PLANT PATHOLOGY

AICRIP Progress Report- Plant Pathology 2016

3. PATHOLOGY

SUMMARY

The All India Coordinated Rice Pathology Program of the ICAR-Indian Rice Research Institute (formerly as Directorate of Rice Research) 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 2016, a total of 14 trials were conducted at 46 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, 2016'.

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

❖ LEAF BLAST

National Screening Nursery 1 (NSN-1)

The National Screening Nursery 1 (NSN-1) comprised of 373 entries and national and regional checks were included in the trials for comparison. The composition of AVTs represented promising rice cultures developed for different ecosystems like upland, irrigated and rainfed lowlands. The nursery was evaluated against leaf blast under uniform blast nursery (UBN) at 23 locations representing diverse ecosystems. The entries that exhibited low scores over the locations and low susceptible index (SI <4) and high promising index were IET # 24692, 24905, 24934, 24797, 24982, 25113, 25358, 25103, 25618, 25278, 25121, 24983, 24904, 24956, 24331, 24919, 25515 and 25484.

National Screening Nursery 2 (NSN-2)

This nursery comprised of 663 entries (including checks) drawn from Initial Variety Trials. They were evaluated at 16 locations along with national, regional and test checks. The lines which recorded resistant reaction were IET # 26190, 26351, 25935, 26157, 26302, 26194, 26287, 26365, 26325, 26375, 25138 and 26345.

National Screening Nursery-Hills (NSN-H)

The nursery included 86 entries drawn from hill trails including checks. The nursery was evaluated at twelve locations along with checks for comparison. The promising entries that had low disease score at the test locations were IET # 25840, 25830, 24229, 25841, 25846, 25144, 25839, 25170, 25835, 24192, 25167 and 25852.

National Hybrid Screening Nursery (NHSN)

One hundred forty five hybrids were evaluated at 18 locations under different ecosystems. The entries showing resistance across the locations were 25743, 25738, 25748, 25741, 25739, 25750 and 25753.

Donor Screening Nursery (DSN)

The nursery which comprised of 109 entries originating from different centres was evaluated at 20 locations. The promising entries that scored low disease score were RP-Bio-Patho-2,VL-32197, VL-31743, VL-31430, VL-31997, RP-Bio-Patho-4, CB 14740 and VL-1802.

❖ **NECK BLAST**

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN, and DSN at 8, 5, 6, 7 and 8 locations respectively. The promising entries that scored low disease score across the locations included were IET # 24471, 24496, 24518, IET 25038, 24495, 24519, 23934, 23906, 23895, 25241, 25278, 25521, 23930, 24505 and 25329 in NSN-1; IET # 25186, 25175, 25219, 25889, 25860, 26238, 25223, 25894, 25917, 25859, 25888, 26071, 25927, 25031, 25040, 25951, 25999, 25256, 26212 and 25921 in NSN-2; IET # 25840, 25845, 25813, 25826, 24188, 24166, 25167, 25841 and 25844 in NSN-H; IET # 25802 and 25790 in NHSN and RP-Patho-6, RBF-TC-2, RP-Patho-8 and RBF-TC-1 in DSN.

❖ **SHEATH BLIGHT**

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN, and DSN nurseries at 23, 14, 3, 18 and 17 locations, respectively. In majority of the locations, the disease pressure was moderate to high. None of the entries were found resistant (SI<3) against sheath blight. Highly Promising entries found in NSN-1 were IET Nos. 24474, 25501, 25086, 24505 and 25487; in NSN-2 were IET Nos. 25897, 25211, 25900, 26374, 25877, 25196, 26326 and 25889; in NSN-H were IET Nos. 2816, 2501, 2504, 2702, 2801, 2914 and 2603; in NHSN were IET 25808, IET 24896, IET 25783; and in DSN were CB 05022, CB 1107, RMS-BL-19, RMS-BL-14 and CB 09123.

❖ **BROWN SPOT**

The entries were evaluated under NSN-1, NSN-2, NSN-Hills, NHSN, and DSN at 14, 10, 4, 11 and 12 locations respectively. The promising entries to brown spot were IET # 25316, 25055, 25293, 24990, 25097, 25086, 25334, 25287, 24325, 25520 and 25369 from NSN-1; IET # 25186, 25894, 26208, 26346, 26045, 25957, 25042 and 26122 in NSN-2; IET # 25834, 2419, 25149, 24207, 25833, 25838 and 25842 in NSN-H; IET # 25728 and 25811 in NHSN and RP-Bio-Patho-3, CB 13132 and RP-Bio-Patho-2 in DSN.

❖ **SHEATH ROT**

The entries under NSN-1, NSN-2, NSN-Hills, NHSN and DSN were screened against sheath rot at 12, 7, 2, 11 and 10 locations, respectively. Some of the promising entries in different nurseries were: IET # 25113 and 25121 in NSN-1; 25891, 26052, 25890, 25959, 25874, 26053, 25186, 26019, 26042, CST 7-1, 26407, 26307, 26333, 25884 and 26164 in NSN-2. None of the entries showed resistance reaction from NSN-Hills and some promising entries with IET

25766, 25799, 25787 in NHSN. A few promising entries in DSN includes VL-31997 and RP-Patho-8.

❖ **GLUME DISCOLOURATION**

Test entries were screened at Chatha, Lonavala and Navsari during *Kharif* 2016. Some of the promising entries were IET # 25325, 24977, 24956, 25577, 25603, 25549 and 24774 in NSN-1; IET # 26147, 25946, 25728, 25136, 26196, 26238, 26416 and 26417 in NSN-2; IET # 24188 in NSN-H; 25715, 25735, 25739, 25742, 25748, 25750, 25790 and 25800 in NHSN and VL-8657, VL-31430, VL-31716 and CB 13204 from DSN.

❖ **LEAF SCALD**

Leaf scald (*Rhynchosporuim* sp.) disease incidence was noticed during *Kharif* 2016 at Lonavala in all the screening nurseries. The promising entries recorded ≤3 score were: IET # 25350 and 24241in NSN-1; 22565 and RMS-BL-13 in DSN.

❖ **BACTERIAL LEAF BLIGHT**

The nursery was evaluated for their resistance to bacterial leaf blight at 24, 15, 6, 19 and 20 locations respectively across India under NSN-1, NSN-2, NSN-H, NHSN and DSN respectively. Some of the promising entries were IET # 25501, 239300, 25369, 24519, 25252, 24496), IET 25467, 24951 and 24855 in NSN-1; IET # 25886, 25190, 25861, 26106, 25895, 25918, 25219, 25952 and 26023 in NSN-2; IET # 25834, 25826 and 25846 in NSN-Hills; IET # 25796, 25745, 24888, 25788, 24891, 24892, 25784, 25785 and 25738 and RMS-BL-1, RMS-BL-22, RMS-BL-2, RMS-BL-11, RMS-BL-21, RMS-BL-13 and RMS-BL-16 in DSN.

❖ **RICE TUNGRO DISEASE**

The entries in NSN-1, NSN-2, NHSN and DSN were evaluated at 3, 2, 3 and 3 locations against rice tungro virus disease. The promising entries identified in different nurseries were: IET # 24338, 25123, 24505 and 24519 in NSN-1; IET # 25769, 25717, 25752, 25770, 25710, 25789, 25792, 25804, 25806 and 25810 in NHSN; CB 05022, VL-31430, VL-31817, PRDF-214-10, RMS-BL-3, RMS-BL-13, CB 09123, RP-Patho-6, CB 1107, RP-Patho-9, VL-31598, RMS-BL-9, CB 14932, CB 13532, RP-Bio-Patho-3, VL-32197, VL-32216 and KMP-220 in DSN.

❖ **MULTIPLE DISEASE RESISTANT LINES**

In NSN-1, few lines were resistant against more than one disease that included IET # 25501 (sheath blight, bacterial leaf blight and Rice tungro disease), 23930 (neck blast and bacterial leaf blight), 24519 (neck blast and sheath rot) and 24956 (leaf blast and glume discoloration), 25278 (leaf blast and neck blast). In NSN-2, IET no. 25186 showed multiple disease resistance to neck blast, brown spot and sheath rot. Under NSN-H, resistance lines were IET # 25813 (neck blast and sheath blight), IET# 25167 (leaf blast and neck blast), IET# 25826 (neck blast and bacterial leaf blight), IET # 25834 (brown spot and bacterial leaf blight), IET # 25840 and 25841 (leaf blast and neck blast). In NHSN, entries which show resistance to two diseases included IET Nos. 25739, 25748, 25750 and 25790 (leaf blast and glume discoloration). In DSN screening nurseries entry which showed resistance to three diseases were VL-31430 (against leaf blast, glume discoloration and rice tungro disease).

❖ GERMPLASM SCREENING NURSERY (GSN)

Under Agro biodiversity project, a total of 1214 germplasm accessions along with checks were screened in *Kharif* 2016 for resistance against major rice diseases at seven locations *viz.*, Almora (blast), Coimbatore (blast and brown spot), Cuttack (sheath blight), IIRR (blast, sheath blight, bacterial leaf blight and rice tungro disease), Hazaribagh (blast), Pantnagar (sheath blight and bacterial leaf blight) and Titabar (sheath blight and bacterial leaf blight). The accessions were evaluated at Almora, Coimbatore, Hazaribagh and IIRR with LSI 6.4, 5.6, 5.7 and 7.0 respectively against blast disease. The entries that scored low blast disease scores were IC # 245865, 246277, 246403, 246274, 454167, 121865, 199562, 218270, 245927, 246012, 246228, 246273 and 246659. The accessions were also evaluated against sheath blight at four centre's *viz.*, Cuttack, IIRR, Pantnagar and Titabar. A few accessions that showed tolerance to sheath blight were IC # 458442, 454167, 458491X, 210824, 458464, 459446, 17051X, 17122X, 462046, 121904, 216905, 216946, 217203 and 217625. The nursery was evaluated at 3 centres against bacterial blight. A very high disease pressure was recorded at Pantnagar (LSI 7.7) and IIRR (LSI 7.3). A few accessions that recorded low bacterial leaf blight disease score were IC # 454257X, 458491X, 211170, 211192, 211209, 216505, 216520, 216655, 245667, 246214 and 246677. The entries were also evaluated against rice tungro disease at IIRR only with LSI 6.0. A few accessions that scored low disease score were IC # 216526, 216753, 216862, 217143, 217277, 217330, 217421, 217606, 217721, 217952, 218372, 218862, 245899, 246078, 246283, 246435, 246567, 246691 and 246795. These were evaluated against brown spot at Coimbatore with LSI 6.1. Accessions that scored low disease score against brown spot were IC # 245963 and 454212. Two entries that showed resistance to more than one disease were IC # 454167 (blast and sheath blight) and 458491X (sheath blight and BLB).

II. FIELD MONITORING OF VIRULENCE

1. *Pyricularia oryzae*

The nursery included twenty five cultures consisting of international differentials, donors and commercial cultivars. The experiment was conducted at twenty three locations with different dates of sowing during the crop season to monitor the blast reaction on different host genotypes. Tetep, Tadukan and Raminad str-3 were resistant across most of the locations. Raminad str-3 was highly susceptible at Ghaghraghat and Navsari and also susceptible at Coimbatore, Gudalur, Imphal, Ponnampet and Umaiam. Tetep was highly susceptible at Ghaghraghat and Tadukan was susceptible at Almora, Cuttack, Ghaghraghat, Imphal and Umiam. It shows that the isolates belonging to these locations found to be more virulent to exhibit susceptibility even in resistant cultivars. The susceptible checks like HR 12 and CO39 recorded low disease score at Mugad and Karjat. The resistant check Rasi recorded high disease score at Cuttack, Imphal, Ponnampet, Umiam and Upper Shillong. The difference in disease reaction scores of susceptible and resistant checks reveals that a shift in the pathogen population. The reaction pattern of genotypes at all the locations was grouped into six major groups. The reaction pattern at Almora, Cuttack, Ghaghraghat, Imphal, Varanasi, Navsari, Umiam, Ponnampet, Pattambi and Gangavati were in

group one; Jagadalpur, Khudwani and Malan in group two; Coimbatore and Gudalur in group 3; Lonavala and New Delhi in group 4; Karjat, Nellore, IIRR, Mugad, Mandya and Upper Shillong in group 5 and Rajendranagar in group 6.

2. *Xanthomonas oryzae* pv. *oryzae*

This trial consisted of twenty eight near isogenic lines of IRBB lines possessing different bacterial blight resistant genes (singly) or various combination 5 BB resistance genes *viz.*, *Xa4, xa5, Xa7, xa13* and *Xa21* in the background of rice cultivar IR 24 and with different checks. The trial was conducted in 24 hot spot locations in India during *Kharif*' 2016. Most of the single genes were found susceptible at most of the locations. BB resistance gene *xa13* was found susceptible in 10 locations while *Xa21* was found susceptible in 11 locations. The isolates from Aduthurai, Navsari, New Delhi, Chiplima, Maruteru and Gerua were highly virulent with LSI > 6. The isolates from IIRR, Hyderabad, Patna, Pattambi, Gangavati, Coimbatore, Faizabad, Cuttack, Rajendranagar, Nawagam, Ludhiana, Chinsurah, Titabar, Kaul and Raipur were moderately virulent with LSI ranging from 4.1-5.7. Rest all the isolates were less virulent. BB resistance gene *xa13* was susceptible in 10 locations while *Xa21* was susceptible in 11 locations. Most of the 2, 3, 4 and 5 genes combinations lines also showed susceptibility at some places indicating shift towards higher virulence.

III. DISEASE OBSERVATION NURSERY

The trial was conducted at 7 locations *viz.*, Chinsurah, Chiplima, Malan, Mandya, Maruteru, Moncompu and Pusa. Terminal percent disease index/disease severity of leaf blast, neck blast, brown spot, sheath blight, sheath rot, false smut and bacterial leaf blight diseases were recorded. Eastern zone was represented by three locations *viz.*, Chinsurah, Chiplima and Pusa. The results concluded that early sowing of the crop in the fort night of June (10.06.16 to 16.06.16) favoured the inoculum build up of *Rhizoctonia solani* (DS 22.5% – PDI 33.3%) and *Xanthomonas oryzae* pv. *oryzae* (DS 13.5% - PDI 78.89%) and late sowing favoured the multiplication of *Sarocladium oryzae* (DS 37.5%) and *Bipolaris oryzae* (DS 37.5% - 68%). Malan represent the northern zone, wherein early sowing (21.05.16) of crop recorded low disease index of leaf blast (14.3%) and late sowing (20.06.16) highly favoured the build up of leaf blast pathogen *Pyricularia oryzae* (PDI 95.2%). Locations *viz.*, Mandya, Maruteru and Moncompu are under southern zone. At Mandya, Maruteru sowing of the crop in the first week of July (04.07.16 to 06.07.16) resulted in the high intensity of neck blast (DS 53.9%; PDI 72.8%) and sowing of crop between 23rd June to 6th July recorded high incidence of sheath blight at Mandya (PDI-68.89%), Maruteru (DS-75.55%) and Moncompu (PDI-73.11%). Late sowing of the crop in the month of September (10.09.16) recorded high incidence of brown spot (PDI 55.00%).

IV. DISEASE MANAGEMENT TRIALS

1. EVALUATION OF FUNGICIDES AGAINST LOCATION SPECIFIC DISEASES

The trial was conducted with an objective to evaluate new combination of fungicidal product *viz.*, tricyclazole 20% SC+ tebuconazole 16% SC (36 SC) at two different concentration (2.0 ml/l & 2.25 ml/l) in comparison with individual molecule of tricyclazole 75% WP and

tebuconazole 25% EC against fungal diseases of rice which are locally important in a particular rice growing region. Besides, bio-efficacy of the test product is measured with commercially available popular fungicides like hexaconazole 5% EC and carbendazim 50% SC used as standard checks. The fungicides were evaluated against leaf blast (nine locations), neck blast (seven locations), node blast (one location), sheath blight (13 locations), sheath rot (seven locations), brown spot (seven locations), grain discoloration (two locations), leaf scald (one location) and false smut (one location). The observations were recorded as disease incidence (DI), disease severity (DS) and grain yield.

The combination fungicide tricyclazole 20% SC + tebuconazole 16% SC (36 SC) at higher concentration (2.25 ml/l) significantly reduced severity and intensity of leaf blast, sheath blight and brown spot, whereas it was on par with check fungicide (tricyclazole 75 WP) in case of neck blast. The same test product at lower concentration (2.0 ml/l) was performed on par with the check fungicides (tricyclazole, tebuconazole, hexaconazole and carbendazim) in reducing the disease severity and/or intensity of leaf blast, sheath blight and brown spot. In case of sheath rot, both the concentrations of test product was significantly reduced the disease incidence as well as severity when compared to check fungicides. Regarding grain yield, both the concentrations (2.0 ml /l and 2.25 ml/l) of test fungicide performed better than other check fungicides in reducing disease and enhancing the yield.

2. INTEGRATED DISEASE MANAGEMENT

Trial was formulated with three cultivars *viz*., susceptible, moderately resistant, and locally grown hybrid along with IDM and without IDM practices. At Malan leaf and neck blast was successfully managed by cultivation of Arize 6129 (hybrid). At Mandya, integrated disease management of neck blast and sheath blight and high grain yield was achieved by cultivation of locally released hybrid (KRH-4) along with necessary spraying of suitable fungicide. Among the three cultivars tested at Rewa, hybrid JRH-5 performed well and completely free from leaf blast disease and recorded high grain yield. At Lonavala, leaf blast, neck blast and node blast were managed effectively by cultivating either Indrayani or Sahyadri-2 along with application of 3 sprays of fungicide. At Rajendranagar location, the results conclude that leaf blast, neck blast and sheath rot can be managed by choosing the cultivar either RNR 15048 or KRH 2 along with application of 2 sprays of fungicide at the time of disease initiation. Integrated disease management of sheath blight was attempted at Faizabad and Pantnagar wherein experimental results revealed that application of fungicide, cultivation of Arize 6444 (Faizabad) and LG-94-02 (Pantnagar) resulted in high grain yield. At Maruteru integrated disease management trial was conducted to manage sheath blight and bacterial blight disease. Results shown that application of suitable fungicide, cultivation of MTU 1061 and Arize 6444 were performed well against sheath blight and bacterial leaf blight respectively along with high grain yield. Cultivation of Aathira (high yielding variety) and one spray of hexaconazole (2 ml/l) resulted in the well management of the sheath blight disease along with high grain yield at Pattambi. Similarly adoption of integrated management practices against sheath blight and bacterial leaf blight and cultivation of

Uma (high yielding variety) resulted in high grain yield at Moncompu. At Kaul, adoption of seed treatment and cultivation of Haryana Sankardhan-1 resulted in foot rot disease free crop and high grain yield.

