		+	
31279		+	+		
29031		+		+	
29026		+		+	
30423			+	+	
32128			+	+	
29036			+	+	

(BS- Brown Spot; BB- Bacterial Blight; LB- Leaf Blast; SHR- Sheath Rot; SHB – Sheath Blight)

❖ Multiple Disease Resistant Lines in NSN-2

Among the screened entries under rainfed conditions, in NSN-2, nine entries recorded resistant/tolerant disease reaction against minimum of three diseases (IET Nos. 32110, 32164, 32175, 32188, 32213, 32081, 32143, 32177, 32204). Thirty entries recorded resistant/tolerant disease reaction against minimum of two diseases. The details are given below in the table format.

Multiple Disease Resistant Lines in NSN-2 under Rainfed conditions - *Khairf* 2023

Dis-ease	32098	32110	32139	32149	32159	32164	32165	32174	32175	32188	32190	32213	32230	32081	32092	32143	32154	32163	32172	32176	32177
BB	+	+	+	+	+	+	+	+	+	+	+	+	+								
LB		+				+								+	+	+	+	+	+	+	+
SHB					+	+			+	+		+		+		+					+
SHR	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

(BB- Bacterial Blight; LB- Leaf Blast; SHR- Sheath Rot; SHB – Sheath Blight)

(Contd.,) Multiple Disease Resistant Lines in NSN-2 under Rainfed conditions - *Khairf* 2023

Disease	32183	32199	32202	32204	32211	32227	32138	32140	32142	32146	32147	32148	32193	32205	32206	32209	32219	32224
LB	+	+	+	+	+	+												
SHB				+	+		+	+	+	+	+	+	+	+	+	+	+	+
SHR	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+

(LB- Leaf Blast; SHR- Sheath Rot; SHB – Sheath Blight)

Annexure I

Weather conditions at test locations where Plant Pathology Coordinated Trials were conducted, *Kharif*-2023

S. No	Location/ Details		Weather data from May-2023 to January-2024								
1	**Aduthurai**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		4	3	2	6	6	3	14	4	3
	Rainfall (mm)		58.5	79.8	14.8	120.9	120.9	17.2	270.6	79.2	134.2
	Temp. (ºC)	Maximum	35.9	36.4	35.6	36.5	36.5	34.2	30.9	29.9	29.8
		Minimum	25.9	25.6	25.6	27.1	27.1	24.6	24	22.7	21.7
	RH (%)	Morning	89.6	82.4	79.1	84.5	87.9	91.0	95.7	93.4	95.0
		Evening	61.5	58.9	57.8	57.0	62.5	67.2	79.1	76.9	73.3
2	**Almora**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Weather data not available										
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.)		6	4	9	11	7	6	3	4	-
	Rainfall (mm)		9.8	14.6	7.42	23.1	18.7	54.2	1.02	77.98	-
	Temp. (ºC)	Maximum	39	39.2	35.29	33.87	35.06	34.76	30.02	25.8	-
		Minimum	24	27.93	27.7	28.06	26.58	26.65	17.7	13.4	-
	RH (%)	Morning	60.32	82	80.13	69	79.12	68.27	69.7	72	-
		Evening	-	-	-	-	-	-	-	-	-
5	**Chatha**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		10	6	10	12	8	4	3	2	-
	Rainfall (mm)		138.4	182.06	388.8	356.2	114.6	100	66.8	9	-
	Temp. (ºC)	Maximum	34.1	36.2	33.6	34.8	33.9	30.3	26.2	21.4	-
		Minimum	19.1	24.2	25.5	25.2	23.1	16.3	10.9	5.9	-
	RH (%)	Morning	68	74.1	85	87	89	88	92	96	-
		Evening	38	47	67	66	60	51	51	54	-
6	**Chinsurah**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		11	12	20	21	20	8	1	-	-
	Rainfall (mm)		99.9	168.4	148.4	249.3	157.3	153.4	3.4	-	-
	Temp. (ºC)	Maximum	36.9	36.7	34.8	33	33.6	31.5	29.8	-	-
		Minimum	24.2	26.4	27.1	26.1	27.1	23.6	18	-	-
7	**Chiplima**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	-	20	17	14	3	0	3	-
	Rainfall (mm)		-	-	331.8	347.4	242	86.6	0	37.2	-
	Temp. (ºC)	Maximum	-	-	32.8	30.9	31.2	31.5	29.6	25.8	-
		Minimum	-	-	25.8	25.4	25.2	21.8	18.2	13.4	-
	RH (%)	Morning	-	-	89.1	91.4	92.9	84.4	86.4	88.4	-
		Evening	-	-	78.8	81.9	77.1	61	49.9	75.4	-
8	**Coimbatore**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		12	3	4	0	1	4	13	3	-
	Rainfall (mm)		5.9	0.5	1.5	0	0.4	1.1	13.1	2	-
	Temp. (ºC)	Maximum	34.3	33.8	31.2	33.5	32.5	32.9	30	28.9	-
		Minimum	24.2	24	23.4	23.5	23.8	23.6	22.9	22.2	-
	RH (%)	Morning	87.7	83.4	83.4	83	83.2	84.8	91	90.3	-
		Evening	56.9	50.9	57.2	48.3	55	46.7	61.1	62.5	-