3. INTEGRATED PEST MANAGEMENT (SPECIAL - IPM TRIAL)

During *Kharif* 2016, a special IPM trial was proposed at 12 different locations and data was received from Chinsurah, Coimbatore, Gangavati, Malan, Mandya and Sakoli. Among these locations, the Coimbatore and Malan centres recorded only Leaf blast (LB) and Neck blast (NB) diseases and other centres recorded Sheath blight (ShB), Bacterial leaf blight (BLB), Sheath rot (ShR) and Brown spot (BS). Leaf blast disease at Coimbatore in Farmer's practice was high at about 10.40 PDI when compared to 4.53 in IPM. In Sakoli, leaf blast was maximum in FP (18.95) when compared to 10.65 in IPM. Similarly the bacterial leaf blight was recorded significantly from Sakoli centre, whiles the other centres including Malan, Chinsurah and Mandya recorded very low levels of the disease and hence was not considered for analysis. In Sakoli, the disease was almost found to be on par with both the IPM and FP. With respect to sheath blight, maximum disease was observed in Gangavati when compared to the other two centres. The disease was observed from 43 to 120 DAT in Sakoli, 36 to 92 DAT in Chinsurah and from 43 to 106 DAT in Gangavati. Thus results indicated that the practice of integrated pest management helps in the overall improvement of the crop conditions leading to better resistance of the plants against the disease.

4. SPECIAL TRIAL ON CHEMICAL CONTROL OF FALSE SMUT

The chemical control of false smut disease trial was proposed at 15 locations and data was received from 10 locations *viz.,* Aduthurai, Gangavati, Imphal, Karjat, Kaul, Ludhiana, Maruteru, Rewa, Titabar and Varanasi. Under natural disease pressure the percentage of infected panicles/m^2 was varied from 0.46% to 42.10% and the percentage of infected spikelet/panicle was varied from 0.31% to 39.11%. The trail was formulated with 10 treatments which includes 9 commercially available fungicides along with check. The performance of fungicides varied according to locations. Fungicides *viz.,* azoxystrobin 18.2% + difenoconazole 11.4% w/w SC @ 1.0 ml/l (T3) at Gangavati and Varanasi; propiconazole 25 EC @1.0 ml/l (T9) at Kaul, Ludhiana, Titabar; metiram 55% + pyraclostrobin 5% WG @ 1.5 g/l at Rewa and difenoconazole 25 EC @ 1.0 ml/l (T2) at Aduthurai performed well by reducing both percentage of infected panicles/m^2 and percentage of infected spikelet/panicle along with higher grain yield.

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 departments 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 2016, a total of 14 trials were conducted at 46 locations on host plant resistance, field monitoring of virulence in major pathogens and disease management. Five national screening nurseries including germplasm screening nursery comprising of 2590 entries of advanced breeding lines, new rice hybrids and germplasm accessions, were evaluated for their reactions to major rice diseases at 46 locations.

The composition of the nurseries is as follows:

- National Screening Nursery 1 (NSN-1) - 373 entries drawn from Advanced Variety Trials.
- National Screening Nursery 2 (NSN-2) - 663 entries from Initial Variety Trials.
- National Screening Nursery-Hills (NSN-H) - 86 entries from Advanced and Initial Varietal Trials.
- National Hybrid Screening Nursery (NHSN) - 145 entries from Initial National Hybrid Rice Trials (HRT'S).
- Donor Screening Nursery (DSN) - 109 entries from different centres.
- Germplasm screening Nursery (GSN) - 1214 Accessions from NBPGR.

The virulence patterns of blast and bacterial leaf blight pathogens in the field were monitored, using differentials for bacterial blight and blast pathogens 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 formulations against major rice diseases. Production Oriented Survey (POS) was undertaken in 20 states to identify the production constraints in different rice growing ecosystems.

Different agro-ecological zones of India are represented by 46 Plant Pathology AICRIP centres with SAU's and ICAR institutes and coordinated by ICAR-IIRR. Data was received as disease severity from 19 AICRIP centres. Northern zone is represented by Almora, Ludhiana, Malan, New Delhi and Varanasi. In this region, major diseases *viz.*, leaf blast, neck blast, sheath

blight and false smut were recorded as low to moderate level and narrow brown leaf spot was reported (10 to 20 %) from districts like Kangra, Una and Sirmaur (Panota Sahib) of Himachal Pradesh. Chakdha, Chiplima, Gerua, Patna and Titabar represents the North eastern and Eastern zone. In this region, the major rice diseases *viz.*, leaf blast, sheath blight, sheath rot, brown spot and rice tungro disease were reported as low to moderate level of disease severity. Further among these locations, very high disease severity of bacterial leaf blight (upto 60 %) was reported from Sambalpur and Bargarh districts of Odisha.

The Southern agro-ecological zone is represented by Gangavati, Maruteru, Mugad, Pattambi and Rajendranagar. In this zone, bacterial leaf blight severity was moderate to high at Koppal, Bellary and Raichur districts of Karnataka (30-40 %), East Godavari district of Andhra Pradesh (40-50 %), Palakkad district of Kerala (20-50 %). With respect to neck blast, the disease severity was 25-30 % at Karnataka and 16- 42 % at Telangana. Central zone consists of Jagadalpur, Karjat and Rewa. Very high severity of leaf blast (50-65 %), brown spot (65-75 %) and false smut (50-60 %) and moderate severity of bacterial leaf blight (20-25 %), sheath blight (30-35 %) and sheath rot (20-25 %) were reported from Bastar, Tokapal, Darbha districts of Chhattisgarh.

The weather conditions and location details are given in Annexure I to Annexure III. Out of 541 experiments proposed, data were received from 516 experiments of 14 trials indicating the good response with 95.4 % return of data sets from centres.

Table 1: Scientists involved in Pathology Coordinated Programme, *Kharif* 2016. ICAR-IIRR, Headquarters, Hyderabad - Dr. M. Srinivas Prasad, PI; Associates: Drs. G. S. Laha, D. Krishnaveni, C. Kannan, D. Ladhalakshmi, V. Prakasam and P. Valarmathi

S.No	Location	Code	Co-operators	Experiments	
				Proposed	Conducted
1	Aduthurai	ADT	Dr. K. Rajappan	15	15
2	Almora	ALM	Dr. H. Rajashekara	11	12
3	Arundhatinagar	ARD	Dr. Abijit Saha	8	3
4	Bankura	BNK	Dr. Partha Pratim Ghosh	3	4
5	Chakdha	CKD	Mr. Raghunath Mandal	3	3
6	Chatha	CHT	Dr. Anil Gupta	8	10
7	Chinsurah	CHN	Dr.D.K.Patra ,Dr.P.Bandyopadhyay and C.K. Bhunia	11	11
8	Chiplima	CHP	Mrs. Rini Pal	8	7
9	Coimbatore	CBT	Dr. A. Ramanathan	14	14
10	Cuttack (NRRI)	CTK	Drs. A. Mukharjee and Sri Kanta Lenka	15	11
11	Faizabad (Masodha)	MSD	Dr. Vindeshwari Prasad	10	10
12	Gangavati	GNV	Dr. D. Pramesh	19	19
13	Gerua	GER	Dr. K. B. Pun	13	11
14	Ghaghraghat	GGT	Dr. A. L. Upadhay	10	8
15	Gudalur	GDL	Dr. A. Ramanathan	4	5
16	IIRR	IIRR	Drs. M. S. Prasad, G. S. Laha, D. Krishnaveni, D. Ladhalakshmi and V. Prakasam	26	22
17	Imphal	IMP	Dr. Susheel Kumar Sharma	8	6
18	Jagadalpur	JDP	Dr. R. S. Netam	14	14
19	Karjat	KJT	Dr. M. B. Dalvi	18	18
20	Karaikal	KRK	Dr. C. Rattinasababady	2	-
21	Kaul	KUL	Dr. Ram Singh	8	7
22	Khudwani	KHD	Dr. M. Najeeb Mughal	8	10
23	Lonavala	LNV	Dr. A.P. Gaikwad	23	32
24	Ludhiana	LDN	Drs. Jagjeet Singh Lore and Jyoti Jain	15	16
24	Malan	MLN	Dr. Sachin Upmanyu	15	15
26	Mandya	MND	Mrs. B. S. Chethana	24	24
27	Maruteru	MTU	Drs. S. Krishnam Raju and V. Bhuvaneswari	17	17
28	Moncompu	MNC	Dr. M. Surendran	12	12
29	Mugad	MGD	Dr. S. V. Hiremath	10	8
30	Navsari	NVS	Dr. Vijay A. Patil	10	13
31	Nawagam	NWG	Dr. K. S. Prajapati	10	10
32	Nellore	NLR	Dr. C. P. D. Rajan	10	10
33	New Delhi (IARI)	NDL	Drs. K.K. Mondal, B. Bishnu Maya & G. Prakash	7	7
34	Pantnagar	PNT	Drs. Vishwanath and J. Kumar	14	13
35	Patna	PTN	Dr. Arvind Kumar	9	9
36	Pattambi	PTB	Dr. P. Raji	16	16
37	Ponnampet	PNP	Dr. G. N. Hosagoudar	13	13
38	Portblair	POB	Mr. K. Sakthivel	2	1
39	Pusa	PSA	Dr. Bimla Rai	10	9
40	Raipur	RPR	Dr. P. K. Tiwari	14	14
41	Rajendranagar	RNR	Dr. R. Jagadeeshwar	16	13
42	Rewa	REW	Dr. S. K. Tripathi	14	11
43	Titabar	TTB	Dr. Bubul Ch. Das,	12	12
44	Umiam (Barapani)	UMM	Dr. Pankaj Baiswar	9	6
45	Upper Shillong	USG	Smt. Sypailynora Dkhar	13	13
46	Varanasi	VRN	Dr. R. K. Singh.	10	2
Total Experiments (95.37%)				**541**	**516**

I. HOST PLANT RESISTANCE

1. Screening nurseries (NSN-1, NSN-2, NSN-H, NHSN and DSN)

❖ LEAF BLAST

➢ **National Screening Nursery 1 (NSN-1)**

The National Screening Nursery 1 (NSN-1) comprised of 359 test entries and 14 checks were included in the trials for comparison. The nursery was drawn from AVTs representing promising rice cultures developed for different ecosystems like Rainfed shallow lowland (AVT 1-RSL), Semi-deep water (AVT 1-SDW), Early (AVT 1& 2 E), Irrigated Mid early (AVT 2-IME), Irrigated medium (AVT 1 & 2- IM), Late (AVT 1-L), Alkaline and Inland Saline Tolerant Variety Trial (AVT 1- AL& ISTVT), Coastal Saline Tolerant Variety Trial (AVT 1- CSTVT), Early Hills (AVT 1-E -H), Medium Hills (AVT 1-M -H), Upland Hills (AVT 1- U-H), Basmati (AVT 1-BT), Aromatic Short Grain (AVT-1- ASG), Aerobic (AVT 1& 2 - AEROB), Rice Bio-fortification (AVT1& 2-Biofort), Near Isogenic Lines- Blast (AVT 2-NIL- Blast) and Near Isogenic Lines-Submergence and Drought (AVT 1-NIL- SUB & DRT). These entries were screened against all major diseases of rice. The nursery was evaluated against leaf blast under Uniform Blast Nursery (UBN) pattern at 23 locations representing diverse ecosystems. The frequency distribution of disease scores and the representative location severity indices (LSI) are given in Table 2.

The disease pressure was high at Karjat with LSI 6.8 and the lowest at Mugad and Khudwani with LSI 2.0 and 1.7 respectively. The disease pressure was high (LSI 6 - 7) at Malan (6.5) and Navsari (6.5). It was moderate (LSI 3 - 6) at Almora (6.0), New Delhi (5.6), Lonavala (5.6), Ghaghraghat (5.4), IIRR (5.4), Umiam (5.4), Gangavati (5.2), Gudalur (5.1), Coimbatore (5.0), Mandya (5.0), Nellore (5.0), Upper Shillong (4.4), Ponnampet (4.3), Pattambi (4.2), Jagadalpur (4.0), Rewa (3.5), Rajendranagar (3.3) and Cuttack (3.1). The disease pressure was low (LSI <3.0) at locations like Mugad and Khudwani. The selection of promising entries was done based on the data of those locations where LSI was more than 3. Accordingly, the data of locations *viz.*, Rewa, Rajendranagar, Mugad, Khudwani and Cuttack were not considered for the selection of resistant entries. The promising entries were identified based on the disease reaction of the test entries with low susceptibility index (SI) at locations with moderate to high disease pressure Table 2.

None of the entries scored SI <3 and hence the entries with SI upto 3.7 were considered as promising lines. The entries that exhibited low over all scores and low susceptible index (SI <4) and high promising index were listed in the Table 3 that were IET # 24692, 24905, 24934, 24797, 24982, 25113, 25358, 25103, 25618, 25278, 25121, 24983, 24904, 24956, 24331, 24919, 25515 and 25484.

Table 2: Location severity index and frequency distribution of leaf blast scores for NSN-1 entries, *Kharif* 2016

Score	Location /frequency of score (0-9)																						
	ALM	**CBT**	**CTK**	**GDL**	**GGT**	**GNV**	**IIRR**	**JDP**	**KHD**	**KJT**	**LNV**	**MGD**	**MLN**	**MND**	**NDL**	**NLR**	**NVS**	**PNP**	**PTB**	**REW**	**RNR**	**UMM**	**USG**
0	0	0	40	0	0	0	0	0	89	0	0	0	0	0	0	0	0	0	2	6	0	0	16
1	0	0	71	0	0	0	2	2	115	0	1	91	47	0	6	3	4	35	7	27	108	25	20
2	0	4	17	0	0	4	12	61	0	5	27	199	16	1	0	17	2	52	57	87	0	33	75
3	47	103	4	165	1	35	63	101	143	5	77	66	10	63	72	49	13	64	105	51	158	34	64
4	0	34	9	0	21	82	64	90	0	23	20	16	24	18	0	79	24	62	68	87	0	28	45
5	132	104	41	72	262	120	47	58	10	39	82	0	21	198	133	84	77	55	35	94	50	69	23
6	69	36	39	0	7	69	35	27	0	45	31	1	18	53	0	64	32	25	35	13	0	44	28
7	36	61	11	88	79	33	112	12	0	81	20	0	29	34	115	45	99	38	32	7	32	48	25
8	22	18	6	0	1	20	10	11	0	165	16	0	25	0	0	14	85	6	17	0	0	39	65
9	66	12	5	47	0	9	24	9	0	6	93	0	172	5	44	15	37	31	12	0	18	47	12
Total	**372**	**372**	**243**	**372**	**371**	**372**	**369**	**371**	**357**	**369**	**367**	**373**	**362**	**372**	**370**	**370**	**373**	**368**	**370**	**372**	**366**	**367**	**373**
LSI	**6.0**	**5.0**	**3.1**	**5.1**	**5.4**	**5.2**	**5.4**	**4.0**	**1.7**	**6.8**	**5.6**	**2.0**	**6.5**	**5.0**	**5.6**	**5.0**	**6.5**	**4.3**	**4.2**	**3.5**	**3.3**	**5.4**	**4.4**
Screening Method	**N**	**A**	**N**	**N**	**N**	**A**	**A**	**N**	**N**	**A**	**N**	**N**	**N/A**	**N/A**	**A**	**N**	**N/A**	**N**	**N**	**A**	**A**	**N**	**N**

(N-Natural; A-Artificial)

Table 3: Promising entries with low susceptibility index (< 4.0) and high PI in NSN-1 to leaf blast disease, *Kharif* 2016

Ent No.	IET No.	Location /score (0-9)																		SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	CBT	GDL	GGT	GNV	IIRR	JDP	KJT	LNV	MLN	MND	NDL	NLR	NVS	PNP	PTB	UMM	USG					
3	24692	3	6	5	5	3	2	4	2	5	3	3	3	4	5	2	3	2	0	**3.3**	**17**	**94**	**11**	**61**
170	24905	3	3	3	5	4	3	2	2	5	1	5	3	6	5	3	2	3	2	**3.3**	**17**	**94**	**12**	**67**
64	24934	5	5	3	4	5	3	2	5	3	-	5	5	4	1	5	1	1	0	**3.4**	**17**	**100**	**8**	**47**
194	24797	3	3	3	7	4	4	3	6	3	1	3	3	4	6	-	1	1	2	**3.4**	**14**	**82**	**11**	**65**
363	Tetep	3	2	3	7	2	1	2	4	2	2	3	3	2	5	3	2	7	8	**3.4**	**15**	**83**	**13**	**72**
41	24982	3	5	3	4	4	4	1	6	4	1	5	1	5	7	4	3	1	1	**3.4**	**16**	**89**	**8**	**44**
334	DHMASQ164-2B (DP)	3	4	3	5	3	4	2	5	3	1	3	3	3	5	9	3	1	3	**3.5**	**17**	**94**	**12**	**67**
1	25113	6	3	3	7	4	2	2	3	3	4	3	7	3	3	5	2	2	1	**3.5**	**15**	**83**	**12**	**67**
60	25358	3	5	3	5	3	4	5	5	5	1	3	1	5	5	4	2	2	3	**3.6**	**18**	**100**	**9**	**50**
4	25103	5	6	5	5	2	2	3	2	3	4	3	5	4	8	1	3	2	1	**3.6**	**16**	**89**	**10**	**56**
289	25618	3	3	3	5	5	3	6	8	3	1	5	1	4	4	3	4	3	0	**3.6**	**16**	**89**	**10**	**56**
142	25278	5	3	3	5	5	1	5	3	2	4	5	5	6	5	3	3	2	0	**3.6**	**17**	**94**	**9**	**50**
2	25121	3	5	5	5	2	3	3	2	6	4	2	3	3	7	3	4	4	1	**3.6**	**16**	**89**	**10**	**56**
82	24983	3	4	3	5	5	3	3	5	3	1	5	3	2	7	7	3	1	2	**3.6**	**16**	**89**	**11**	**61**
162	24904	3	3	3	5	6	3	4	3	4	1	5	3	4	3	6	3	4	2	**3.6**	**16**	**89**	**10**	**56**
84	24956	3	4	3	5	4	3	2	6	5	4	3	3	3	5	7	3	1	2	**3.7**	**16**	**89**	**10**	**56**
216	24331	6	4	3	5	5	3	3	8	3	1	5	7	4	3	1	2	1	2	**3.7**	**15**	**83**	**10**	**56**
160	24919	3	5	3	4	6	4	3	5	5	4	5	3	3	4	5	3	1	1	**3.7**	**17**	**94**	**8**	**44**
297	25515	5	3	3	5	4	5	3	7	2	2	5	5	5	5	1	2	2	3	**3.7**	**17**	**94**	**9**	**50**
329	25484	3	3	3	5	5	3	4	6	6	1	5	1	5	7	1	3	4	2	**3.7**	**15**	**83**	**9**	**50**
361	IR-64 (R check)	5	3	3	5	6	3	3	4	5	1	5	5	7	5	2	2	2	4	**3.9**	**16**	**89**	**8**	**44**
362	Rasi (R check)	9	3	3	5	6	3	4	5	4	9	6	3	7	9	3	3	9	8	**5.5**	**10**	**56**	**6**	**33**
360	HR-12 (S check)	9	8	9	5	9	9	9	7	9	9	7	9	8	7	5	8	8	7	**7.9**	**2**	**11**	**0**	**0**
371	CO 39 (S check)	5	9	9	7	7	7	9	9	9	9	7	9	7	9	4	9	7	5	**7.6**	**3**	**17**	**0**	**0**
LSI		**6.0**	**5.0**	**5.1**	**5.4**	**5.2**	**5.4**	**4.0**	**6.8**	**5.6**	**6.5**	**5.0**	**5.6**	**5.0**	**6.5**	**4.3**	**4.2**	**5.4**	**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 ≤ 5and ≤ 3)**

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

This nursery comprised of 649 test entries drawn from Initial Variety Trials (IVT) with combination of Early Direct Seeded (IVT-E-DS), Rainfed Shallow Lowland (RSL), Semi Deep Water (SDW), Deep Water (DW), Early (E -TP), Irrigated Medium (IM), Late (L), Early (Hills)-E(H), Medium (Hills) - M(H), Upland (Hills) - U(H), Basmati (BT), Aromatic Short Grain (ASG), Aerobic (AEROB), Biofortification (Biofort), Medium Slender (MS), New Plant Type (NPT), Alkaline and Inland Saline Tolerant Variety Trial (AL& ISTVT), Coastal Saline Tolerant Variety Trial (CSTVT) during 2016. They were evaluated at 16 locations along with 14 national, regional, susceptible and resistant checks. The frequency distribution of leaf blast scores and the location severity indices (LSI) are given in the Table 4.

The disease pressure was high (LSI 6-7) at Malan (6.5) and Karjat (6.3). The disease pressure was moderate (LSI 3-6) at Umiam (6.0), IIRR (5.8), Ghaghraghat (5.7), Gangavati (5.6), Pattambi (5.4), Coimbatore (5.3), Lonavala (5.3), Mandya (5.2), Nellore (5.2), Almora (5.1), Ponnampet (4.7) and Jagadalpur (4.1). The selection of promising entries was done based on the data of those locations where LSI was more than 3. Accordingly, the data of location Rewa (3.5) and Cuttack (2.7) were not considered for the selection of resistant entries.

None of the entries were recorded less than 3 but a few promising entries listed in the Table 5 included IET # 26190, 26351, 25935, 26157, 26302, 26194, 26287, 26365, 26325, 26375, 25138 and 26345.

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

The nursery included 72 entries drawn from hill trail including 14 checks. The entries were evaluated at twelve locations along with checks for comparison. The frequency distribution of leaf blast scores and location severity indices (LSI) are given in Table 6. The highest disease pressure was recorded at Imphal (LSI 7.1) and lowest at Khudwani (LSI 1.5) followed by Upper Shillong (LSI 3.1) and Cuttack (LSI 1.2). The disease pressure was high (LSI>5) at Karjat, Lonavala and Ponnampet. It was moderate at Gudalur, Malan, IIRR and Umiam. The disease pressure was very low at Cuttack (1.2), Khudwani (1.5) and Upper Shillong (3.1) and data from these centres were not considered for selection of best entries.

The entries that had shown low disease scores are given in the Table 7. The promising entries that had low disease scores are IET Nos. 25830, 25840, 24229, 25841, 25846, 25144, 25839, 25170, 25835, 24192, 25167 and 25852.

Table 4: Location severity index and frequency distribution of leaf blast scores for NSN-2 entries, *Kharif* 2016

Score	Location/ frequency of score (0-9)															
	ALM	**CBT**	**CTK**	**GGT**	**GNV**	**IIRR**	**JDP**	**KJT**	**LNV**	**MLN**	**MND**	**NLR**	**PNP**	**PTB**	**REW**	**UMM**
0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0
1	5	0	170	0	2	0	2	3	1	88	0	4	30	2	25	26
2	0	1	103	0	11	2	106	4	33	13	0	27	70	10	180	45
3	55	135	20	0	27	67	190	20	197	19	25	85	98	165	66	31
4	0	102	30	43	105	144	150	98	22	38	108	110	126	118	245	61
5	493	105	89	359	181	91	106	98	158	50	297	135	178	39	101	89
6	7	115	32	2	142	64	38	93	52	35	145	145	6	127	38	92
7	91	150	10	255	126	197	34	98	31	70	83	93	81	85	8	109
8	2	53	3	0	52	9	12	231	23	75	2	20	1	27	0	112
9	5	1	0	0	17	87	23	9	131	248	1	33	65	88	0	92
Total	658	662	471	659	663	661	661	654	648	636	661	652	655	661	663	657
LSI	**5.1**	**5.3**	**2.7**	**5.7**	**5.6**	**5.8**	**4.1**	**6.3**	**5.3**	**6.5**	**5.2**	**5.2**	**4.7**	**5.4**	**3.5**	**6.0**
Screening Method	**N**	**A**	**N**	**N**	**A**	**A**	**N**	**A**	**N**	**N/A**	**N/A**	**N**	**N**	**N**	**A**	**N**

(N-Natural; A-Artificial)

Table 5: Promising entries with low susceptibility index (<4.0) and high PI in NSN-2 to leaf blast disease, *Kharif* 2016

Ent.No.	IET NO.	Location/score (0-9)														SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	CBT	GGT	GNV	IIRR	JDP	KJT	LNV	MLN	MND	NLR	PNP	PTB	UMM					
653	Tetep	5	2	5	1	3	2	4	1	1	3	3	2	1	4	**2.6**	**14**	**100**	**10**	**71**
397	26190	3	3	7	2	4	2	4	5	1	4	2	3	3	1	**3.1**	**13**	**93**	**9**	**64**
32	26351	3	3	5	5	3	2	5	5	1	5	3	3	4	3	**3.6**	**14**	**100**	**8**	**57**
244	25935	1	6	4	4	4	3	8	2	1	5	4	4	3	1	**3.6**	**12**	**86**	**6**	**43**
359	26157	1	4	7	6	4	3	5	2	1	5	2	4	3	3	**3.6**	**12**	**86**	**7**	**50**
112	26302	5	3	5	5	3	2	4	6	2	5	4	2	2	3	**3.6**	**13**	**93**	**7**	**50**
402	26194	5	5	7	4	3	3	4	5	1	4	4	1	3	2	**3.6**	**13**	**93**	**6**	**43**
96	26287	5	4	5	5	4	3	5	5	1	4	3	4	3	1	**3.7**	**14**	**100**	**5**	**36**
46	26365	3	3	5	4	4	2	5	2	4	5	6	4	4	1	**3.7**	**13**	**93**	**5**	**36**
134	26325	5	3	7	5	3	2	3	2	4	4	4	4	3	3	**3.7**	**13**	**93**	**7**	**50**
618	26375	5	3	7	4	3	5	4	5	1	4	1	5	3	2	**3.7**	**13**	**93**	**6**	**43**
109	25138	3	3	5	6	5	3	6	3	1	5	4	2	3	3	**3.7**	**12**	**86**	**8**	**57**
25	26345	3	6	7	2	4	3	6	3	1	3	5	1	4	4	**3.7**	**11**	**79**	**7**	**50**
651	IR-64 (R check)	5	3	5	5	7	3	3	5	3	5	7	5	4	2	**4.4**	**12**	**86**	**5**	**36**
652	Rasi (R check)	5	3	5	5	7	4	5	3	8	4	7	9	3	8	**5.4**	**9**	**64**	**3**	**21**
650	HR-12 (S check)	5	8	7	8	9	9	7	9	9	7	8	9	9	9	**8.1**	**1**	**7**	**0**	**0**
661	CO-39 (S check)	7	9	5	7	7	9	7	9	9	7	7	7	9	9	**7.7**	**1**	**7**	**0**	**0**
LSI		**5.1**	**5.3**	**5.7**	**5.6**	**5.8**	**4.1**	**6.3**	**5.3**	**6.5**	**5.2**	**5.2**	**4.7**	**5.4**	**6.0**					

(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 ≤ 5and ≤ 3)**

Table 6: Location severity index and frequency distribution of leaf blast scores for NSN-H entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)											
	ALM	**CTK**	**GDL**	**IMP**	**IIRR**	**KJT**	**KHD**	**LNV**	**MLN**	**PNP**	**UMM**	**USG**
0	1	16	0	0	0	0	10	0	0	0	0	2
1	19	26	0	0	1	0	55	0	16	1	7	22
2	0	2	0	0	2	1	0	3	5	7	19	17
3	19	0	52	1	21	4	14	23	8	11	10	15
4	0	2	0	1	19	25	1	1	12	10	9	17
5	39	1	17	4	16	32	5	33	13	26	20	2
6	4	1	0	12	6	15	0	6	3	0	6	2
7	3	0	12	36	14	6	1	2	2	22	7	1
8	0	1	0	26	1	3	0	1	4	0	5	2
9	0	0	4	6	5	0	0	17	20	9	2	6
Total	85	49	85	86	85	86	86	86	83	86	85	86
LSI	**3.7**	**1.2**	**4.2**	**7.1**	**4.8**	**5**	**1.5**	**5.3**	**4.9**	**5.3**	**4.2**	**3.1**
Screening Method	**N**	**N**	**N**	**N/A**	**A**	**A**	**N**	**N**	**N/A**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Table 7: NSN-H entries with low disease scores (<=5) and high PI to leaf blast, *Kharif* 2016

Ent. No.	IET No.	Location/Score (0-9)								SI	<=5*	PI (<=5)**
		GDL	**IMP**	**IIRR**	**KJT**	**LNV**	**MLN**	**PNP**	**UMM**			
76	Tetep	5	3	**1**	4	2	1	7	2	**3.1**	**7**	**88**
24	25830	3	5	3	5	2	1	5	3	**3.4**	**8**	**100**
35	25840	3	8	4	4	3	1	2	2	**3.4**	**7**	**88**
41	24229	3	5	3	4	5	1	5	2	**3.5**	**8**	**100**
36	25841	3	7	-	5	2	5	2	1	**3.6**	**6**	**86**
11	25144	3	4	7	4	5	1	4	1	**3.6**	**7**	**88**
34	25839	3	7	4	4	3	3	3	2	**3.6**	**7**	**88**
45	25846	3	7	5	4	5	1	3	1	**3.6**	**7**	**88**
43	25170	3	8	2	5	5	1	2	4	**3.8**	**7**	**88**
30	25835	3	8	5	3	3	-	3	2	**3.9**	**6**	**86**
7	24192	3	7	3	4	5	1	4	4	**3.9**	**7**	**88**
23	25167	3	7	4	6	3	3	1	4	**3.9**	**6**	**75**
51	25852	3	7	5	4	5	1	4	2	**3.9**	**7**	**88**
74	IR 64 (R check)	3	7	3	2	5	2	9	5	**4.5**	**6**	**75**
75	Rasi (R check)	3	7	5	4	3	9	5	7	**5.4**	**5**	**63**
73	HR 12 (Scheck)	9	8	9	7	9	9	5	7	**7.9**	**1**	**13**
84	CO 39 (S check)	9	8	7	8	9	9	9	8	**8.4**	**0**	**0**
LSI		**4.2**	**7.1**	**4.8**	**5.0**	**5.3**	**4.9**	**5.3**	**4.2**			

(SI-Susceptibility Index; * No. of locations where the entry has scored ≤ 5; ** Promising index (PI) based on no. of location where the entry has scored ≤ 5)

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

One hundred thirty one hybrids along with 14 checks were evaluated at 18 locations under different ecosystems. The frequency distribution of leaf blast scores and the location severity indices are given in the Table 8. The disease pressure was high at Almora (LSI 6.0). It was moderate (LSI 3-6) at Ponnampet (5.8), IIRR (5.5), Malan (5.5), Gangavati (5.3), Lonavala (5.3), Jagadalpur (5.0), Karjat (4.9), Mandya (4.9), Nellore (4.9), Coimbatore (4.8), Umiam (4.4), Pattambi (4.1) and Rewa (3.8). The data from the locations Upper Shillong (3.4), Khudwani (2.8), Rajendranagar (2.7) and Mugad (1.5) were not considered for selection of best entries. The lines which recorded resistant reaction are listed as promising entries in the Table 9 included IET # 25743, 25738, 25748, 25741, 25739, 25750 and 25753.

Table 8: Location severity index and frequency distribution of leaf blast scores for NHSN entries, *Kharif* 2016

Score	Location/frequency of score (0-9)																	
	ALM	**CBT**	**GNV**	**IIRR**	**JDP**	**KHD**	**KJT**	**LNV**	**MGD**	**MLN**	**MND**	**NLR**	**PNP**	**PTB**	**REW**	**RNR**	**UMM**	**USG**
0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	3	0	1
1	0	0	0	1	0	33	0	1	58	18	0	0	1	3	6	61	19	26
2	0	3	6	0	4	0	12	5	59	7	1	9	1	14	33	0	23	42
3	34	42	7	24	19	94	12	34	11	11	11	22	10	52	11	46	15	21
4	0	23	25	20	35	0	23	10	0	18	48	31	18	29	50	0	18	23
5	42	29	44	43	44	17	50	52	0	20	51	36	55	20	30	23	23	1
6	13	17	32	7	19	0	24	5	1	12	13	22	0	12	14	0	10	12
7	8	20	21	30	14	0	22	1	0	12	20	16	43	8	1	9	25	3
8	11	10	9	0	6	0	1	7	1	6	1	3	0	3	0	0	8	16
9	37	1	1	19	4	0	0	27	0	37	0	5	17	4	0	1	4	0
Total	145	145	145	144	145	144	144	142	145	141	145	144	145	145	145	143	145	145
LSI	**6.0**	**4.8**	**5.3**	**5.5**	**5.0**	**2.8**	**4.9**	**5.3**	**1.5**	**5.5**	**4.9**	**4.9**	**5.8**	**4.1**	**3.8**	**2.7**	**4.4**	**3.4**
Screening Method	**N**	**A**	**A**	**A**	**N**	**N**	**A**	**N**	**N**	**N/A**	**N/A**	**N**	**N**	**N**	**A**	**A**	**N**	**N**

(N-Natural; A-Artificial)

➢ **Donor Screening Nursery (DSN)**

The nursery comprised of 109 entries originating from different centres was evaluated at 20 locations. The frequency distribution of disease scores and LSI are presented in Table 10. The highest disease pressure was recorded at IIRR with LSI 7.1 and lowest at Rewa with LSI 2.5. The disease pressure was high at Lonavala (6.8), Ponnampet (6.6) and Cuttack (6.4). It was moderate (LSI 3-6) at Ghaghraghat (5.9), Malan (5.6), Nellore (5.5), Karjat (5.3), Umiam (5.1), Pattambi (5.1), Coimbatore (5.0), Imphal (5.0), Gangavati (5.0), Jagadalpur (4.8), Mandya (4.7), Upper Shillong (4.5), Almora (4.2) and Rajendranagar (3.5). It was too low at Mugad (2.6), Rewa (2.5) and Rajendranagar (3.5) to evaluate the performance of the entries.

The promising entries that scored low disease are RP-Bio-Patho-2, VL-32197, VL-31743, VL-31430, VL-31997, RP-Bio-Patho-4, CB 14740 and VL-31802 (Table 11).

Table 9: Promising entries with low susceptibility index (< 4.0) and high PI in NHSN to leaf blast disease, *Kharif* 2016

Ent. No.	IET No.	Location/ score (0-9)													SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	CBT	GNV	IIRR	JDP	KJT	LNV	MLN	MND	NLR	PNP	PTB	UMM					
42	25743	3	4	3	3	3	2	5	1	4	2	1	3	1	**2.7**	**13**	**100**	**10**	**77**
135	Tetep	5	2	2	1	3	3	1	2	2	4	4	2	5	**2.8**	**13**	**100**	**9**	**69**
36	25738	3	2	4	5	2	2	5	1	4	4	5	4	1	**3.2**	**13**	**100**	**6**	**46**
47	25748	3	3	4	5	2	2	5	1	5	3	3	2	4	**3.2**	**13**	**100**	**8**	**62**
40	25741	5	4	2	3	2	4	5	2	3	3	5	3	2	**3.3**	**13**	**100**	**8**	**62**
38	25739	5	3	5	3	3	2	5	1	4	4	4	3	2	**3.4**	**13**	**100**	**7**	**54**
49	25750	3	3	5	3	4	5	5	3	4	5	4	3	1	**3.7**	**13**	**100**	**6**	**46**
53	25753	3	5	5	4	4	3	5	1	4	5	3	3	3	**3.7**	**13**	**100**	**6**	**46**
34	25736	3	5	6	3	3	5	3	1	5	4	5	3	2	**3.7**	**12**	**92**	**7**	**54**
133	IR-64 (R check)	7	3	6	3	3	2	5	1	6	7	5	3	4	**4.2**	**9**	**69**	**6**	**46**
134	Rasi (R check)	9	3	6	3	4	3	4	7	5	6	9	3	9	**5.5**	**7**	**54**	**4**	**31**
132	HR-12 (S check)	9	8	8	9	9	7	9	9	7	7	9	9	7	**8.2**	**0**	**0**	**0**	**0**
143	CO-39 (S check)	5	9	7	7	9	7	9	9	7	7	9	9	8	**7.8**	**1**	**8**	**0**	**0**
LSI		**6.0**	**4.8**	**5.3**	**5.5**	**5.0**	**4.9**	**5.3**	**5.5**	**4.9**	**4.9**	**5.8**	**4.1**	**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 ≤ 5and ≤ 3)**

Table 10: Location severity index and frequency distribution of leaf blast scores for DSN entries, *Kharif* 2016