S. No	Location/ Details		Weather data from May-2023 to January-2024								
9	**Cuttack**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	3	7	7	14	3	0	-	-
	Rainfall (mm)		-	17	128	90.8	297	89	0	-	-
	Temp. (ºC)	Maximum	-	33.6	32.0	33.2	31.9	34.0	31.0	-	-
		Minimum	-	25.8	27.5	25.9	25.0	25.1	23.9	-	-
	RH (%)	Morning	-	93.8	94.1	88.8	91.6	84.4	82.1	-	-
		Evening	-	73.3	71.2	88.5	89.6	82.5	76.5	-	-
10	**Faizabad (Masodha)**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	5	11	11	9	2	0	-	-
	Rainfall (mm)		-	81.6	188.2	242.8	222	11	0	-	-
	Temp. (ºC)	Maximum	-	37.5	33.8	33.2	33.7	32	30.1	-	-
		Minimum	-	25.2	26.6	25.9	24.9	18.7	14	-	-
	RH (%)	Morning	-	67.6	80.4	81.6	78.1	72.2	71.3	-	-
		Evening	-	-	-	-	-	-	-	-	-
11	**Gangavathi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		3	3	11	2	6	0	2	0	-
	Rainfall (mm)		52.5	35	104.5	13	52.5	0	38.5	0	-
	Temp. (ºC)	Maximum	38.01	36.58	30.78	32.93	31.29	32.15	30.15	29.77	-
		Minimum	25.49	25.51	24.01	23.86	23.77	21.93	21.54	18.23	-
	RH (%)	Morning	60.1	65.28	79.83	72.63	78.82	71.13	89.37	84.68	-
		Evening	29.03	41.59	70.93	55.33	65.41	59.53	69.7	49.42	-
12	**Ghaghraghat**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	07	13	13	7	3	Nil	2	-
	Rainfall (mm)		-	58	173.2	210.8	474.4	38	0	10.8	-
	Temp. (ºC)	Maximum	-	38.23	34.19	31.97	32.43	32.26	29.3	22.19	-
		Minimum	-	26.56	26.81	26.58	26.30	22.55	15.5	11.52	-
13	**Gudalur**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		13	17	24	23	19	11	8	11	-
	Rainfall (mm)		214	418	460	458	413	191	67	58	-
	Temp. (ºC)	Maximum	26.4	23.2	21.9	22.3	25.7	25.7	25.6	23.9	-
		Minimum	19.3	16.8	17	16.3	16.5	16.5	15.1	15.2	-
	RH (%)	Morning	94.2	96.7	98.3	98.5	95.3	93.6	91.2	90.4	-
		Evening	78.4	88	93.2	91.7	90.6	86.4	75.2	72	-
14	**Hazaribag**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		8	9	19	25	25	7	0	3	-
	Rainfall (mm)		122.2	125.5	192.2	225.4	285.6	243.2	0	49.8	-
	Temp. (ºC)	Maximum	40	35.8	30.9	28.9	30.1	28.5	26.8	27	-
		Minimum	11.5	30.9	19.5	18.9	18.6	13.7	8.8	3.5	-
	RH (%)	Morning	56.03	61.13	86	87	86.3	79.42	76.63	79.9	-
		Evening	38.16	48.73	76	79	79	57	51.76	55.2	-
15	**IIRR, Hyderabad**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	6	14	3	13	1	1	0	0
	Rainfall (mm)		-	159.2	378.4	42.1	270.8	3.0	10.7	3.8	0.0
	Temp. (ºC)	Maximum	-	36.4	29.2	31.0	30.0	32.0	30.2	28.3	29.9