Score	Location/frequency of score (0-9)																		
	ALM	**CBT**	**CTK**	**GGT**	**GNV**	**IIRR**	**IMP**	**JDP**	**KJT**	**LNV**	**MGD**	**MLN**	**MND**	**NLR**	**PNP**	**PTB**	**REW**	**RNR**	**UMM**	**USG**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4	0	1
1	14	0	0	0	0	0	0	0	2	1	17	27	0	0	0	0	24	30	16	0
2	0	2	0	0	8	0	4	12	1	1	46	5	1	0	1	4	27	0	9	16
3	20	35	8	0	11	7	28	22	8	20	22	5	26	8	6	26	38	37	6	18
4	0	13	0	6	27	9	14	19	32	2	15	8	28	18	10	26	1	0	9	34
5	65	17	31	49	25	9	21	16	23	14	4	3	29	37	22	3	9	16	17	4
6	6	15	0	0	18	13	14	14	13	5	5	3	6	26	0	16	0	0	9	19
7	4	13	51	53	10	16	20	18	11	7	0	4	18	9	39	11	4	10	17	5
8	0	13	0	0	8	4	7	4	19	8	0	18	1	2	0	10	0	0	11	9
9	0	1	16	0	2	49	1	4	0	51	0	36	0	9	31	9	0	8	15	3
Total	109	109	106	108	109	107	109	109	109	109	109	109	109	109	109	105	109	105	109	109
LSI	**4.2**	**5.0**	**6.4**	**5.9**	**5.0**	**7.1**	**5.0**	**4.8**	**5.3**	**6.8**	**2.6**	**5.6**	**4.7**	**5.5**	**6.6**	**5.1**	**2.5**	**3.5**	**5.2**	**4.5**
Screening Method	**N**	**A**	**N**	**N**	**A**	**A**	**N/A**	**N**	**A**	**N**	**N**	**N/A**	**N/A**	**N**	**N**	**N**	**A**	**A**	**N**	**N**

(N-Natural; A-Artificial)

Table 11: Promising entries with low susceptibility index (< 4.0) and high PI in DSN to leaf blast disease, *Kharif* 2016

Ent. No	Designation	Location/score (0-9)																	SI	<=5*	PI (<=5)**	<=3*	PI <=3)**
		ALM	CBT	CTK	GGT	GNV	IIRR	IMP	JDP	KJT	LNV	MLN	MND	NLR	PNP	PTB	UMM	USG					
106	Tetep	1	2	5	5	2	5	2	3	4	1	1	3	4	7	3	3	4	**3.2**	**16**	**94**	**10**	**59**
97	RP-Bio-Patho-2	1	3	5	4	4	9	4	2	4	3	1	3	3	3	3	1	3	**3.3**	**16**	**94**	**11**	**65**
70	Tetep	5	2	5	7	2	5	2	3	4	2	1	2	4	5	2	4	2	**3.4**	**16**	**94**	**9**	**53**
14	VL-32197	5	5	3	5	3	4	3	2	4	3	1	3	6	5	3	1	2	**3.4**	**16**	**94**	**10**	**59**
7	VL-31743	3	3	7	5	4	4	3	3	5	3	1	4	5	5	3	1	2	**3.6**	**16**	**94**	**9**	**53**
3	VL-31430	1	3	7	5	4	3	3	3	6	3	1	3	5	7	4	1	2	**3.6**	**14**	**82**	**10**	**59**
13	VL-31997	1	4	5	5	5	4	6	4	5	3	1	4	5	5	2	1	2	**3.6**	**16**	**94**	**6**	**35**
99	RP-Bio-Patho-4	3	3	5	5	4	5	4	2	3	7	2	4	4	4	3	2	3	**3.7**	**16**	**94**	**8**	**47**
47	CB 14740	5	3	5	7	2	7	3	2	4	5	1	3	5	3	3	1	4	**3.7**	**15**	**88**	**9**	**53**
8	VL-31802	1	3	9	5	3	4	3	4	6	3	1	4	4	7	3	1	2	**3.7**	**14**	**82**	**9**	**53**
68	IR-64 (R check)	3	3	7	5	6	6	7	3	4	5	1	5	6	5	3	1	4	**4.4**	**12**	**71**	**6**	**35**
69	Rasi (R check)	5	3	3	5	5	9	3	4	4	5	8	7	6	7	4	9	8	**5.6**	**10**	**59**	**3**	**18**
67	HR-12 (S check)	7	9	9	7	9	-	8	9	6	9	9	8	9	9	9	9	5	**8.2**	**1**	**6**	**0**	**0**
78	CO -39 (S check)	7	8	7	7	8	9	9	9	7	9	9	7	6	9	9	9	4	**7.8**	**1**	**6**	**0**	**0**
LSI		**4.2**	**5.0**	**6.4**	**5.9**	**5.0**	**7.1**	**5.0**	**4.8**	**5.3**	**6.8**	**5.6**	**4.7**	**5.5**	**6.6**	**5.1**	**5.2**	**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 ≤ 5and ≤ 3)**

❖ NECK BLAST

➢ NSN-1

The nursery was evaluated for neck blast disease at eight locations. Neck blast disease was observed naturally in all these locations. The disease pressure was very high at Lonavala with LSI of 7.4 and low at Mugad with LSI of 2.3. The disease pressure was moderate to high (LSI 3 - 6) at Rajendranagar (6.1), Malan (5.5), Mandya (5.5), Nellore (4.8) and Ponnampet (3.9). The disease pressure was very low at Mugad (2.3) and Jagadalpur (2.6). Therefore, the data from these two centres were not considered for selecting the best entries. The frequency distribution of neck blast scores are presented in the Table 12 along with location severity indices. A few promising entries that scored less disease across the locations included IET # 24471, 24496, 24518, 25038, 24495, 24519, 23934, 23906, 23895, 25241, 25278, 25521, 23930, 24505 and 25329 are presented in Table 13.

➢ NSN-2

The entries were evaluated at five locations under natural disease condition. The disease pressure was very high at Lonavala and Malan with LSI of 7.5 and 7.1 respectively. Moderate disease pressure was observed at Mandya (5.4) and Ponnampet (LSI 4.1) and low disease at Jagadalpur (LSI 2.3). The frequency distribution of disease scores and the respective location severity indices are given in the Table 14.

A few promising entries that scored low disease scores across the locations included IET # 25186, 25175, 25219, 25889, 25860, 26238, 25223, 25894, 25917, 25859, 25888, 26071, 25927, 25031, 25040, 25951, 25999, 25256, 26212 and 25921 (Table 15).

➢ NSN-H

The nursery included 86 entries evaluated at six locations along with checks for comparison. The disease pressure was very high at Lonavala with LSI of 7.9. It was moderate at Almora (5.1), Malan (5.1), Imphal (5.0) and Ponnampet (4.5). It was very low at Khudwani (1.0), therefore the data from this centre was not considered. The frequency distribution of disease scores along with location severity indices are presented in the Table 16.

The entries that had shown low disease scores are given in the Table 17. The promising entries that had low disease score at the five test locations are IET Nos. 25840, 25845, 25813, 25826, 24188, 24183, 24166, 25167, 25841 and 25844.

➢ NHSN

The nursery was evaluated at seven locations with 145 entries. Very high disease pressure was recorded at Rajendranagar (LSI 7.7), Lonavala (LSI 7.4) and Mandya (LSI 6.8). It was moderate (LSI 3-6) at Malan (LSI 5.9), Almora (4.8), Mugad (4.3) and Jagadalpur (LSI 3.4). The frequency distribution of disease scores are presented in the Table 18. A few promising entries that recorded less disease across the locations are listed in the Table 19 included IET # 25802 and 25790.

Table 12: Location severity index and frequency distribution of neck blast scores for NSN- 1 entries, *Kharif* 2016

Score	Location/frequency of score (0-9)							
	JDP	**LNV**	**MGD**	**MLN**	**MND**	**NLR**	**PNP**	**RNR**
0	102	0	13	0	0	0	19	39
1	63	0	103	23	18	9	40	2
2	0	0	135	0	0	0	0	0
3	86	5	53	14	120	56	143	19
4	0	0	52	0	0	0	0	0
5	96	60	9	32	66	266	106	76
6	0	0	4	0	0	0	0	0
7	23	149	1	35	85	38	54	146
8	0	0	3	0	0	0	0	0
9	0	131	0	31	83	1	9	86
Total	**370**	**345**	**373**	**135**	**372**	**370**	**371**	**368**
LSI	**2.6**	**7.4**	**2.3**	**5.5**	**5.5**	**4.8**	**3.9**	**6.1**
Screening Method	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Table 13: NSN-1 entries with high promising index to neck blast disease, *Kharif* 2016

Ent. No.	IET No.		Location/score (0-9)				SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		LNV	MLN	MND	NLR	RNR					
14	24471	5	-	1	3	0	**2.3**	**4**	**100**	**3**	**75**
363	Tetep	3	-	3	3	0	**2.3**	**4**	**100**	**4**	**100**
22	24496	7	-	1	1	0	**2.3**	**3**	**75**	**3**	**75**
23	24518	7	-	1	1	0	**2.3**	**3**	**75**	**3**	**75**
359	MTU 1064	-	-	5	3	0	**2.7**	**3**	**100**	**2**	**67**
16	25038	5	-	1	5	0	**2.8**	**4**	**100**	**2**	**50**
18	24495	5	-	1	5	0	**2.8**	**4**	**100**	**2**	**50**
20	24519	5	-	1	5	0	**2.8**	**4**	**100**	**2**	**50**
24	23934	5	-	1	5	0	**2.8**	**4**	**100**	**2**	**50**
25	23906	5	-	3	3	0	**2.8**	**4**	**100**	**3**	**75**
26	23895	5	-	1	5	0	**2.8**	**4**	**100**	**2**	**50**
120	25241	5	-	3	3	0	**2.8**	**4**	**100**	**3**	**75**
142	25278	5	-	3	3	0	**2.8**	**4**	**100**	**3**	**75**
323	25521	5	-	3	3	0	**2.8**	**4**	**100**	**3**	**75**
10	23930	7	-	3	1	0	**2.8**	**3**	**75**	**3**	**75**

Ent. No.	IET No.		Location/score (0-9)				SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		LNV	MLN	MND	NLR	RNR					
19	24505	9	-	1	1	0	**2.8**	**3**	**75**	**3**	**75**
45	25329	7	-	1	3	0	**2.8**	**3**	**75**	**3**	**75**
107	25071	-	-	-	-	3	**3.0**	**1**	**100**	**1**	**100**
361	IR-64 (R check)	7	1	9	5	0	**4.4**	**3**	**60**	**2**	**40**
362	Rasi 64 (R check)	5	7	7	1	0	**4.0**	**3**	**60**	**2**	**40**
360	HR-12 (S check)	7	-	9	5	7	**7.0**	**1**	**25**	**0**	**0**
371	CO-39 (S check)	9	9	9	3	-	**7.5**	**1**	**25**	**1**	**25**
LSI		**7.4**	**5.5**	**5.5**	**4.8**	**6.1**					

(SI-Susceptibility Index;*No. of locations where the entry has scored ≤ 5 and ≤ 3;Promising index (PI) based on no. of locations where the entry had scored ≤ 5and ≤ 3)**

Table 14: Location severity index and frequency distribution of neck blast scores for NSN-2 entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)				
	JDP	LNV	MLN	MND	PNP
0	151	0	0	0	32
1	161	0	2	47	71
2	0	0	0	1	0
3	193	6	0	209	212
4	0	0	0	0	0
5	147	87	19	117	210
6	0	0	0	0	0
7	9	278	24	135	117
8	0	0	0	0	0
9	0	267	30	152	14
Total	661	638	75	661	656
LSI	**2.3**	**7.5**	**7.1**	**5.4**	**4.1**
Screening Method	**N**	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Table 15: NSN-2 entries with high promising index to neck blast disease, *Kharif* 2016

Ent. No.	IET No.	Location/ score(0-9)			SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		LNV	MND	PNP					
7	25186	5	1	0	**2.0**	**3**	**100**	**2**	**67**
57	25175	5	1	0	**2.0**	**3**	**100**	**2**	**67**
61	25219	5	1	0	**2.0**	**3**	**100**	**2**	**67**
149	25889	5	1	0	**2.0**	**3**	**100**	**2**	**67**
62	25860	5	3	0	**2.7**	**3**	**100**	**2**	**67**
542	26238	5	3	0	**2.7**	**3**	**100**	**2**	**67**
64	25223	7	1	0	**2.7**	**2**	**67**	**2**	**67**
154	25894	7	1	0	**2.7**	**2**	**67**	**2**	**67**
177	25917	7	1	0	**2.7**	**2**	**67**	**2**	**67**
60	25859	5	1	3	**3.0**	**3**	**100**	**2**	**67**
76	25872	-	3	3	**3.0**	**2**	**100**	**2**	**100**
148	25888	5	3	1	**3.0**	**3**	**100**	**2**	**67**
181	26045	-	3	3	**3.0**	**2**	**100**	**2**	**100**
207	26071	5	3	1	**3.0**	**3**	**100**	**2**	**67**
228	26149	-	3	3	**3.0**	**2**	**100**	**2**	**100**
236	25927	5	3	1	**3.0**	**3**	**100**	**2**	**67**
251	25031	5	1	3	**3.0**	**3**	**100**	**2**	**67**
256	25040	5	1	3	**3.0**	**3**	**100**	**2**	**67**
267	25951	5	3	1	**3.0**	**3**	**100**	**2**	**67**
304	25999	5	3	1	**3.0**	**3**	**100**	**2**	**67**
318	25256	5	3	1	**3.0**	**3**	**100**	**2**	**67**
507	26212	5	3	1	**3.0**	**3**	**100**	**2**	**67**
514	25921	5	3	1	**3.0**	**3**	**100**	**2**	**67**
653	Tetep	3	3	3	**3.0**	**3**	**100**	**3**	**100**
663	Swarnadhan	5	3	1	**3.0**	**3**	**100**	**2**	**67**
155	25895	7	1	1	**3.0**	**2**	**67**	**2**	**67**
172	25912	7	1	1	**3.0**	**2**	**67**	**2**	**67**
178	25918	7	1	1	**3.0**	**2**	**67**	**2**	**67**
651	IR-64 (R check)	9	7	3	**6.3**	**1**	**33**	**1**	**33**
652	Rasi (R check)	5	7	9	**7.0**	**1**	**25**	**0**	**0**
650	HR-12 (S check)	9	7	3	**6.3**	**1**	**33**	**1**	**33**
661	CO-39 (S check)	9	9	1	**7.0**	**1**	**25**	**1**	**25**
LSI		**7.5**	**5.4**	**4.1**					

(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 ≤ 5and ≤ 3)**

Table 16: Location severity index and frequency distribution of neck blast scores for NSN-H entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)					
	ALM	**KHD**	**LNV**	**MLN**	**IMP**	**PNP**
0	0	24	0	0	0	3
1	1	31	0	17	1	1
2	0	0	0	0	0	0
3	27	11	1	11	28	40
4	0	0	0	0	0	0
5	26	0	8	18	30	23
6	0	0	0	0	0	0
7	30	0	26	11	25	9
8	0	0	0	0	0	0
9	1	0	50	19	2	10
Total	**85**	**66**	**85**	**76**	**86**	**86**
LSI	**5.1**	**1.0**	**7.9**	**5.1**	**5.0**	**4.5**
Screening Method	**N**	**N**	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Table 17: NSN-H entries with low susceptibility index to neck blast disease, *Kharif* 2016

Ent No.	IET No.	Location/Score (0-9)					SI	<=5*	PI**
		ALM	**LNV**	**MLN**	**IMP**	**PNP**			
76	Tetep	3	3	1	3	3	**2.6**	**5**	**100**
35	25840	3	5	1	5	3	**3.4**	**5**	**100**
40	25845	3	7	1	3	3	**3.4**	**4**	**80**
54	25813	3	5	-	3	3	**3.5**	**4**	**100**
69	25826	3	7	-	3	1	**3.5**	**3**	**75**
4	24188	3	9	1	5	0	**3.6**	**4**	**80**
2	24183	3	7	1	5	3	**3.8**	**4**	**80**
20	25166	1	7	1	5	5	**3.8**	**4**	**80**
23	25167	5	7	1	3	3	**3.8**	**4**	**80**
36	25841	3	7	3	3	3	**3.8**	**4**	**80**
39	25844	3	9	1	3	3	**3.8**	**4**	**80**
74	IR 64 (R check)	7	9	1	5	3	**5**	**3**	**60**
75	Rasi (R check)	7	5	9	5	7	**6.6**	**2**	**40**
73	HR 12 (S check)	-	9	-	7	7	**7.7**	**0**	**0**
84	CO 39 (S check)	5	9	9	3	9	**7.0**	**2**	**40**
LSI		**5.1**	**7.9**	**5.1**	**5.0**	**4.5**			

(SI-Susceptibility Index; * No. of locations where the entry has scored ≤ 5; ** Promising index (PI) based on no. of location where the entry has scored ≤ 5)

Table 18: Location severity index and frequency distribution of neck blast scores for NHSN entries, *Kharif* 2016

Score	Location/frequency of score (0-9)						
	ALM	**JDP**	**LNV**	**MGD**	**MLN**	**MND**	**RNR**
0	0	3	0	0	0	0	4
1	0	25	0	2	12	5	0
2	0	0	0	23	0	0	0
3	60	63	1	29	8	18	0
4	0	1	0	42	0	0	0
5	38	50	23	5	15	26	1
6	0	1	0	22	0	0	0
7	44	2	67	11	36	34	75
8	0	0	0	11	0	0	0
9	0	0	54	0	19	62	63
Total	**142**	**145**	**145**	**145**	**90**	**145**	**143**
LSI	**4.8**	**3.4**	**7.4**	**4.3**	**5.9**	**6.8**	**7.7**
Screening Method	**N**	**N**	**N**	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Table 19: NHSN entries with low susceptibility index to neck blast disease, *Kharif* 2016

Ent. No.	IET NO.	Location/score (0-9)						SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	**LNV**	**MGD**	**MLN**	**MND**	**RNR**					
135	Tetep	3	3	3	-	3	0	**2.4**	**5**	**100**	**5**	**100**
115	25802	3	5	2	-	1	7	**3.6**	**4**	**80**	**3**	**60**
94	25790	3	5	3	-	1	7	**3.8**	**4**	**80**	**3**	**60**
145	Swarnadhan	-	5	8	-	3	0	**4.0**	**3**	**75**	**2**	**50**
133	IR-64 (R check)	5	9	7	-	9	0	**6.0**	**2**	**40**	**1**	**20**
134	Rasi (R check)	7	5	4	9	7	-	**6.4**	**2**	**40**	**0**	**0**
132	HR-12 (S check)	-	9	4	-	9	-	**7.3**	**1**	**33**	**0**	**0**
143	CO-39 (S check)	7	9	2	7	9	7	**6.8**	**1**	**17**	**1**	**17**
LSI		**4.8**	**7.4**	**4.3**	**5.9**	**6.8**	**7.7**					

(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 ≤ 5and ≤ 3)**

➢ **DSN**

The nursery was evaluated at eight locations with 109 entries. The disease pressure was very high at Lonavala (LSI 7.8). The disease pressure was high at Rajendranagar (6.8), Malan (6.1), Mandya (6.0); moderate at Almora (5.7) and Imphal (4.2). The data from Jagadalpur (2.9) and Mugad (3.0) were not considered for selecting best entries as their LSI was low. The frequency distribution of disease scores are presented in the Table 20.

A few promising entries that recorded less disease across the locations are listed in the Table 21 which includes RP-Patho-6, RBF-TC-2, RP-Patho-8 and RBF-TC-1.

Table 20: Location severity index and frequency distribution of neck blast scores for DSN entries, *Kharif* 2016

Score	Location/frequency of score (0-9)							
	ALM	**IMP**	**JDP**	**LNV**	**MGD**	**MLN**	**MND**	**RNR**
0	0	0	16	0	0	0	0	6
1	0	6	19	0	9	6	6	0
2	0	0	0	0	45	0	0	0
3	10	49	36	2	19	6	23	6
4	0	0	0	0	27	0	0	0
5	34	40	38	11	1	5	26	12
6	0	0	0	0	5	0	0	0
7	28	11	0	40	0	8	17	52
8	0	0	0	0	3	0	0	0
9	5	3	0	56	0	17	37	32
Total	**77**	**109**	**109**	**109**	**109**	**42**	**109**	**108**
LSI	**5.7**	**4.2**	**2.9**	**7.8**	**3.0**	**6.1**	**6.0**	**6.8**
Screening Method	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Table 21: DSN entries with low susceptibility index and high PI to neck blast, *Kharif* 2016

Ent. No	Designation	Location/score (0-9)						SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	**IMP**	**LNV**	**MLN**	**MND**	**RNR**					
70	Tetep	-	3	3	-	1	3	**2.5**	**4**	**100**	**4**	**100**
89	RP-Patho-6	-	5	5	-	3	0	**3.3**	**4**	**100**	**2**	**50**
109	RBF-TC-2	-	3	5	-	5	0	**3.3**	**4**	**100**	**2**	**50**
91	RP-Patho-8	3	3	7	-	1	5	**3.8**	**4**	**80**	**3**	**60**
80	Swarnadhan	-	3	5	-	3	5	**4.0**	**4**	**100**	**2**	**50**
108	RBF-TC-1	5	5	7	-	3	0	**4.0**	**4**	**80**	**2**	**40**

Ent. No	Designation	Location/score (0-9)						SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	IMP	LNV	MLN	MND	RNR					
68	IR-64 (R check)	5	7	7	-	9	3	**6.2**	**2**	**40**	**1**	**20**
69	Rasi (R check)	7	3	7	7	9	3	**6.0**	**2**	**33**	**2**	**33**
67	HR-12 (S check)	7	7	9	-	9	9	**8.2**	**0**	**0**	**0**	**0**
78	CO-39 (S check)	5	9	9	9	9	7	**8.0**	**1**	**17**	**0**	**0**
LSI		**5.7**	**4.2**	**7.8**	**6.1**	**6.0**	**6.8**					

(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 ≤ 5and ≤ 3)**

❖ SHEATH BLIGHT

➢ NSN-1

The National Screening Nursery-1 (NSN-1) was evaluated for resistance to sheath blight at 23 locations across India. The entries were screened by artificial inoculation at most of the centres except at Arundhutinagar, Bankura, Khudwani and Patna where the entries were evaluated under natural condition. The highest disease pressure was recorded at Aduthurai (8.4) and New Delhi (8.4) through artificial inoculation and lowest at Bankura (0.1) by natural incidence. The frequency distribution of disease scores and location severity indices (LSI) were presented in Table 22. The disease pressure was very high (LSI >7) at Aduthurai (8.4), New Delhi (8.4), Ludhiana (8.2), Pattambi (8.2), Chakdha (7.9), Gangavati (7.8), IIRR (7.5), Cuttack (7.4) and Mandya (7.2); high (LSI 6 - 7) at Maruteru (6.6); Chinsurah (6.5), Masodha (6.3), Raipur (6.2) and Moncompu (6.1) and moderate (LSI 3-6) at Pant Nagar (5.6), Titabar (4.6), Chiplima (4.7) and Patna (4.5) and very less (LSI <3) at Arundhatinagar (1.7), Khudwani (1.0) and Bankura (0.1) where natural screening was practiced.

The selection of promising entries in NSN-1 was done based on the reaction at those locations where LSI was ≥4.0. Some of the promising entries with SI ≤ 5.4 are presented in the Table 23. None of the entries were resistant (SI≤3.0) against sheath blight. Some of the highly promising entries found better than tolerant check (Tetep) were IET Nos. 24474 and 25501. Some of the other promising entries better than Swarnadhan (tolerant) are IET Nos. 25086, 24505 and 25487.

Table 22: Location severity index (LSI) and frequency distribution of sheath blight disease scores for NSN-1 entries, *Kharif* 2016

Score	Locations/ Frequency of score (0-9)																				
	ADT	**ARD**	**BNK**	**CHN**	**CHP**	**CKD**	**CTK**	**GNV**	**IIRR**	**KHD**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NDL**	**PNT**	**PTB**	**PTN**	**RPR**	**TTB**
0	0	0	346	0	0	0	0	0	0	13	0	2	0	0	0	0	0	0	0	0	16
1	2	97	0	0	32	0	0	0	0	336	0	15	0	0	0	0	1	0	26	0	44
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	17	33	14	18	129	0	26	10	2	7	0	36	11	23	1	0	31	3	112	18	70
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	19	7	0	126	95	0	39	58	65	0	5	87	72	147	109	4	201	18	158	149	129
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	10	0	0	164	95	202	134	81	150	0	129	181	159	134	215	94	133	99	77	163	78
8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
9	317	0	0	64	18	168	162	221	154	0	234	51	130	64	47	231	6	251	0	43	26
Total	**365**	**137**	**360**	**372**	**369**	**370**	**361**	**370**	**372**	**356**	**368**	**372**	**372**	**368**	**372**	**329**	**372**	**371**	**373**	**373**	**363**
LSI	**8.4**	**1.7**	**0.1**	**6.5**	**4.7**	**7.9**	**7.4**	**7.8**	**7.5**	**1.0**	**8.2**	**6.1**	**7.2**	**6.3**	**6.6**	**8.4**	**5.6**	**8.2**	**4.5**	**6.2**	**4.6**
Screening Method	**A**	**N**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**

(N-Natural ; A-Artificial)

Table 23: Promising entries with low susceptibility index (SI≤5) and high promising index in NSN-1 to sheath blight disease, *Kharif* 2016

Ent. No.	IET NO.	Locations/Score (0-9)																		SI	<=3	P I(<=3)*	<=5	PI(<=5)**
		ADT	CHN	CHP	CKD	CTK	GNV	IIRR	LDN	MNC	MND	MSD	MTU	NDL	PNT	PTB	PTN	RPR	TTB					
337	Tetep (DP)	3	3	5	7	5	7	7	7	3	5	5	7	7	3	5	1	5	5	**5.0**	**5**	**27.8**	**12**	**66.7**
13	24474	7	3	1	7	7	7	7	7	3	5	5	5	9	5	3	5	5	3	**5.2**	**5**	**27.8**	**11**	**61.1**
300	25501	1	3	5	7	9	5	5	7	3	9	3	5	9	5	7	5	7	1	**5.3**	**5**	**27.8**	**11**	**61.1**
363	Tetep (T)	9	3	7	7	3	5	5	7	5	3	5	5	7	3	7	3	7	5	**5.3**	**5**	**27.8**	**11**	**61.1**
355	Ranjit (RP)	3	5	1	-	9	5	7	7	1	5	5	7	9	7	7	3	7	3	**5.4**	**5**	**29.4**	**9**	**52.9**
104	25086	9	5	3	7	9	5	9	7	5	5	3	5	7	3	5	3	7	0	**5.4**	**5**	**27.8**	**11**	**61.1**
19	24505	9	7	3	7	3	5	5	7	1	5	7	5	9	5	7	5	5	3	**5.4**	**4**	**22.2**	**11**	**61.1**
305	25487	5	7	3	9	9	5	7	7	1	5	3	7	5	7	5	5	5	3	**5.4**	**4**	**22.2**	**11**	**61.1**
345	IR 81896-13-13-195 (DP)	1	7	3	7	7	5	9	7	3	5	5	5	7	5	7	5	5	5	**5.4**	**3**	**16.7**	**11**	**61.1**
301	24990	3	5	3	7	3	3	7	9	5	7	7	7	7	5	9	3	5	3	**5.4**	**6**	**33.3**	**10**	**55.6**
373	Swarnadhan (T)	7	5	3	7	5	5	5	9	7	7	5	5	9	5	7	5	9	7	**6.2**	**1**	**5.6**	**9**	**50.0**
365	TN1 (S)	9	9	5	9	7	9	9	7	7	9	7	9	9	7	9	5	7	7	**7.8**	**0**	**0.0**	**2**	**11.1**
LSI		**8.4**	**6.5**	**4.7**	**7.9**	**7.4**	**7.8**	**7.5**	**8.2**	**6.1**	**7.2**	**6.3**	**6.6**	**8.4**	**5.6**	**8.2**	**4.5**	**6.2**	**4.6**					

(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) was evaluated for their resistance to sheath blight at 14 hot spot locations. The entries were screened by artificial inoculation at most of the centres except at Arundhutinagar and Patna where the entries were evaluated under natural conditions. The frequency distribution of disease scores and location severity index (LSI) are presented in Table 24. The disease pressure was very high (LSI >7) at Pattambi (8.5), Gangavati (8.0), Aduthurai (8.0), Ludhiana (7.5), Mandya (7.1), IIRR (7.1); high (LSI 6 - 7) at Maruteru (6.6), Raipur (6.5), Masodha (6.5) and Moncompu (6.0); moderate (LSI 3-6) at Pantnagar (5.5), Patna (4.5), Titabar (3.5); and very less (LSI <3) at Arundhutinagar (1.4).

Table 24: Location severity index and frequency distribution of sheath blight disease scores for NSN-2 entries, *Kharif* 2016

Score	Location/ Frequency of score (0-9)													
	ADT	**ARD**	**GNV**	**IIRR**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**PNT**	**PTB**	**PTN**	**RPR**	**TTB**
0	7	207	0	0	0	7	0	0	0	2	0	0	0	38
1	1	243	0	0	0	27	0	0	0	1	0	17	0	122
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	47	169	10	0	2	79	6	14	7	44	3	252	39	244
4	0	0	0	0	0	0	0	0	0	0	0	0	2	0
5	57	36	92	153	12	147	127	237	207	398	21	283	171	151
6	0	0	0	1	0	0	0	0	0	0	0	0	0	0
7	43	1	125	318	466	332	340	298	323	205	107	111	347	60
8	0	0	0	1	0	0	0	0	0	0	0	0	0	0
9	485	0	434	187	169	68	188	100	101	9	527	0	100	27
Total	**640**	**656**	**661**	**660**	**649**	**660**	**661**	**649**	**638**	**659**	**658**	**663**	**659**	**642**
LSI	**8.0**	**1.4**	**8.0**	**7.1**	**7.5**	**6.0**	**7.1**	**6.5**	**6.6**	**5.5**	**8.5**	**4.5**	**6.5**	**3.5**
Screening Method	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**

(N- Natural; A- Artificial)

The selection of promising entries in NSN-2 was done based on the reaction at those locations where LSI was ≤ 4.0. Some of the promising entries with SI ≤ 5.1 are presented in the Table 25. None of the entries were resistant (SI≤ 3.0) against sheath blight. Some of the highly promising entries found better than Tetep (tolerant) were IET Nos. 25897, 25211, 25900, 26374, 25877, 25196, 26326 and 25889.

Table 25: Promising entries with low susceptibility index (SI≤ 4.4) and high promising index in NSN-2 to sheath blight disease, *Kharif* 2016

Ent. No.	IET NO.	Location/Score (0-9)												SI	<=3	PI (<=3)*	<=5	PI (<=5)**
		ADT	GNV	IIRR	LDN	MNC	MND	MSD	MTU	PNT	PTB	PTN	RPR					
157	25897	0	5	5	7	1	5	5	7	3	5	3	7	**4.4**	**4**	**33.3**	**9**	**75.0**
9	25211	3	3	5	7	3	9	5	3	5	3	3	7	**4.7**	**6**	**50.0**	**9**	**75.0**
160	25900	3	5	5	7	1	5	5	5	5	9	3	5	**4.8**	**3**	**25.0**	**10**	**83.3**
617	26374	0	5	7	7	3	7	5	5	5	7	3	5	**4.9**	**3**	**25.0**	**8**	**66.7**
82	25877	5	9	5	7	3	5	5	5	5	3	3	5	**5.0**	**3**	**25.0**	**10**	**83.3**
12	25196	9	3	5	7	3	7	5	3	5	5	3	5	**5.0**	**4**	**33.3**	**9**	**75.0**
135	26326	3	5	5	-	3	5	7	7	5	7	3	5	**5.0**	**3**	**27.3**	**8**	**72.7**
149	25889	3	7	5	7	0	5	7	5	5	7	5	5	**5.1**	**2**	**16.7**	**8**	**66.7**
653	Tetep	9	5	5	9	3	3	5	5	3	9	5	7	**5.7**	**3**	**25.0**	**8**	**66.7**
663	Swarnadhan (T)	9	7	5	7	1	9	7	5	5	7	1	9	**6.0**	**2**	**16.7**	**5**	**41.7**
655	TN1 (S)	9	9	9	9	5	9	7	-	5	7	5	9	**7.5**	**0**	**0.0**	**3**	**27.3**
LSI		**8.0**	**8.0**	**7.1**	**7.5**	**6.0**	**7.1**	**6.5**	**6.6**	**5.5**	**8.5**	**4.5**	**6.5**	**6.8**				

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5)**

- **NSN-H**

The National Screening Nursery - Hills (NSN-H) was evaluated for their reaction to sheath blight at three different locations. These entries were screened through artificial inoculation at IIRR and Pantnagar. In case of Khudwani, it was under natural incidence. The frequency distribution of disease scores and location severity indices are presented in Table 26. The disease pressure was moderate at (LSI 3-6) IIRR (5.9) and Pantnagar (5.2) and it was low (LSI <3) at Khudwani (1.6).

Table 26: Location severity index and frequency distribution of sheath blight disease scores for NSN-H entries, *Kharif*, 2016

Score	Location/ Frequency of score (0-9)		
	IIRR	KHD	PNT
0	0	1	0
1	0	59	1
2	0	0	0
3	0	26	10
4	0	0	0
5	55	0	54
6	0	0	0
7	24	0	21
8	0	0	0
9	7	0	0
Total	**86**	**86**	**86**
LSI	**5.9**	**1.6**	**5.2**
Screening Method	**A**	**N**	**A**

(N- Natural; A- Artificial)

The selection of entries in NSN-H was done based on the reaction at those locations (IIRR and Pantnagar) where LSI was ≥4.0. Some of the highly promising entries found better than Tetep (tolerant check) were IET Nos. 25844, 24183, 24207, 25831, 25813 and 25816 (Table 27).

Table 27: Promising entries with low susceptibility index (SI≤4) and high promising index in NSN-H to sheath blight disease, *Kharif*, 2016

S.No.	IET No.	Location/Score (0-9)		SI	<=5*	PI (<=5)**
		IIRR	PNT			
38	25844	5	1	**3**	**2**	**100**
1	24183	5	3	**4**	**2**	**100**
4	Vivekdhan 86 (NC)	5	3	**4**	**2**	**100**
16	24207	5	3	**4**	**2**	**100**
24	25831	5	3	**4**	**2**	**100**
53	25813	5	3	**4**	**2**	**100**
56	25816	5	3	**4**	**2**	**100**
86	Swarnadhan (T)	5	3	**3**	**1**	**100**
78	T(N1) (S)	7	7	**7**	**0**	**0**
LSI		**5.6**	**5.3**			

SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5**

- **NHSN**

The National Hybrid Screening Nursery (NHSN) was evaluated for their resistance to sheath blight at 18 varied hot spot locations. The entries were screened by artificial inoculation at most of the centres except at Khudwani and Patna where the entries were evaluated under natural incidence. The frequency distribution of disease scores and location severity index (LSI) are presented in Table 28. The disease pressure was very high (LSI >7) at Aduthurai (8.8), Pattambi (8.6), IIRR (8.3), New Delhi (8.2), Gangavati (8.0), Chakdha (7.7), Cuttack (7.3) and Maruteru (7.2); High (LSI 6-7) at Ludhiana (8.5), Mandya (7.9), Raipur (7.8), Chinsurah (7.2) and Masodha (6.1); moderate (LSI 3-6) at Moncompu (5.9), Pantnagar (5.1), Titabar (4.5) and Patna (4.1); and low (LSI <3) at Khudwani (1.3). Therefore, the data from those centres having LSI ≤4.0 was not considered for selecting the promising entries. None of the entries showed resistance (SI ≤3) against sheath blight. Three promising entries *viz.*, IET # 25808, 24896 and 25783 are identified and presented in the Table 29.

- **DSN**

The Donor Screening Nursery (DSN) was evaluated for resistance to sheath blight at 17 locations. The entries were screened by artificial inoculation at most of the centres except at Patna where the entries were evaluated under natural conditions. The frequency distribution of disease scores and location severity index (LSI) were presented in Table 30. The disease pressure was very high (LSI >7) at Aduthurai (8.6), Gangavati (8.1), Ludhiana (7.2); Pattambi (6.8), New Delhi (6.0); Cuttack (6.4), Maruteru (7.4); high (LSI 6-7) at Mandya (6.6), Raipur (6.6), Chakdha (8.6), and

Masodha (5.9); moderate (LSI 3-6) at IIRR (8.2), Moncompu (5.0), Pant Nagar (5.3), Titabar (5.3), Chiplima (4.5) and Patna (4.3). The selection of entries in DSN was done based on the reaction at those locations where LSI was ≥4.0. Some of the promising entries were presented in the Table 31. Some of the highly promising entries found better than Tetep (tolerant check) were IET # CB 05022, CB 1107, RMS-BL-19, RMS-BL-14 and CB 09123

❖ BROWN SPOT

➢ NSN-1

The National Screening Nursery-1 (NSN-1) nursery was evaluated at 14 locations for brown spot disease. The entries were screened under natural conditions at most of the centres except Coimbatore, Chinusurah, Gangavati, Ludhiana and Pusa where screening was conducted under artificial inoculation with spore suspension. The frequency distribution of disease scores and location severity indices are presented in Table 32. The disease pressure was very high (LSI >7) at Gangavati (8.7), Pusa (7.1); high (LSI 6-7) at Ludhiana (7.0) and Mandya (6.3); moderate (LSI 3-6) at Lonavala (5.9), Coimbatore (5.9), Ghaghraghat (5.9), Gudalur (5.8), Chatha (5.1), Bankura (4.4), Rewa (4.2), Ponnampet (4.0) and Jagadalpur (3.8). The disease pressure was very low (LSI <3) at Chinusurah (2.7) and therefore the data was not considered for the selection of resistant entries from these centres.