S. No	Location/ Details		Weather data from May-2023 to January-2024								
		Minimum	-	25.6	23.3	23.2	22.5	19.9	19.8	15.0	16.0
	RH (%)	Morning	-	72	88	85	90	85	87	82	87
		Evening	-	42	71	61	68	42	51	45	37
16	**Imphal**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		13	25	16	25	14	9	3	3	-
	Rainfall (mm)		77.5	173.2	256.2	166	150.3	41.7	63.9	47.3	-
	Temp. (ºC)	Maximum	36.8	35.5	34.4	35.6	34.2	31.2	30.4	25.8	-
		Minimum	16.3	18.8	21.4	21.3	21	14	8	7	-
	RH (%)	Morning	71.2	81.5	83.9	90	86.9	86	87.4	86.2	-
		Evening	46.8	65.8	63.9	72.9	66.4	59.6	52.7	55.1	-
17	**Jagdalpur**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		8	9	16	16	14	1	1	2	-
	Rainfall (mm)		163.5	232.9	398.3	213.3	232.3	6.2	15.8	54	-
	Temp. (ºC)	Maximum	35.3	35.7	29.5	29.9	29.4	31.7	30.4	27.5	-
		Minimum	21	22.7	22.6	22.1	22.1	17.9	16.1	11.7	-
	RH (%)	Morning	81.8	78.8	91	91.5	93.5	89.7	87.5	87.6	-
		Evening	42.6	44.8	76	71.2	75.9	48.7	49.3	49.3	-
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**
	Rainy days (No.)		3	4	2	2	6	5	25	10	3
	Rainfall (mm)		51.5	69.2	10.6	78.5	62.7	53.5	886.8	190.2	307.2
	Temp. (ºC)	Maximum	36.9	38	36.9	37.6	36.5	36.4	31.3	30.6	30.8
		Minimum	26.7	27	26.6	26.2	26	25.5	24.6	23.8	22.6
	RH (%)	Morning	87	80	75	82	80	86	94	93	90
		Evening	61	52	49	51	51	60	80	78	71
20	**Karjat**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	10	31	25	22	2	2	-	-
	Rainfall (mm)		0	462.8	2238.1	392.9	612.6	83	41.8	-	-
	Temp. (ºC)	Maximum	42.4	35.3	27.8	30.25	30.21	24.57	34.39	-	-
		Minimum	21.9	26.14	24	24.99	24.16	17.63	19.92	-	-
	RH (%)	Morning	77.1	90	92.1	92.3	89.6	90.1	87	-	-
		Evening	43.5	79	84.6	79	83.1	57	56.5	-	-
21	**Kaul**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		5	8	13	3	3	2	1	1	-
	Rainfall (mm)		72	166.9	388.5	20	50.9	30.6	11.3	7.5	-
	Temp. (ºC)	Maximum	36	36.1	27	34.3	34.3	32.2	27.8	21.8	-
		Minimum	20.2	24.6	20.5	26.2	23.9	16.8	11.9	6.9	-
	RH (%)	Morning	74	83	93	91	94	93	96	97	-
		Evening	45	57	83	73	67	57	61	72	-
22	**Khudwani**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		14	12	14	2	3	5	4	2	-
	Rainfall (mm)		96.1	92.6	206.6	12.8	37.4	59.4	31.5	23	-
	Temp. (ºC)	Maximum	21.8	28.8	27.9	31.4	29.4	22.5	15	10.3	-

S. No	Location/ Details		Weather data from May-2023 to January-2024								
		Minimum	8.1	13.6	16.6	16.2	12.8	5.2	0.5	-3.5	–
	RH (%)	Morning	85.8	83.7	89.3	86.3	88.5	90.1	92.3	91.6	–
		Evening	62.8	53.4	62.5	50.8	44.3	61.5	78.4	80.1	–
23	**Lonavala**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	13	30	30	21	3	3	0	0
	Rainfall (mm)		0	492.3	2624.3	572.1	682.2	135.4	43.5	0	1.2
	Temp. (ºC)	Maximum	33.5	35.9	28.9	26.6	27.3	30.7	29.5	29.5	31.9
		Minimum	14.5	19.5	16.7	17.6	16.3	15.3	13.9	13.9	14.1
	RH (%)	Morning	83.3	75.2	90.9	92.9	90.8	90.75	98.1	98.7	70.4
		Evening	46	57.6	76.9	92.6	88.3	83.2	76.8	74.8	59.6
24	**Ludhiana**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		5	4	0	4	6	4	2	-	-
	Rainfall (mm)		48.4	94	0	77	55	34	28.6	-	-
	Temp. (ºC)	Maximum	35.5	36.8	33	34.6	33.2	30.7	26.2	-	-
		Minimum	21.2	26.3	27.3	27.4	25	17.8	13.1	-	-
	RH (%)	Morning	60	67	81	82	86	89	91	-	-
		Evening	29	41	69	62	60	42	45	-	-
25	**Malan**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	3	19	11	5	2	1	–	–
	Rainfall (mm)		15.2	18.4	108.92	102.2	31.4	29.6	15.4	–	–
	Temp. (ºC)	Maximum	31.6	32.95	30.49	30.13	30	29.97	28.7	–	–
		Minimum	16.45	16.59	16.02	15.53	13.12	12.64	11.91	–	–
	RH (%)	Morning	78.57	79.46	74.44	73.92	75.53	76.51	74.03	–	–
		Evening	73.2	75.24	71.82	70.78	71.38	57.19	69.35	–	–
26	**Mandya**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		6	0	5	2	6	4	5	0	-
	Rainfall (mm)		163	1	40	45.7	65.6	89.5	56.6	0	-
	Temp. (ºC)	Maximum	33.1	31.6	28.6	32.3	28.2	31.3	29.7	29.8	-
		Minimum	22.2	21.9	19.5	19.4	20.6	19.4	19.4	18	-
	RH (%)	Morning	77.6	79.3	84.1	85	85.1	85.8	82.9	82	-
		Evening	56.4	57	68.4	58.8	59	60	59	57.8	-
27	**Maruteru**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		8	7	17	8	9	0	4	3	-
	Rainfall (mm)		119	71.1	197.3	119.3	79.4	8.1	25.2	275.8	-
	Temp. (ºC)	Maximum	35.03	35.13	31.35	30.45	31.17	33.43	30.6	28.71	-
		Minimum	21.94	22.87	24.77	27.13	27.07	26.9	22.32	20.77	-
	RH (%)	Morning	83.58	83.87	85.42	84	87.6	80.27	86.4	89.84	-
		Evening	46.29	65.27	72.19	73.42	82.67	69.73	66.6	57.23	-
28	**Moncompu**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		6	21	20	4	23	16	14	7	-
	Rainfall (mm)		100.4	319.1	502.3	90.6	420.6	348.6	290.4	76.1	-
	Temp. (ºC)	Maximum	34.3	32.7	30.3	33	32.1	32.5	32.7	34.1	-
		Minimum	26.5	25.1	24.2	26.9	26.6	26.6	26.9	26.2	-
	RH (%)	Morning	82.4	91.2	91.6	84	91.2	88.9	87.6	83.6	-
		Evening	72.7	85.2	88.6	75.9	86.5	78.7	76.9	72.4	-