The selection of promising entries was done based on the data of those locations where LSI was more than 4. Accordingly data of Chinsurah and Jagadalpur were not considered for selection of promising entries. Some of the promising entries with SI less than 5 and which had a score of 5 or less in 60% of the locations are presented in Table 33**.** The promising entries were IET # 25316, 25055, 25293, 24990, 25097, 25086, 25334, 25287, 24325, 25520 and 25369.

➢ NSN-2

The National Screening Nursery-2 was evaluated at 10 locations across the country. The locations are Coimbatore, Ghaghraghat, Gangavati, Jagadalpur, Ludhiana, Lonavala, Mandya, Ponnampet, Pusa and Rewa. The frequency distribution of the disease scores along with LSI are presented in the Table 34**.** The disease pressure was very high (LSI >7) at Gangavati (8.3) and Pusa (7.2); high (LSI 6-7) at Ludhiana (7.0), Mandya (6.7) and Lonavala (6.3). The disease pressure was moderate (LSI 3-6) at Coimbatore (5.7), Ghaghraghat (5.5), Jagadalpur (4.3), Ponnampet (4.0) and Rewa (4.0).

Some of the highly promising entries which performed equal and better than resistant check were IET # 25186, 25894, 26208, 26346, 26045, 25957, 25042 and 26122 (Table 35).

Table 28: Location severity index and frequency distribution of sheath blight disease scores for NHSN entries, *Kharif* 2016

Score	Location/ Frequency of score (0-9)																	
	ADT	**CHN**	**CKD**	**CTK**	**GNV**	**IIRR**	**KHD**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NDL**	**PNT**	**PTB**	**PTN**	**RPR**	**TTB**
0	0	0	2	0	0	0	0	0	0	0	0	0	0	5	0	0	0	2
1	0	0	0	0	0	0	124	0	2	0	0	0	0	0	0	17	0	25
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2	4	0	11	1	0	19	9	22	1	1	0	0	8	0	54	9	34
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	3	53	8	16	17	5	0	26	40	34	56	15	3	103	3	54	38	39
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	3	68	71	52	38	44	0	63	74	79	65	101	51	29	24	20	81	32
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	131	20	63	62	89	96	0	47	7	31	18	29	91	0	118	0	17	11
Total	**139**	**145**	**144**	**141**	**145**	**145**	**143**	**145**	**145**	**145**	**140**	**145**	**145**	**145**	**145**	**145**	**145**	**143**
LSI	**8.8**	**6.4**	**7.7**	**7.3**	**8.0**	**8.3**	**1.3**	**7.0**	**5.9**	**6.9**	**6.4**	**7.2**	**8.2**	**5.1**	**8.6**	**4.1**	**6.5**	**4.5**
Screening Method	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**

(N- Natural; A- Artificial)

Table 29: Promising entries with low susceptibility index (SI≤ 5.0) and high promising index in NHSN to sheath blight disease, *Kharif* 2016

Ent. No.	IET NO.	Location/Score (0-9)																	SI	<=3	PI (<=3)*	<=5	PI (<=5)**
		ADT	CHN	CKD	CTK	GNV	IIRR	LDN	MNC	MND	MSD	MTU	NDL	PNT	PTB	PTN	RPR	TTB					
135	Tetep	9	3	9	3	3	5	5	3	3	5	9	9	5	7	5	5	-	**5.5**	**5**	**31.3**	**11**	**68.8**
129	KRH-4 (OBCH-3)	9	5	7	7	5	9	5	3	5	5	7	7	3	9	3	5	3	**5.7**	**4**	**23.5**	**10**	**58.8**
145	Swarnadhan (T)	9	5	7	5	7	5	9	1	7	5	5	9	7	7	3	3	3	**5.7**	**4**	**23.5**	**9**	**52.9**
124	25808	9	3	7	-	9	7	5	7	5	7	7	7	0	7	5	7	1	**5.8**	**3**	**18.8**	**6**	**37.5**
140	Benibhog	9	5	9	3	9	7	7	3	5	5	7	7	5	7	3	5	3	**5.8**	**4**	**23.5**	**9**	**52.9**
104	WGL-14 (NCV-1)	9	5	7	7	9	9	3	3	7	5	5	7	5	7	1	7	3	**5.8**	**4**	**23.5**	**8**	**47.1**
109	24896	-	5	7	9	7	7	9	5	5	5	7	7	3	9	5	5	0	**5.9**	**2**	**12.5**	**8**	**50.0**
86	25783	3	7	7	7	5	9	7	5	9	7	7	9	5	9	1	3	1	**5.9**	**4**	**23.5**	**7**	**41.2**
125	DRRH-3 (NCH)	-	5	0	9	7	9	7	7	5	-	7	7	5	9	5	7	1	**6.0**	**2**	**13.3**	**6**	**40.0**
136	TN1 (S)	9	9	9	7	9	9	5	7	7	7	9	9	5	9	5	9	7	**7.7**	**0**	**0.0**	**3**	**17.6**
LSI		**8.8**	**6.4**	**7.7**	**7.3**	**8.0**	**8.3**	**7.0**	**5.9**	**6.9**	**6.4**	**7.2**	**8.2**	**5.1**	**8.6**	**4.1**	**6.5**	**4.5**					

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5)**

Table 30: Location severity index and frequency distribution of sheath blight disease scores for DSN entries, *Kharif* 2016

Score	Location/ frequency of score (0-9)																
	ADT	**CHP**	**CKD**	**CTK**	**GNV**	**IIRR**	**LDN**	**MNC**	**MND**	**MSD**	**MTU**	**NDL**	**PNT**	**PTB**	**PTN**	**RPR**	**TTB**
0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0
1	1	20	0	0	0	0	0	10	0	0	0	0	1	0	13	0	10
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	5	25	0	8	3	0	0	19	4	5	0	1	12	0	25	10	24
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	38	47	15	13	68	2	27	41	42	13	11	61	13	58	25	32
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2	18	50	36	9	32	48	38	36	37	69	32	29	32	13	62	28
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	94	7	8	46	84	8	59	13	28	14	27	62	2	64	0	12	11
Total	**103**	**108**	**105**	**105**	**109**	**108**	**109**	**109**	**109**	**98**	**109**	**106**	**108**	**109**	**109**	**109**	**105**
LSI	**8.6**	**4.4**	**6.3**	**7.8**	**8.6**	**5.9**	**8**	**5.4**	**6.6**	**6.2**	**7.3**	**7.9**	**5.2**	**7.9**	**4.3**	**6.4**	**5.1**
Screening Method	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**

(N- Natural; A- Artificial)

Table 31: Promising entries with low susceptibility index (SI≤5.3) and high promising index in DSN to sheath blight disease, *Kharif* 2016

Ent. No	Designation	Location/Score (0-9)																	SI	=3	PI <=3*	<=5	PI <=5**
		ADT	CHP	CKD	CTK	GNV	IIRR	LDN	MNC	MND	MSD	MTU	NDL	PNT	PTB	PTN	RPR	TTB					
57	CB 05022	1	1	5	3	5	5	7	5	5	5	5	7	3	7	7	3	3	**4.5**	**6**	**35.3**	**13**	**76.5**
59	CB 1107	3	3	7	9	5	5	7	0	5	5	5	7	3	7	3	9	5	**5.2**	**5**	**29.4**	**11**	**64.7**
41	RMS-BL-19	9	1	5	9	5	5	9	3	5	5	7	7	7	5	1	5	1	**5.2**	**4**	**23.5**	**11**	**64.7**
36	RMS-BL-14	3	1	5	7	9	7	7	5	7	9	5	7	3	5	1	5	3	**5.2**	**5**	**29.4**	**10**	**58.8**
58	CB 09123	9	1	5	7	3	5	7	1	5	-	5	9	5	7	5	7	3	**5.3**	**4**	**25.0**	**10**	**62.5**
106	Tetep	9	5	-	5	3	5	7	5	3	5	7	5	3	7	5	5	7	**5.4**	**3**	**18.8**	**11**	**68.8**
13	VL-31997	-	5	5	-	9	5	7	5	5	3	7	5	3	7	5	7	3	**5.4**	**3**	**20.0**	**10**	**66.7**
80	Swarnadhan (T)	3	3	5	5	7	5	9	1	5	7	7	9	5	9	1	9	5	**5.6**	**4**	**23.5**	**10**	**58.8**
72	TN1 (S)	-	3	-	9	9	9	9	9	5	-	7	9	5	9	5	5	-	**7.2**	**1**	**7.7**	**5**	**38.5**
LSI		**8.6**	**4.4**	**6.3**	**7.3**	**8.2**	**5.9**	**8.0**	**5.4**	**6.6**	**6.2**	**7.3**	**7.9**	**5.2**	**7.9**	**4.3**	**6.4**	**5.1**					

(SI- Susceptibility Index; Promising Index (PI) based on percentage of locations the entry has scored ≤3* and ≤5)**

Table 32: Location severity index (LSI) and frequency distribution of brown spot scores for NSN-1 *Kharif* 2016

Score	Location /Frequency of score (0-9)													
	BNK	**CBT**	**CHN**	**CHT**	**GDL**	**GGT**	**GNV**	**JDP**	**LDN**	**LNV**	**MND**	**PNP**	**PSA**	**REW**
0	33	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	16	13	0	0	0	4	0	0	0	6	0	6
2	30	1	167	0	0	0	0	33	0	0	0	48	6	40
3	23	28	115	103	61	1	1	125	0	9	6	114	6	54
4	30	23	62	0	0	9	1	124	0	0	22	69	8	102
5	163	88	5	125	115	172	8	62	5	200	171	74	30	127
6	56	69	3	0	0	101	5	16	0	0	0	32	53	23
7	24	135	4	102	176	19	18	7	364	112	83	19	103	19
8	0	21	1	0	0	56	6	0	0	0	3	7	93	0
9	0	7	0	27	20	12	333	0	0	24	87	2	71	1
Total	360	372	373	370	372	370	372	371	369	345	372	371	370	372
LSI	**4.4**	**5.9**	**2.7**	**5.1**	**5.8**	**5.9**	**8.7**	**3.8**	**7.0**	**5.9**	**6.3**	**4.0**	**7.1**	**4.2**
Screening Method	**N**	**A**	**A**	**N**	**N**	**N**	**A**	**N**	**A**	**N**	**N**	**N**	**A**	**N**

(N-Natural; A-Artificial)

Table 33: NSN-1 entries with high promising index to brown spot, *Kharif* 2016

Ent.No.	IET No.	Location / score (0-9)												SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		BNK	CBT	CHT	GDL	GGT	GNV	LDN	LNV	MND	PNP	PSA	REW					
32	25316	0	5	1	5	5	9	7	5	3	3	6	2	**4.3**	**9**	**75**	**5**	**42**
103	25055	0	3	3	3	5	9	7	5	5	2	8	3	**4.4**	**6**	**50**	**6**	**50**
62	25293	5	5	1	5	4	5	7	3	5	3	8	4	**4.6**	**5**	**42**	**3**	**25**
301	24990	2	6	1	3	5	9	7	5	7	2	3	5	**4.6**	**5**	**42**	**5**	**42**
101	25097	0	3	3	3	5	9	7	5	9	3	7	2	**4.7**	**6**	**50**	**6**	**50**
102	Jaya (Yield Check)	0	3	3	3	6	9	7	5	7	3	8	2	**4.7**	**6**	**50**	**6**	**50**
104	25086	0	5	3	5	5	9	7	7	5	1	7	2	**4.7**	**4**	**33**	**4**	**33**
33	25334	0	7	1	5	4	9	7	5	3	5	7	5	**4.8**	**4**	**33**	**3**	**25**
125	25287	0	5	5	3	5	9	7	5	5	2	7	5	**4.8**	**3**	**25**	**3**	**25**
199	24325	5	4	3	3	5	9	7	5	7	3	2	5	**4.8**	**5**	**42**	**4**	**33**
299	25520	3	3	5	3	-	9	7	5	5	2	5	7	**4.9**	**4**	**36**	**4**	**36**
81	24855	5	5	3	5	3	5	7	5	5	3	8	5	**4.9**	**3**	**25**	**3**	**25**
230	25369	5	6	7	7	6	4	7	5	4	2	5	1	**4.9**	**4**	**33**	**2**	**17**
292	Shobini (NC)	2	5	7	5	7	9	7	5	5	4	2	1	**4.9**	**4**	**33**	**3**	**25**
362	Rasi	3	8	7	7	5	6	7	5	7	4	5	3	**5.6**	**3**	**25**	**2**	**17**
367	CH-45	-	7	5	7	8	9	7	9	7	3	6	3	**6.5**	**2**	**18**	**2**	**18**
365	T(N1) (S check)	-	7	7	7	6	9	7	5	5	6	8	1	**6.2**	**1**	**9**	**1**	**9**
LSI		**4.4**	**5.9**	**5.1**	**5.8**	**5.9**	**8.7**	**7.0**	**5.9**	**6.3**	**4.0**	**7.1**	**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 ≤ 5and ≤ 3)**

Table 34: Location severity index (LSI) and frequency distribution of brown spot scores for NSN-2 *Kharif* 2016

Score	Location/ Frequency of score (0-9)									
	CBT	**GGT**	**GNV**	**JDP**	**LNV**	**LDN**	**MND**	**PNP**	**PSA**	**REW**
0	0	0	0	0	0	0	0	0	1	0
1	0	0	0	0	0	0	0	10	0	0
2	2	0	1	50	0	0	0	68	1	83
3	49	0	5	115	15	2	22	187	3	163
4	110	75	9	206	0	0	0	173	4	149
5	100	343	33	203	275	2	234	119	38	208
6	195	150	8	74	0	0	0	68	130	49
7	118	0	86	13	265	658	211	20	214	11
8	81	89	44	0	0	0	0	11	188	0
9	7	2	473	0	83	0	194	0	84	0
Total	662	659	659	661	638	662	661	656	663	663
LSI	**5.7**	**5.5**	**8.3**	**4.3**	**6.3**	**7.0**	**6.7**	**4.0**	**7.2**	**4.0**
Screening Method	**A**	**N**	**A**	**N**	**N**	**A**	**N**	**N**	**A**	**N**

(N-Natural; A-Artificial)

Table 35: NSN-2 entries with high promising index to brown spot, *Kharif* 2016

Ent. No	IET No.	Location/score (0-9)										SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		CBT	GGT	GNV	JDP	LNV	LDN	MND	PNP	PSA	REW					
7	25186	4	5	7	3	3	7	5	5	3	5	**4.7**	**8**	**80**	**3**	**30**
154	25894	6	5	5	3	5	7	5	3	5	4	**4.8**	**8**	**80**	**2**	**20**
503	26208	3	5	9	4	5	7	3	2	8	2	**4.8**	**7**	**70**	**4**	**40**
660	Ajaya	6	5	6	5	7	7	5	3	2	2	**4.8**	**6**	**60**	**3**	**30**
26	26346	3	6	7	4	-	7	7	2	6	2	**4.9**	**4**	**44**	**3**	**33**
181	26045	3	6	3	3	-	7	9	3	5	5	**4.9**	**6**	**67**	**4**	**44**
273	25957	3	5	9	3	5	3	7	2	8	4	**4.9**	**7**	**70**	**4**	**40**
294	25042	4	6	9	3	5	7	5	4	4	2	**4.9**	**7**	**70**	**2**	**20**
467	26122	6	5	5	3	5	7	7	2	7	2	**4.9**	**6**	**60**	**3**	**30**
652	Rasi	7	5	7	5	5	7	7	2	5	3	**5.3**	**6**	**60**	**2**	**20**
657	CH-45	6	5	9	7	9	7	5	7	6	3	**6.4**	**3**	**30**	**1**	**10**
655	T(N1) (S check)	7	5	9	5	9	5	9	5	9	4	**6.7**	**5**	**50**	**0**	**0**
LSI		**5.7**	**5.5**	**8.3**	**4.3**	**6.3**	**7.0**	**6.7**	**4.0**	**7.2**	**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 ≤ 5and ≤ 3)**

- **NSN-H**

The NSN-hills nursery was evaluated at 4 centres *viz.*, Almora, Gudalur, Lonavala and Ponnampet. The screening for the disease was carried out under natural conditions at all the centres. The disease pressure was very high at Lonavala with LSI of 7.0. It was moderate (LSI 3-6) at Almora, Gudalur and Ponnampet respectively. The frequency distribution of disease scores along with location severity indices are presented in the Table 36.

Table 36: Location severity index and frequency distribution of brown spot scores for NSN-H entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)			
	ALM	**GDL**	**LNV**	**PNP**
0	0	0	0	1
1	0	0	0	1
2	0	0	0	1
3	0	19	1	17
4	13	0	0	13
5	31	34	24	15
6	24	0	0	18
7	17	27	34	10
8	0	0	0	7
9	0	5	26	3
Total	85	85	85	86
LSI	**5.5**	**5.4**	**7.0**	**5.1**
Screening Method	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

The promising entries at three locations are with IET nos. 25834, 24197, 25149, 24207, 25833, 25838 and 25842 (Table 37).

Table 37: NSN-H entries with disease scores (<=5) and PI to brown spot, *Kharif*, 2016

Ent. No.	IET No.	Location/Score (0-9)				SI	<=5*	PI (<=5)**
		ALM	**GDL**	**LNV**	**PNP**			
76	Tetep	4	3	3	3	**3.3**	**4**	**100**
28	25834	5	3	-	5	**4.3**	**3**	**100**
6	24197	6	5	7	0	**4.5**	**2**	**50**
8	25149	6	3	7	3	**4.8**	**2**	**50**
17	24207	7	3	5	4	**4.8**	**3**	**75**
27	25833	4	7	5	3	**4.8**	**3**	**75**
33	25838	6	5	7	1	**4.8**	**2**	**50**
37	25842	6	5	5	3	**4.8**	**3**	**75**
83	Ajaya	5	5	5	4	**4.8**	**4**	**100**

Ent. No.	IET No.	Location/Score (0-9)				SI	<=5*	PI (<=5)**
		ALM	GDL	LNV	PNP			
75	Rasi	5	5	5	7	**5.5**	**3**	**75**
80	CH-45	4	5	9	8	**6.5**	**2**	**50**
78	T (N1) (S check)	-	-	5	8	**6.5**	**1**	**50**
LSI		**5.6**	**5.5**	**7.0**	**5.2**			

(SI-Susceptibility Index; * No. of locations where the entry has scored ≤ 5; ** Promising index (PI) based on no. of location where the entry has scored ≤ 5)

- **NHSN**

National Hybrid Screening Nursery (NHSN) was screened for brown spot reaction at 11 locations with 145 entries across India. The host plant resistance screening was done under natural infection at Almora, Chatha, Jagadalpur, Lonavala, Mandya and Rewa while the screening was performed artificially at Coimbatore, Chinsurah, Gangavati, Ludhiana and Pusa. The frequency distribution of disease scores and location severity indices are presented in Table 38. The disease pressure was very high (LSI >7) at Gangavati (8.6). The disease pressure was high (LSI-6-7) at Coimbatore (7.0), Pusa (6.7), Lonavala (6.3) and Mandya (6.0). It was moderate (LSI 3-6) at Chatha (5.4), Almora (5.2), Ludhiana (5.0), Jagadalpur (4.6) and Rewa (3.6). It was low too at Chinsurah (LSI 2.6). The selection of promising entries was done based on the data of those locations where LSI was more than 4. Hence data from Rewa and Chinsurah were not considered for selection of best entries. None of the entries recorded resistant reaction. However few promising lines *viz.*, IET # 25728 and 25811 are presented in the Table 39.