S. No	Location/ Details		Weather data from May-2023 to January-2024								
29	**Mugad**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		4	3	21	10	7	1	3	0	-
	Rainfall (mm)		52	29	521.6	46.2	61.4	24.2	66	2.2	-
30	**Navsari**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		0	9	26	7	12	0	2	0	-
	Rainfall (mm)		0	306	1130	40	289	0	42	0	-
	Temp. (ºC)	Maximum	35	33.8	29.5	30.6	31.8	35.1	33.7	30.09	-
		Minimum	25.7	26.9	24.8	25.2	24.3	21.8	19.1	17.1	-
	RH (%)	Morning	83	84	96	91	95	92	80	87	-
		Evening	56	68	89	76	73	48	43	46	-
31	**Nawagam**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		2	7	15	3	6	0	1	0	-
	Rainfall (mm)		40.0	214.8	334.4	19.0	126.1	0.0	29.5	0.0	-
	Temp. (ºC)	Maximum	41.0	36.0	32.2	31.4	32.3	34.8	32.4	29.8	-
		Minimum	24.9	25.1	24.9	24.3	25.2	21.1	17.2	15.8	-
	RH (%)	Morning	59	72	83	85	84	79	72	78	-
		Evening	28	56	74	69	71	49	45	47	-
32	**Nellore**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		1	2	5	1	6	5	14	4	0
	Rainfall (mm)		3	25.2	76.6	16	80.6	41	296	579.4	0
	Temp. (ºC)	Maximum	36.8	36.8	32.5	34	33.6	32.8	28.7	27.4	27.2
		Minimum	24.1	25.3	25	25.3	24.8	23.4	23	22	24
	RH (%)	Morning	67.7	65.1	69	62.7	64	67.7	87.5	85.5	81
		Evening	49.6	46.1	57	48.5	50.1	54	77.2	73.7	77.1
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.)		6	6	14	15	7	1	3	0	-
	Rainfall (mm)		114.00	125.60	597.60	395.20	301.80	7.40	15.70	0	-
	Temp. (ºC)	Maximum	34.00	37.10	32.40	32.40	32.70	31.60	27.70	23.60	-
		Minimum	20.10	24.70	26.20	26.00	24.70	17.60	12.70	7.80	-
	RH (%)	Morning	70.10	72.10	85.30	90.90	89.60	85.50	88.30	91.00	-
		Evening	36.00	43.60	74.30	72.50	67.50	44.90	43.60	47.60	-
35	**Patna**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		4	8	19	19	20	8	0	3	2
	Rainfall (mm)		33.62	68.44	218.67	125.5	165.85	57.36	0	11.67	23.5
	Temp. (ºC)	Maximum	45	47	40	35.8	34	31	33	28	24
		Minimum	23	28	26	26	25	18	15	8	8
	RH (%)	Morning	70	87	97	95	91	89	86	89	81
		Evening	10	20	79	53	55	30	26	20	40
36	**Pattambi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		2	14	17	3	20	10	9	1	1
	Rainfall (mm)		75.5	304.9	542.1	42.2	461.2	248.1	351.5	28	28.2
	Temp. (ºC)	Maximum	34.7	31.4	29.1	31.7	30.3	32.1	32.7	32.4	32.9
		Minimum	24.1	22.7	21.8	22.2	22.3	22.5	21.7	22.1	20.4
	RH (%)	Morning	89.2	91.7	95.7	94.7	95.6	94.9	92	90.5	87.6

S. No	Location/ Details		Weather data from May-2023 to January-2024								
		Evening	54.4	72.2	80.2	64.3	76.1	71.7	69	66	56.2
37	**Ponnampet**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		10	15	28	5	17	6	2	0	1
	Rainfall (mm)		189.3	122.3	774.8	102	251.6	145.3	78	0	22.2
	Temp. (ºC)	Maximum	32	28	26	29	27	30	30	29	30
		Minimum	20	20	20	19	20	20	20	17	18
38	**Pusa**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		5	5	7	17	12	7	0	-	-
	Rainfall (mm)		37.4	92.6	146.2	532.9	434.6	39.6	0	-	-
	Temp. (ºC)	Maximum	35.5	38.3	33.9	32.2	32.7	31.9	29.8	-	-
		Minimum	21.3	24.6	25.4	24.7	24.4	21.9	16.3	-	-
	RH (%)	Morning	79	79	90	93	94	94	95	-	-
		Evening	45	46	70	77	76	64	53	-	-
39	**Raipur**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		3	6	18	14	15	1	2	2	-
	Rainfall (mm)		71.4	226.4	501.8	348.6	479.6	9.4	7.5	17.8	-
	Temp. (ºC)	Maximum	39.4	39.5	32.2	31.7	31.04	32.46	30.68	27.3	-
		Minimum	24.36	27	25.7	25.08	25	20.9	17.69	13.08	-
	RH (%)	Morning	61.96	61.1	88	88.87	91	88.35	86.1	88.12	-
		Evening	27.38	42.46	72	68.03	72	44.41	42.5	42.61	-
40	**Rajendranagar**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	6	14	3	13	1	1	0	0
	Rainfall (mm)		-	159.2	378.4	42.1	270.8	3.0	10.7	3.8	0.0
	Temp. (ºC)	Maximum	-	36.4	29.2	31.0	30.0	32.0	30.2	28.3	29.9
		Minimum	-	25.6	23.3	23.2	22.5	19.9	19.8	15.0	16.0
	RH (%)	Morning	-	72	88	85	90	85	87	82	87
		Evening	-	42	71	61	68	42	51	45	37
41	**Ranchi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		2	7	15	11	17	5	0	3	-
	Rainfall (mm)		16.4	91.6	276.8	193.8	497.8	223.7	2.0	38.8	-
	Temp. (ºC)	Maximum	40.4	41.6	37.4	35.4	35.4	32.5	29.0	28.5	-
		Minimum	37.5	37.9	32.9	31.5	31.3	29.1	26.0	24.9	-
	RH (%)	Morning	85.8	86.9	86.6	87.0	86.6	86.6	86.7	86.7	-
		Evening	70.1	70.3	70.3	70.6	70.1	69.9	69.8	69.2	-
42	**Rewa**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	**4**	**8**	**10**	**7**	**1**	-	-	-
	Rainfall (mm)		-	**100.6**	**286.6**	**315.2**	**67.4**	**3**	-	-	-
	Temp. (ºC)	Maximum	-	**38.92**	**33.56**	**31.2**	**32.47**	**31.73**	**28.5**	-	-
		Minimum	-	**25.61**	**24.65**	**24.77**	**24.13**	**18.78**	**12.52**	-	-
	RH (%)	Morning	-	**56.27**	**76.71**	**84.55**	**85.63**	**85.06**	**81.27**	-	-
		Evening	-	**37.13**	**58.81**	**68.94**	**70.3**	**56.58**	**38.53**	-	-
43	**Sabour**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	-	-	-	-	-	-	-	-
	Rainfall (mm)		**27**	**253.8**	**198.6**	**358.2**	**445.6**	**222**	**0**	**8**	-
	Temp. (ºC)	Maximum	**36.9**	**38.4**	**33.8**	**33.3**	**33.2**	**32.1**	**30**	**25**	-
		Minimum	**22.3**	**25.4**	**26.1**	**25.5**	**25.2**	**21**	**15.6**	**11**	-