- **DSN**

The donor screening nursery (DSN) was evaluated for their resistance to brown spot at 12 locations with 109 entries across the country. The brown spot resistance screening was done artificially at Coimbatore, Gangavati, Ludhiana and Pusa where as it was screened under natural infection at Almora, Chatha, Ghaghraghat, Jagadalpur, Lonavala, Mandya and Rewa. The frequency distribution of disease scores and location severity index (LSI) are presented in Table 40. The disease pressure was very high (LSI >7) at Gangavati (8.5), Pusa (7.9) and high (LSI-6-7) at Ludhiana (7.0), Cuttack (6.9), Lonavala (6.5) and Mandya (6.2); moderate (LSI 3-6) at Ghaghraghat (5.9), Almora (5.3), Coimbatore (5.2), Chatha (5.2) and Jagadalpur (4.4). Due to low disease pressure at Rewa (2.8) the data from this location was not taken into consideration for selection of the promising lines.

The selection of best entries was done based on the data of those locations where the LSI was more than 4. The entries with SI less than 5.0 and those with scores 5 at 50% or more locations are presented in Table 41. Some promising entries are RP-Bio-Patho-3, CB 13132 and RP-Bio-Patho-2.

Table 38: Location severity index (LSI) and frequency distribution of brown spot scores for NHSN *Kharif* 2016

Score	Location/ Frequency of score (0-9)										
	ALM	**CBT**	**CHN**	**CHT**	**GNV**	**JDP**	**LDN**	**LNV**	**MND**	**PSA**	**REW**
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	18	2	0	0	0	0	0	1	0
2	0	0	57	0	0	1	0	0	0	1	37
3	3	1	45	20	0	16	26	1	18	10	26
4	28	1	20	0	0	44	0	0	0	9	52
5	67	17	0	76	3	67	90	59	57	13	19
6	38	23	4	0	6	12	0	0	0	16	9
7	9	49	1	40	15	5	29	72	50	48	1
8	0	49	0	0	2	0	0	0	0	22	0
9	0	5	0	7	118	0	0	13	20	25	0
Total	145	145	145	145	144	145	145	145	145	145	144
LSI	**5.2**	**7.0**	**2.6**	**5.4**	**8.6**	**4.6**	**5.0**	**6.3**	**6.0**	**6.7**	**3.6**
SM	**N**	**A**	**A**	**N**	**A**	**N**	**A**	**N**	**N**	**A**	**N**

(N-Natural; A-Artificial)

Table 39: NHSN entries with high promising index to brown spot *Kharif* 2016

Ent . No.	IET No.	Location/Score (0-9)									SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	**CBT**	**CHT**	**GNV**	**JDP**	**LDN**	**LNV**	**MND**	**PSA**					
138	Nidhi	4	5	3	6	4	5	5	3	5	**4.4**	**8**	**89**	**2**	**22**
133	IR-64	4	5	3	9	4	5	5	3	3	**4.6**	**8**	**89**	**3**	**33**
142	Ajaya	4	5	5	7	5	5	5	3	3	**4.7**	**8**	**89**	**2**	**22**
24	25728	3	8	5	5	4	7	7	5	2	**5.1**	**6**	**67**	**2**	**22**
128	25811	5	5	3	9	4	5	7	3	6	**5.2**	**6**	**67**	**2**	**22**
135	Tetep	5	6	5	9	5	5	3	3	6	**5.2**	**6**	**67**	**2**	**22**
134	Rasi	4	8	5	7	5	5	5	7	6	**5.8**	**5**	**56**	**0**	**0**
139	CH-45	3	7	5	9	7	5	7	7	6	**6.2**	**3**	**33**	**1**	**11**
137	T(N1) (S check)	4	6	5	7	5	5	9	5	9	**6.1**	**5**	**56**	**0**	**0**
LSI		**5.2**	**7.0**	**5.4**	**8.6**	**4.6**	**5.0**	**6.3**	**6.0**	**6.7**					

(SI-Susceptibility Index; * No. of locations where the entry has scored ≤ 5; ** Promising index (PI) based on no. of location where the entry has scored ≤ 5)

Table 40: Location severity index (LSI) and frequency distribution of brown spot scores for DSN *Kharif* 2016

Score	Location/ Frequency of score (0-9)											
	ALM	**CBT**	**CHT**	**CTK**	**GGT**	**GNV**	**JDP**	**LNV**	**LDN**	**MND**	**PSA**	**REW**
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	4	0	0	0	0	0	0	0	0	10
2	0	0	0	0	0	1	4	0	0	0	1	39
3	0	7	25	7	0	1	20	3	0	25	3	42
4	26	28	0	0	8	0	35	0	0	0	1	5
5	38	32	45	20	53	5	37	41	1	27	11	12
6	31	23	0	0	19	3	10	0	0	0	17	0
7	14	15	22	50	2	5	2	46	107	24	39	1
8	0	4	0	0	26	1	1	0	0	0	10	0
9	0	0	12	29	0	93	0	19	1	33	26	0
Total	109	109	108	106	108	109	109	109	109	109	108	109
LSI	**5.3**	**5.2**	**5.2**	**6.9**	**5.9**	**8.5**	**4.4**	**6.5**	**7.0**	**6.2**	**7.9**	**2.8**
Screening Method	**N**	**A**	**N**	**N**	**N**	**A**	**N**	**N**	**A**	**N**	**A**	**N**

(N-Natural; A-Artificial)

Table 41: DSN entries with high promising index to brown spot *Kharif* 2016

Ent. No	Designation	Location /score (0-9)											SI	<=5*	PI (<=5)**	<=3*	PI (<=3)**
		ALM	**CBT**	**CHT**	**CTK**	**GGT**	**GNV**	**JDP**	**LNV**	**LDN**	**MND**	**PSA**					
103	IR-64	5	5	3	5	5	5	4	5	7	3	3	**4.5**	**10**	**91**	**3**	**27**
98	RP-Bio-Patho-3	4	5	1	7	4	5	2	7	7	5	5	**4.7**	**8**	**73**	**2**	**18**
66	CB 13132	4	4	7	7	5	9	3	5	7	3	4	**5.3**	**7**	**64**	**2**	**18**
97	RP-Bio-Patho-2	4	3	3	9	4	9	2	5	7	5	7	**5.3**	**7**	**64**	**3**	**27**
69	Rasi	4	5	5	5	5	7	4	7	7	9	5	**5.7**	**7**	**64**	**0**	**0**
74	CH-45	4	6	5	5	5	9	5	7	7	5	6	**5.8**	**6**	**55**	**0**	**0**
72	T(N1) (S check)	4	6	5	-	5	9	4	7	7	3	5	**5.5**	**6**	**60**	**1**	**10**
LSI		**5.3**	**5.2**	**5.2**	**6.9**	**5.9**	**8.5**	**4.4**	**6.5**	**7.0**	**6.2**	**7.9**					

(SI-Susceptibility Index;*No. of locations where the entry has scored ≤ 5 and ≤ 3;Promising index (PI) based on no. of locations where the entry had scored ≤ 5and ≤ 3)**

❖ SHEATH ROT

➢ NSN-1

The Nursery 1 consisting of 373 entries were evaluated against sheath rot at 12 locations across the country. At Chinsurah, Navsari, Rajendranagar and Raipur screening was done artificially while it was done under natural conditions at other centres like Aduthurai, Karjat, Lonavala, Mandya, Maruteru, Nellore, Nawagam, and Pusa. Very high disease pressure (LSI>7) was recorded at Lonavala (7.9) and Raipur (7.8); High at Navsari (6.3) and Rajendranagar (6.0); moderate disease pressure at Aduthurai and Chinsurah (5.6), Pusa (5.3), Nellore (4.9) and Mandya (4.5). The disease pressure was very low (LSI≤ 3) at Karjat (1.7), Nawagam (0.5) and Maruteru (0.3). Hence, the data from these centres were not considered for selecting the resistant entries for sheath rot. The frequency distribution of sheath rot scores are presented in the Table 42 along with location severity indices.

Table 42: Location severity index (LSI) and frequency distribution of sheath rot disease scores for NSN-1 entries, *Kharif* 2016

Score	Location/Frequency of score (0-9 scale)											
	ADT	**CHN**	**KJT**	**LNV**	**MND**	**MTU**	**NLR**	**NVS**	**NWG**	**PSA**	**RNR**	**RPR**
0	68	9	172	0	0	326	0	0	304	1	31	0
1	9	0	67	0	87	20	0	0	0	17	0	0
2	0	0	0	0	1	0	0	0	0	0	0	0
3	67	39	66	0	108	19	17	23	64	56	9	6
4	0	0	0	0	0	0	0	0	0	0	0	1
5	28	183	38	24	55	4	341	122	2	168	115	51
6	0	0	0	0	0	0	0	0	0	0	0	0
7	18	109	23	134	49	3	11	183	0	117	160	108
8	0	0	0	0	0	0	0	0	0	0	0	0
9	175	33	0	187	72	0	1	45	0	11	53	207
Total	**365**	**373**	**366**	**345**	**372**	**372**	**370**	**373**	**370**	**370**	**368**	**373**
LSI	**5.6**	**5.6**	**1.7**	**7.9**	**4.5**	**0.3**	**4.9**	**6.3**	**0.5**	**5.3**	**6.0**	**7.8**
Screening Method	**N**	**A**	**N**	**N**	**N**	**N**	**N**	**A**	**N**	**N**	**A**	**A**

(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 43 included IET # 25113 and 25121.

Table 43: NSN-1 entries with high promising index to sheath rot, *Kharif*, 2016

Ent. no.	IET No.	Location/Score (0-9)									SI	<=5	PI (<=5)**
		ADT	CHN	LNV	MND	NLR	NVS	PSA	RNR	RPR			
1	25113	3	5	7	1	5	7	5	5	7	**5.0**	**6**	**66.6**
2	25121	0	5	7	1	5	7	5	5	7	**4.6**	**6**	**66.6**
365	T(N1) (S)	1	7	9	9	5	9	5	5	9	**6.5**	**4**	**44.4**
LSI		**5.6**	**5.6**	**7.9**	**4.5**	**4.9**	**6.3**	**5.3**	**6.0**	**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 ≤ 5 and ≤ 3)**

- **NSN-2**

The NSN -2 nurseries consisting of 663 entries was evaluated at 7 locations across the country. Except at Raipur, in all the locations *viz.*, Aduthurai, Lonavala, Maruteru, Nawagam, Pusa and Rajendranagar the screening was done under natural conditions. At Lonavala (8.2) and Raipur (7.0) very high disease pressure was recorded. Moderate to high disease pressure was recorded at Aduthurai (6.7), Pusa (6.6) and Mandya (5.3). The disease pressure was very low at Karjat (1.4) and Maruteru (0.2). The frequency distribution of disease scores along with location severity indices are presented in the Table 44.

Table 44: Location severity index (LSI) and frequency distribution of sheath rot disease scores for NSN-2 entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)						
	ADT	KJT	LNV	MND	MTU	PSA	RPR
0	78	318	0	0	567	4	0
1	17	155	0	91	47	10	0
2	0	0	0	1	0	0	0
3	62	92	4	167	20	25	15
4	0	0	0	0	0	0	2
5	46	44	28	123	5	163	188
6	0	0	0	0	0	0	0
7	28	27	174	96	0	348	243
8	0	0	0	0	0	0	0
9	409	3	432	183	0	113	212
Total	**640**	**639**	**638**	**661**	**639**	**663**	**660**
LSI	**6.7**	**1.4**	**8.2**	**5.3**	**0.2**	**6.6**	**7.0**
Screening Method	**N**	**N**	**N**	**N**	**N**	**N**	**A**

(N-Natural; A-Artificial)

The selection of promising entries was done based on the disease data from those locations where the disease was moderate to very high. IET Nos. *viz.*, 25891, 26052, 25890, 25959, 25874, 26053, 25186, 26019, 26042, 26407, 26307, 26333, 25884 and 26164 performed better across the locations (Table 45).

Table 45: NSN-2 entries with high promising index to sheath rot, *Kharif* 2016

Ent No.	IET No.	Location/Score (0-9)					SI	<=5*	PI (<=5)**
		ADT	LNV	MND	PSA	RPR			
151	25891	0	9	1	0	7	**3.4**	**3**	**60.0**
188	26052	0	-	1	7	7	**3.8**	**2**	**50.0**
150	25890	1	5	1	7	5	**3.8**	**4**	**80.0**
275	25959	0	5	3	5	7	**4.0**	**4**	**80.0**
79	25874	1	7	5	3	5	**4.2**	**4**	**80.0**
189	26053	3	7	3	5	3	**4.2**	**4**	**80.0**
7	25186	0	5	5	7	5	**4.4**	**3**	**80.0**
329	26019	-	7	3	3	5	**4.5**	**2**	**75.0**
355	26042	5	5	1	5	7	**4.6**	**1**	**80.0**
519	CST 7-1	0	5	5	5	9	**4.8**	**1**	**80.0**
599	26407	0	5	5	9	5	**4.8**	**1**	**80.0**
117	26307	1	9	5	5	5	**5.0**	**1**	**80.0**
142	26333	-	7	3	5	5	**5.0**	**1**	**75.0**
144	25884	-	5	3	5	7	**5.0**	**1**	**75.0**
366	26164	3	-	3	9	5	**5.0**	**2**	**75.0**
655	T(N1) (S)	9	9	5	5	7	**7.0**	**0**	**40.0**
LSI		**6.7**	**8.2**	**5.3**	**6.6**	**7.0**			

(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 ≤ 5and ≤ 3)**

- **NSN-H**

Eighty six entries from NSN hills were tested at Karjat and Lonavala. Sheath rot disease pressure was very high with LSI of 8.6 at Lonavala but in contrast, it was very low at Karjat with LSI 2.2 (Table 46). All the entries succumbed to the disease at Lonavala. None of the entries found resistant in this nursery during the season.

Table 46: Location severity index and frequency distribution of Sheath rot scores for NSN-H entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)	
	KJT	LNV
0	15	0
1	33	0
3	20	0
5	8	3
6	0	0
7	7	10
9	0	72
Total	**83**	**85**
LSI	**2.2**	**8.6**
Screening Method	**N**	**N**

(N-Natural; A-Artificial)

- **NHSN**

The NHSN trial consisted of 145 entries including checks. The trial was evaluated at 11 locations representing different geographical regions. At 4 centres (Chinsurah, Navsari, Rajendranagar and Raipur) the screening was done by artificial inoculation method, while at 7 centres (Aduthurai, Karjat, Lonavala, Mandya, Maruteru, Nawagam and Pusa) was done under natural conditions. The frequency distribution of disease scores and the LSI are presented in Table 47. The disease pressure was very high (LSI >7) at Aduthurai (8.5), Lonavala (8.3) Raipur (8.6) followed by Raipur (7.2); Moderate disease pressure was noticed at Rajendranagar (6.8), Pusa (6.2) and Navsari (6.2), Chinsurah (6.1) and Mandya (5.2).Very low disease pressure was noticed at Nawagam (0.2) and Karjat (1.6) and these centres are not considered in the selection of the promising entries. Some of the hybrids showed resistance against sheath rot disease during this year are IET Nos. 25766, 25799 and 25787 (Table 48).

Table 47: Location severity index (LSI) and frequency distribution of sheath rot disease scores for NHSN entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)										
	ADT	**CHN**	**KJT**	**LNV**	**MND**	**MTU**	**NVS**	**NWG**	**PSA**	**RNR**	**RPR**
0	2	1	37	0	0	87	0	139	0	20	0
1	0	0	63	0	23	26	0	0	7	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	4	13	25	0	42	25	8	4	15	0	2
4	0	0	0	0	0	0	0	0	0	0	0
5	5	65	15	5	19	7	61	2	29	0	33
6	0	0	0	0	0	0	0	0	0	0	0
7	7	37	3	39	23	0	59	0	70	68	55
8	0	0	0	0	0	0	0	0	0	0	0
9	121	29	0	101	38	0	17	0	24	57	55
Total	**139**	**145**	**143**	**145**	**145**	**145**	**145**	**145**	**145**	**145**	**145**
LSI	**8.5**	**6.1**	**1.6**	**8.3**	**5.2**	**0.9**	**6.2**	**0.2**	**6.2**	**6.8**	**7.2**
Screening Method	**N**	**A**	**N**	**N**	**N**	**N**	**A**	**N**	**N**	**A**	**A**

(N-Natural; A-Artificial)

Table 48: NHSN entries with high promising index to sheath rot, *Kharif* 2016

S.No.	IET NO.	Location/Score (0-9)								SI	<=3*	PI (<=3)**
		ADT	**CHN**	**LNV**	**MND**	**NVS**	**PSA**	**RNR**	**RPR**			
67	25766	9	5	7	3	5	5	0	5	**4.9**	**2**	**75.0**
81	25779	9	3	7	3	5	7	0	5	**4.9**	**3**	**62.5**
90	25787	9	3	9	1	5	3	0	9	**4.9**	**4**	**62.5**
145	Swarnadhan	0	3	9	3	5	3	9	7	**4.9**	**4**	**62.5**
140	Benibhog	9	5	9	1	5	1	7	5	**5.3**	**2**	**62.5**
137	T(N1) (S)	9	5	9	3	7	7	9	9	**7.3**	**1**	**25.0**
LSI		**8.5**	**6.1**	**8.3**	**5.2**	**6.2**	**6.2**	**6.8**	**7.2**			

(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 ≤ 5and ≤ 3)**

➢ **DSN**

The donor screening nursery (DSN) consisted of 109 entries including checks and was evaluated at 10 locations across the country. At Rajendranagar and Raipur the screening was done artificially and in rest of the centres under natural conditions. The frequency distribution of disease scores and location severity index (LSI) are presented in Table 49. The disease pressure was very high (LSI-≥7) at Aduthurai (8.5) followed by Lonavala (8.4) and Raipur (7.5); high (LSI-6-7) at Rajendranagar (6.4) and Mandya (6.0); Moderate (LSI 3-6) at Navsari (5.9) and Pusa (5.9). Due to low disease pressure at Maruteru, Karjat and Nawagam data was not taken into consideration for selection of the promising lines. A few promising entries which included VL-31997 and RP-Patho-8.