S. No	Location/ Details		Weather data from May-2023 to January-2024								
	RH (%)	Morning	**75.6**	**76.8**	**89.1**	**92.2**	**91.8**	**93.5**	**93.6**	**94**	**-**
		Evening	**45.5**	**49.5**	**65.6**	**70.1**	**69.9**	**62.7**	**64**	**77.3**	**-**
44	**Titabar**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		13	13	15	15	9	17	2	1	-
	Rainfall (mm)		4.6	9.3	5.46	6.4	4.1	8.7	0.7	0.2	-
	Temp. (ºC)	Maximum	31.5	33.2	33.85	33.2	34.6	32.4	29.1	25.9	-
		Minimum	18.8	22.1	23.44	22.9	22.8	20.7	12.9	9	-
	RH (%)	Morning	93.6	92	91.32	94.2	92.7	94.9	91.9	94.2	-
		Evening	78.1	76.7	75.26	73.8	70.1	73.4	60.5	60.3	-
45	**Umiam (Barapani)**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		13	22	16	-	-	-	-	-	-
	Rainfall (mm)		230.1	616.1	230.5	-	-	-	-	-	-
	Temp. (ºC)	Maximum	28.2	27.8	28.2	-	-	-	-	-	-
		Minimum	16.9	19.5	20.4	-	-	-	-	-	-
	RH (%)	Morning	87.16	91.13	90.68	-	-	-	-	-	-
		Evening	71.65	84.1	85.19	-	-	-	-	-	-
46	**Upper Shillong**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		17	26	22	25	15	-	-	-	-
	Rainfall (mm)		154.2	623	366.8	367.4	202.2	-	-	-	-
	Temp. (ºC)	Maximum	22.99	23.01	23.28	23.26	24.18	-	-	-	-
		Minimum	13.82	16.68	17.74	17.53	17.24	-	-	-	-
	RH (%)	Morning	94.34	96.85	97.12	97.48	96.51	-	-	-	-
		Evening	53.99	75.79	79.66	79.44	71.6	-	-	-	-
47	**Varanasi**		**May**	**June**	**July**	**August**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
	Rainy days (No.)		-	-	-	-	-	-	-	-	-
	Rainfall (mm)		-	128.2	120.4	149.6	72.8	130.8	8.3	3.6	-
	Temp. (ºC)	Maximum	-	42.7	35.9	34.5	34.6	34.9	32.1	25.3	-
		Minimum	-	21.9	26.2	23.3	25.2	21.4	14.8	9.8	-
	RH (%)	Morning	-	87	90	92	95	94	96	94	-
		Evening	-	30	64	67	69	54	50	47	-
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* 2023-2024

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2023)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
1	**Aduthurai**	11° N	79 ° E	19.5 m	Irrigated	13-09-2023	37.5:50:25	112.5:0:25 (NPK)
2	**Almora**	29°36'N	79°40'E	1250 m	Upland	18-07-2023 LB 25-07-2023 BS	60:60:40 20:60:40	20 + 20 N (30 DAT & 60 DAT)
3	**Arundhutinagar**	-	-	-	-	-	-	-
4	**Bankura**	23°24' N	87°05'E	84 m	Upland (Rainfed) Rainfed Shallow lowland Upland (Irrigated – Boro only)	26-06-2023	10:26:26 18Kg+SSP 9Kg+Urea 10Kg	1st top dressing at 21 DAT urea10Kg and 2nd top dressing at 42 DAT urea 10 Kg
5	**Chatha**	32°40'N	74°18'E	293 m	Irrigated	06-07-2023	40:60:30	40+40 N (1st and 2nd top dressing)
6	**Chinsurah**	22°52'N	88°24'E	8.62 m	Irrigated	13-07-2023	60:50:30	60
7	**Chiplima**	20°21'N	80°55'E	178.8 m	Irrigated	11-07-2023	100:40:40 50:40:20	25:0:20 NPK (tillering stage) 25:0:0 NPK (PI stage)
8	**Coimbatore**	11° N	77°E	409 m	Irrigated and Potted plants	31-10-2023 BL, 24-07-2023 BS & 16-06-2023 RTD	-	Urea 25kg for entire uniform blast nursery bed; 10g/pot (RTD)
9	**Cuttack**	20°23'N	85^0 17'E	36 m	Irrigated Shallow lowland	21-06-2023 SHR 28-06-2023 BL & BLB 04-07-2023	100:40:40 50 120Kg 40	Twice @25 Kg Nitrogen 20N
10	**Gangavathi**	15°43'N	76°53'E	1332 ft	Irrigated	20-10-2023 LB 27-10-2023 BS 28-07-2023 ShB & BLB	250:75:75-Blast, ShB & BLB 50:75:75- BS	-
11	**Ghaghraghat**	27°50'N	81°20'E	112m	Irrigated	08-07-2023	-	-
12	**Gudalur**	11°30'N	76°30'E	950 m	Irrigated	22-08-2023 BL & FS 21-08-2023 BS	100:50:50	Urea 15 kg for entire uniform blast nursery bed; for false smut 50 kg N/ha
13	**Hazaribagh**	23° 95'91''N	85° 37'20'' E	614 m	Upland	-	75:60:30 BL & 50:60:30 BS	75:0:0 BL
14	**IIRR**	17°19'N	78°23'E	542m	Irrigated	12-08-2023	45:60:40	135N
15	**Imphal**	24°45' N	93°54' E	774 m	Rainfed lowland	03-08-2023	80:60:40	40N
16	**Jagdalpur**	19°05' N	81°57'E	556 m	Upland / Rainfed	08-08-2023	60:60:60	30:30 (N:N)
17	**Jagtial**	18°831'N	78°96'E	264m	Irrigated	15-07-2023 BLB 09-11-2023 BL	120 Nitrogen 40	40+40
18	**Karaikal**	10°55' N	79°52'E	4	Irrigated	-	150:50:50:25Zn 75:50:50:25Zn	75N
19	**Karjat**	18°55' N	73°15'E	51.7 m	Rainfed lowland	10-07-2023 BLB & ShR 19-07-2023 BL	-	70 N
20	**Kaul**	29°51'N	76°39'E	230.7 m	Irrigated	05-07-2023	50:0:60	100 N
21	**Khudwani**	33.73°N	75.15°E	1601 m	Irrigated	11-07-2023	60:60:30	60 N
22	**Lonavala**	18.9°N	73.5°E	622m	Rainfed lowland	3-07-2023 – 10-07-2023	60:50:50	60 N
23	**Ludhiana**	30°90'N	75° 85'E	262 m	Irrigated	10-07-2023	Urea 37kg / Acre	Urea 74kg / Acre

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2023)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
24	**Malan**	32°1'N	76°2'E	950 m	Upland	20-06-2023	120:40:40 60:40:40	60 N
25	**Mandya**	12°36'N	76°15'E	694.65 m	Irrigated	26-10-2023 BL 05-09-2023 ShB 02-08-2023 NB	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	18-07-2023	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	07-07-2023	ShB- 60:60:60 BLB-75:60:60	ShB-60, BLB-75 N & 25 $ZnSo_4$
28	**Moncompu**	9°51'N	76 °5'E	Below MSL	Irrigated	17-07-2023	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	22-08-2023	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	14-07-2023	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	21-07-2023	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	05-01-2024	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	13-07-2023 ShB	-	-
34	**Pantnagar**	29°N	79°30'E	343.84 m	Irrigated	09-07-2023	60:60:40-25Kg ($ZnSO_4$)	60N
35	**Patna**	25°13N	84°14E	77m	Irrigated	12-07-2023	120:60:40 NPK kg/ha	-
36	**Pattambi**	10°48'N	76°12'E	25.35 m	Upland Rainfed lowland	14-07-2023 BL 13-07-2023 ShB & BLB	120:30:30 80:30:15	40:0:15
37	**Ponnampet**	12°29'N	75°56'E	856 m	Rainfed lowland	08-08-2023 UBN 01-08-2023 Field	75:75:90 37.5:75:45	37.5:0:45
38	**Pusa**	25°98'N	85 °67'E	51.8 m	Irrigated	12-07-2023	80:40:20	20+20 N
39	**Raipur**	21° 16'N	81°36'E	681 m	Irrigated	13-07-2023	120 60	60N as a spray in two split doses
40	**Rajendranagar**	17° 19'N	78°23'E	542 m	Irrigated	09-12-2023 BL 27-06-2023 NB 08-07-2023 ShR	2.5 N for UBN 180:60:0	
41	**Ranchi**	23° 17'N	85° 19'E	625m	Upland	21-07-2023 (direct sown)	60:30:20 30:30:20	15+15 N
42	**Rewa**	24°30'N	81°15'E	360 m	Upland Irrigated	05-08-2023	80:60:40 40	40
43	**Sabour**	25°23'N	87°07'E	37.19 m	Rainfed lowland	12-07-2023	40:40:20	20+20 N
44	**Titabar**	26°60'N	94°20' E	99 m	Irrigated	29-07-2023 to 01-08-2023	60:20:40 30:20:40	15+15 N
45	**Umiam (Barapani)**	25°30' N	91°51' E	1000m	Upland	25-05-2023	60:60	60
46	**Upper Shillong**	25° 54'24" N	91° 83' 96" E	1814 m	Rainfed	17-07-2023	50:40:40 25:40:40	25
47	**Varanasi**	25°20' N	23°03'E°	75.7 m	Irrigated	19-07-2023	180:60:60 120:60:60	15+15 N
48	**Wangbal**	24°8'N	94'E	781 m	Rainfed lowland	22-08-2023	-	-

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	GSN	Germplasm Screening Nursery
Gerua	GER	IC No.	Indigenous collection Number
Ghaghraghat	GGT	IET No.	Initial Evaluation Trail Number
Gudalur	GDL	IVTs	Initial variety trails
Hazaribagh	HZB	LB	Leaf blast
Imphal	IMP	LSD	Least significant difference
Indian Institute of Rice Research	IIRR	LSI	Location Severity Index
Jagadalpur	JDP	MSL	Mean sea level
Jagtial	JGT	N	Natural Infection
Karjat	KJT	NB	Neck blast
Kaul	KUL	NdB	Node blast
Kudhwani	KHD	NHSN	National Hybrid Screening Nursery
Lonavala	LNV	NSN-1	National Screening Nursery 1
Ludhiana	LDN	NSN -2	National Screening Nursery 2
Malan	MLN	NSN-H	National Screening Nursery- Hills
Mandya	MND	PI	Promising index
Maruteru	MTU	RTD	Rice Tungro Disease
Masodha (Faizabad)	MSD	RTV	Rice Tungro Virus
Moncompu	MNC	SE	Standard error
Mugad	MGD	ShB	Sheath blight
Navsari	NVS	ShR	Sheath rot
Nawagam	NWG	SI	Susceptibility Index
Nellore	NLR	StR	Stem rot
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-2023 report was compiled by the following scientists of Department of Plant Pathology, ICAR-IIRR, Hyderabad.

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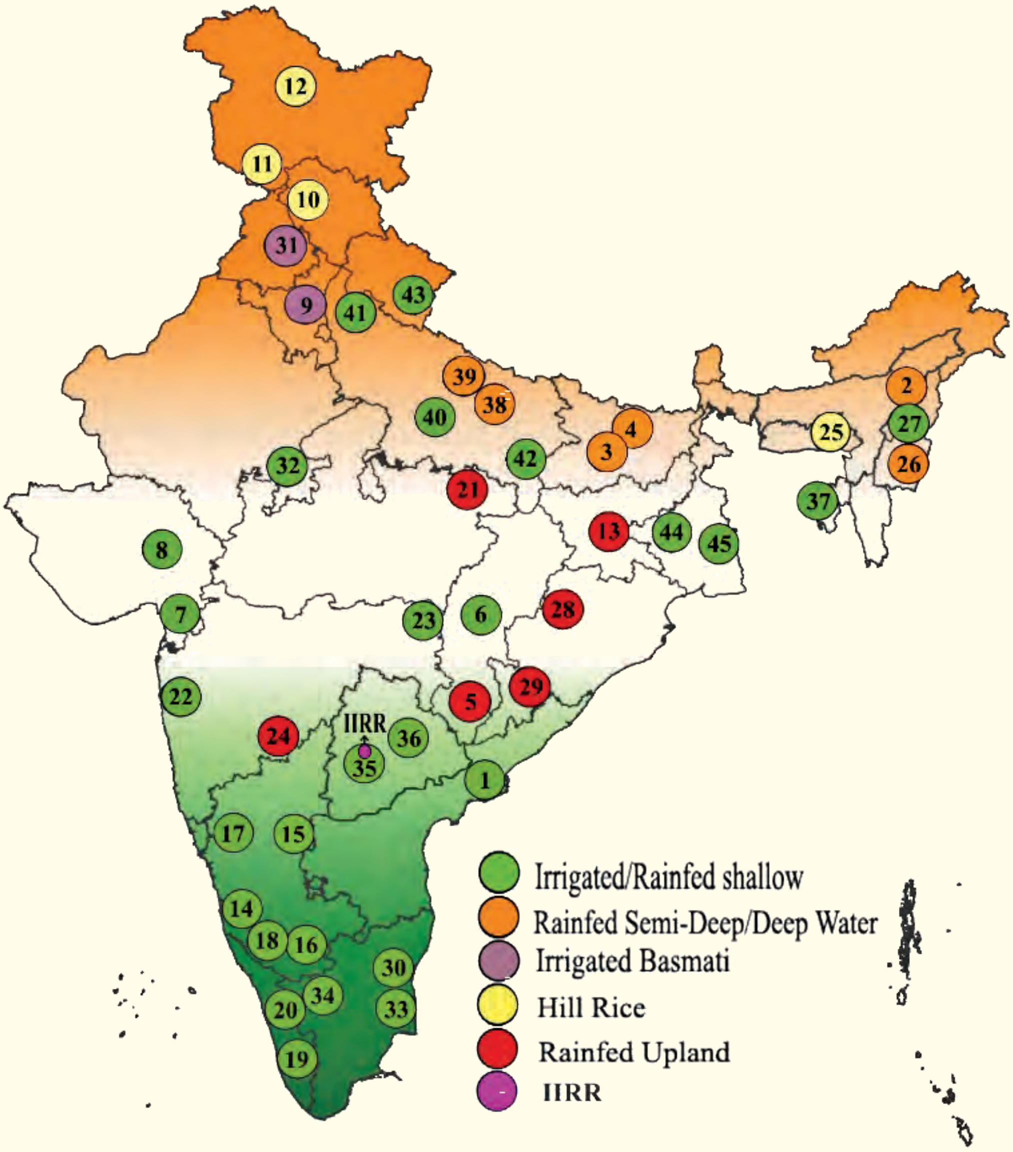

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