Table 49: Location severity index (LSI) and frequency distribution of sheath rot disease scores for DSN entries, *Kharif* 2016

score	Location/Frequency of score (0-9)									
	ADT	**KJT**	**LNV**	**MND**	**MTU**	**NVS**	**NWG**	**PSA**	**RNR**	**RPR**
0	1	31	0	0	102	0	91	0	7	0
1	0	39	0	21	4	3	0	10	0	0
2	0	0	0	0	0	0	0	0	0	0
3	3	20	0	17	2	16	18	13	4	3
4	0	0	0	0	0	0	0	0	0	0
5	5	15	2	11	1	26	0	20	22	15
6	0	0	0	0	0	0	0	0	0	0
7	3	4	29	8	0	58	0	52	53	41
8	0	0	0	0	0	0	0	0	0	0
9	91	0	78	52	0	6	0	14	22	50
Total	**103**	**109**	**109**	**109**	**109**	**109**	**109**	**109**	**108**	**109**
LSI	**8.5**	**1.9**	**8.4**	**6.0**	**0.1**	**5.9**	**0.5**	**5.9**	**6.4**	**7.5**
Screening Method	**N**	**N**	**N**	**N**	**N**	**A**	**N**	**N**	**A**	**A**

(N-Natural; A-Artificial)

❖ **LEAF SCALD**

The incidence of Leaf scald (*Rhynchosporuim* sp.) disease was noticed during *Kharif*, 2016 at Lonavala and the test entries were screened under natural conditions. The details of screening nurseries with respect to number of entries tested and disease pressure are given in the Table 50. The location severity index was ranged from moderate to high in different screening nurseries. The LSI was high in NHSN (7.4), NSN-2 (7.2), NSN-1(7.2), NSN-H (6.9) and DSN (6.2). Three entries were found to show scores of three from 376 entries in NSN-1; one entry from 681 entries of NSN-2; four entries from 111 in DSN (Table 51).

Table 50: Location severity index (LSI) and frequency distribution of leaf scald disease scores for National Screening Nurseries (NSN-1, NSN2, NSN-H, NHSN and DSN) at Lonavala, during *Kharif* 2016

Score	Location/Frequency of score (0-9)				
	NSN-1	**NSN-2**	**NSN-H**	**NHSN**	**DSN**
1	0	0	0	0	0
3	3	1	1	1	4
5	54	112	15	13	47
7	195	355	55	89	47
9	93	171	14	42	11
Total	**346**	**639**	**85**	**145**	**109**
LSI	**7.2**	**7.2**	**6.9**	**7.4**	**6.2**
SM	**N**	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Table 51: Promising entries from all nurseries for leaf scald disease during *Kharif*, 2016

Screening Nursery	IET Nos.
NSN-1	25350, 24241
NSN- 2	Nil
NHSN	Nil
DSN	22565(TKM 13), RMS-BL-13

❖ GLUME DISCOLOURATION

Glume discolouration (GD) was observed at Chatha, Lonavala, and Navsari during *Kharif* 2016. All the Screening Nurseries were sevaluated under natural conditions at these centres.

➢ NSN-1

In NSN-1, 373 entries including checks were screened against glume discolouration under natural conditions. High disease pressure was observed in Lonavala (7.4) and a moderate disease pressure was observed in Navsari (LSI 4.5) and Chatha (LSI 3.3). The frequency distribution of glume discolouration scores is presented in the Table 52 along with location severity indices. A few promising entries found in NSN-1 were IET # 24977 and 25603.

Table 52: Location severity index (LSI) and frequency distribution of glume discolouration disease scores for NSN-1 entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)		
	CHT	**LNV**	**NVS**
1	20	0	24
3	192	0	113
5	54	30	180

Score	Location/Frequency of score (0-9)		
	CHT	**LNV**	**NVS**
7	1	209	49
9	2	106	7
Total	**269**	**345**	**373**
LSI	**3.3**	**7.4**	**4.5**
SM	**N**	**N**	**N**

(N-Natural; A-Artificial)

- **NSN-2**

The entries were tested only at Lonavala against glume discolouration with LSI of 7.8. Some of the promising entries with score of 5 were IET # 26147, 25946, 25728, 25136, 26196, 26238, 26416 and 26417.

- **NSN-H**

Eighty seven entries from NSN hills were tested at Lonavala against glume discolouration with LSI of 7.3. All the entries were susceptible to the disease and except for one entry (IET # 24188) at score of 5, none of the entries scored below 7.

- **NHSN**

National Hybrid Screening Nursery (NHSN) consisting of 163 entries including checks were screened for glume discolouration reaction at 4 locations. The screening was done under natural infestations at Chatha, Lonavala, Navsari and Nawagam The frequency distribution of disease scores and location severity indices are presented in Table 53. The disease pressure was high (LSI-7.3) at Lonavala (7.4), moderate at Navsari (4.4) and low of (3.1 and 3.0) at Chatha and Nawagam respectively.

Table 53: Location severity index (LSI) and frequency distribution of glume discoloration disease scores for NHSN entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)			
	CHT	**LNV**	**NVS**	**NWG**
1	22	0	6	0
3	89	0	50	142
5	24	12	72	3
7	4	93	16	0
9	0	40	1	0
Total	**139**	**145**	**145**	**145**
LSI	**3.1**	**7.4**	**4.4**	**3.0**
SM	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Some of the promising entries from NHSN were IET # 25715, 25735, 25739, 25742, 25748, 25750, 25790 and 25800.

- **DSN**

Donor screening nursery (DSN) comprising of 109 entries including checks were tested against glume discolouration at 4 locations *viz.*, Chatha, Lonavala, Navsari and Nawagam. The frequency distribution of disease scores and LSI are presented in Table 54. The disease pressure was very high at Lonavala (7.1); moderate at Chatha (5.3); low at Navsari (3.6) and Nawagam (3.2).

Table 54: Location severity index (LSI) and frequency distribution of glume discoloration disease scores for DSN entries, *Kharif* 2016

Score	Location/Frequency of score (0-9)			
	CHT	**LNV**	**NVS**	**NWG**
1	18	0	33	0
3	36	0	68	125
5	32	31	71	35
7	38	111	8	5
9	27	37	1	0
Total	**151**	**179**	**181**	**165**
LSI	**5.3**	**7.1**	**3.6**	**3.2**
SM	**N**	**N**	**N**	**N**

(N-Natural; A-Artificial)

Some of the entries that are found promising are given below included VL-8657, VL-31430, VL-31716 and CB 13204 (Table 55).

Table 55: Location severity index (LSI) and frequency distribution of glume discoloration disease scores for DSN entries, *Kharif* 2016

Ent. No	Designation	Location/ score (0-9)		SI	<=3*	PI (<=3)**	<=5*	PI (<=5)**
		LNV	NVS					
1	VL-8657	5	3	**4**	**1**	**50**	**2**	**100**
103	IR-64	5	3	**4**	**1**	**50**	**2**	**100**
3	VL-31430	7	1	**4**	**1**	**50**	**1**	**50**
6	VL-31716	7	1	**4**	**1**	**50**	**1**	**50**
63	CB 13204	7	1	**4**	**1**	**50**	**1**	**50**
67	HR-12	7	1	**4**	**1**	**50**	**1**	**50**
69	Rasi	7	1	**4**	**1**	**50**	**1**	**50**
74	CH-45	7	1	**4**	**1**	**50**	**1**	**50**
LSI		**7.1**	**3.6**					

(SI-Susceptibility Index;*No. of locations where the entry has scored ≤ 5 ;Promising index (PI) based on no. of locations where the entry had scored ≤ 5)**

❖ BACTERIAL LEAF BLIGHT

➢ NSN-1

The entries were evaluated at 24 locations across the country. However, the disease did not develop at Upper Shillong and the data were not considered for analysis. The entries were evaluated under artificially inoculated conditions at all the locations except at Nellore, where the entries were evaluated under natural condition. The frequency distribution of the disease scores and location severity indices are presented in Table 56. The disease pressure was very high (LSI > 7) at Aduthurai (8.6), Chiplima (7.8), IIRR, Hyderabad (7.5), Maruteru (7.1), Pantnagar (7.1) and Patna (7.0); High (LSI-6-7) at Raipur (6.6), Pattambi (6.4), Gangavati (6.2), Ludhiana (6.2) and New Delhi (6.0); moderate (LSI-3.6) at Gerua (5.9), Navsari (5.9), Cuttack (5.8), Masodha, Faizabad (5.5), Nellore (5.1), Moncompu (5.0), Chinsurah (4.7), Chatha (4.7), Karjat (4.4), Kaul (3.8), Port Blair (3.4) and Nawagam (3.4).

The selection of promising entries was done based on the data of those locations where LSI was more than 4. Accordingly, the data of location Kaul, Nawagam and Port Blair were not considered for selection of promising entries. The promising entries with SI ≤ 5 and which exhibited a score of 5 or less at more than 65% of the locations are presented in Table 57. None of the entries were on par with the resistant check RP Bio 226 (Improved Samba Mahsuri). However, some of the promising entries with SI below 5 were IET # 25501, 23930, 25369, 24519, 25252, 24496, 25467, 24951 and 24855.

➢ NSN-2

The entries were evaluated at 15 hot spot locations across India. The entries were evaluated under artificial inoculation condition at all the locations. The frequency distribution of the disease scores and location severity indices are presented in Table 58. The disease pressure was very high (LSI > 7) at Aduthurai (8.4), IIRR (7.8), Pantnagar (7.6), Maruteru (7.5) and Pattambi (7.1); high (LSI- 6-7) at Cuttack (6.9), Raipur (6.4), Pantnagar (6.2), Gerua (6.0) and Gangavati (6.0); moderate (LSI- 3-6) at Masodha, Faizabad (5.6), Moncompu (5.5), Ludhiana (5.4) and Karjat (4.9) and low (LSI< 3) at Arundhatinagar (2.4).

The selection of promising entries was done based on the data of those locations where LSI was more than 4. Accordingly, the data of Arundhatinagar was not considered for selection of promising entries. The promising entries with SI ≤ 5 and which exhibited a score of 5 or less at more than 65% of the locations are presented in Table 59. Four entries *viz.*, entry # 25935, 25927, 26306 and 25901 were on par with the resistant check RP-Bio-226 (Improved Samba Mahsuri). A few promising entries were IET # 25886, 25190, 25861, 26106, 25895, 25918, 25219, 25952 and 26023.

➢ NSN-Hills

The nursery was evaluated at 6 locations across India. However, there was no disease at Upper Shillong and the data were not considered for analysis. In rest of the five locations, the entries were evaluated under artificial inoculation condition. The frequency distribution of the disease scores and location severity indices are presented in Table 60.

Table 56: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-1, *Kharif* 2016

Score	Location/Frequency of scores (0-9)																						
	ADT	**CHN**	**CHP**	**CHT**	**CTK**	**IIRR**	**GER**	**GNV**	**KJT**	**KUL**	**LDN**	**MNC**	**MSD**	**MTU**	**NDL**	**NLR**	**NVS**	**NWG**	**PNT**	**POB**	**PTB**	**PTN**	**RPR**
0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0
1	0	3	1	4	2	13	0	11	39	21	0	26	0	0	9	22	1	28	2	96	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	139	23	123	82	30	9	71	102	194	66	51	49	3	0	69	45	256	30	125	8	8	3
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	15	149	12	169	97	20	161	88	148	132	33	92	186	59	192	164	129	64	75	87	166	79	81
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	33	72	116	70	147	91	145	83	76	20	254	143	131	223	141	106	179	20	99	44	131	183	284
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	316	6	217	4	40	218	8	117	1	0	14	26	2	86	30	9	19	2	166	5	66	103	5
Total	**365**	**369**	**369**	**370**	**368**	**372**	**323**	**370**	**366**	**367**	**367**	**372**	**368**	**371**	**372**	**370**	**373**	**370**	**372**	**357**	**371**	**373**	**373**
LSI	**8.6**	**4.7**	**7.8**	**4.7**	**5.8**	**7.5**	**5.9**	**6.2**	**4.4**	**3.8**	**6.2**	**5.0**	**5.5**	**7.1**	**6.0**	**5.1**	**5.9**	**3.4**	**7.1**	**3.5**	**6.4**	**7.0**	**6.6**
Screening Method	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N-Natural; A-Artificial)

Table 57: NSN-1 entries with low susceptibility index (SI ≤5) with score ≤5 to BB at more than 65% of the locations

Ent. No.	IET NO.	Location /Score (0-9)																				SI	PI (< =5)*
		ADT	CHN	CHP	CHT	CTK	IIRR	GER	GNV	KJT	LDN	MNC	MSD	MTU	NDL	NLR	NVS	PNT	PTB	PTN	RPR		
300	25501	3	3	9	3	5	7	3	5	5	3	1	3	7	5	3	5	5	5	7	5	**4.6**	**80.00**
10	23930	9	3	3	3	5	3	5	9	3	5	0	3	7	5	3	7	3	5	7	5	**4.6**	**75.00**
230	25369	9	3	3	7	7	9	3	5	1	3	0	3	5	5	3	5	5	7	7	5	**4.7**	**70.00**
20	24519	9	3	7	3	3	5	7	3	3	5	1	3	7	5	5	7	5	3	7	5	**4.8**	**70.00**
135	25252	5	5	3	3	5	7	7	5	3	7	1	3	7	5	3	3	5	7	7	5	**4.8**	**70.00**
22	24496	7	3	7	3	7	3	5	5	5	5	1	7	7	7	1	5	5	5	5	5	**4.9**	**70.00**
255	25467	9	3	7	5	3	1	7	5	1	3	7	5	5	7	5	7	3	5	5	5	**4.9**	**70.00**
80	24951	9	3	7	3	3	3	5	3	3	7	1	7	5	7	3	7	5	3	9	5	**4.9**	**65.00**
81	24855 (Repeat)	9	3	7	3	7	1	7	3	5	7	1	5	5	7	3	5	3	5	5	7	**4.9**	**65.00**
127	25269	5	3	5	1	3	7	5	7	7	3	1	5	7	5	3	7	7	5	7	5	**4.9**	**65.00**
87	24954	9	3	7	5	3	3	5	3	3	3	5	7	5	5	7	5	5	5	7	5	**5.0**	**75.00**
299	25520	9	3	7	5	5	3	5	3	3	3	5	5	5	7	7	5	3	5	7	5	**5.0**	**75.00**
93	24426	9	3	1	1	5	7	-	5	3	7	1	5	7	5	5	7	9	5	5	5	**5.0**	**68.42**
372	RP-Bio-226 (R)	7	7	5	3	5	3	5	3	3	3	5	3	5	5	7	5	3	3	7	3	**4.5**	**80.00**
365	TN1 (S)	9	9	9	3	9	9	7	9	7	9	7	9	7	5	7	9	9	7	5	7	**7.6**	**15.00**
LSI		**8.7**	**4.7**	**7.9**	**4.7**	**5.8**	**7.6**	**6.0**	**6.3**	**4.5**	**6.2**	**5.1**	**5.5**	**7.2**	**6.0**	**5.1**	**5.9**	**7.2**	**6.4**	**7.0**	**6.6**		

(SI-Susceptibility index; Promising index (PI) based on number of locations where the entry scored ≤5)

Table 58: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-2, *Kharif* 2016

Score	Location/Frequency of scores (0-9)														
	ADT	**ARD**	**CTK**	**GER**	**GNV**	**IIRR**	**KJT**	**LDN**	**MNC**	**MSD**	**MTU**	**PNT**	**PTB**	**PTN**	**RPR**
0	2	87	0	0	0	0	0	0	41	0	0	0	0	0	0
1	0	236	0	0	2	16	40	2	43	0	0	3	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	11	198	15	30	142	23	163	243	78	90	1	31	10	51	11
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	26	103	151	265	202	21	234	51	131	279	34	103	155	239	174
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	86	31	344	285	138	201	191	361	316	269	409	138	290	284	474
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	515	0	148	33	177	385	11	1	51	11	181	384	198	89	1
Total	**640**	**655**	**658**	**613**	**661**	**646**	**639**	**632**	**660**	**649**	**625**	**659**	**653**	**663**	**660**
LSI	**8.4**	**2.4**	**6.9**	**6.0**	**6.0**	**7.8**	**4.9**	**5.4**	**5.5**	**5.6**	**7.5**	**7.6**	**7.1**	**6.2**	**6.4**
Screening Method	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N-Natural; A-Artificial)

Table 59: NSN-2 entries with low susceptibility index (SI ≤5) with score ≤5 to BB at more than 65% of the locations

Ent. No.	IET NO.	Locations/Score (0-9)														SI	PI (< =5)*
		ADT	CTK	GER	GNV	IIRR	KJT	LDN	MNC	MSD	MTU	PNT	PTB	PTN	RPR		
244	25935	7	7	5	5	1	5	3	1	7	5	3	5	3	5	**4.4**	**78.57**
236	25927	5	5	3	7	7	3	3	0	3	7	7	5	5	5	**4.6**	**71.43**
116	26306	9	5	5	3	7	1	3	3	3	7	5	5	5	5	**4.7**	**78.57**
161	25901	5	5	5	3	5	3	7	1	3	7	7	5	5	5	**4.7**	**78.57**
146	25886	9	7	3	5	3	1	3	0	5	7	7	5	7	5	**4.8**	**64.29**
10	25190	7	5	5	3	7	3	5	1	3	-	7	5	5	7	**4.8**	**69.23**
63	25861	9	5	-	3	7	3	3	1	5	7	7	5	3	5	**4.8**	**69.23**
451	26106	7	5	5	5	1	5	1	7	7	5	5	5	5	5	**4.9**	**78.57**
155	25895	3	7	3	5	7	3	3	1	5	7	9	5	5	5	**4.9**	**71.43**
178	25918	3	7	5	3	5	3	3	1	5	7	7	9	5	5	**4.9**	**71.43**
61	25219	5	7	5	3	7	3	3	3	5	7	5	5	5	7	**5.0**	**71.43**
268	25952	5	5	5	5	7	7	3	5	3	7	5	7	3	3	**5.0**	**71.43**
333	26023	5	7	3	3	7	5	5	5	3	7	5	5	3	7	**5.0**	**71.43**
662	RP-Bio-226 (R)	9	5	5	3	3	3	3	7	3	7	3	3	7	3	**4.6**	**71.43**
655	TN1 (S)	9	9	7	7	9	7	7	7	9	9	9	7	9	7	**8.0**	**0.00**
LSI		**8.4**	**6.9**	**6.0**	**6.0**	**7.8**	**4.9**	**5.4**	**5.5**	**5.6**	**7.5**	**7.6**	**7.1**	**6.2**	**6.4**		

(SI-Susceptibility index; Promising index (PI) based on number of locations where the entry scored ≤5)

The disease pressure was very high (LSI > 7) at IIRR (7.9), Pantnagar (7.6) and Cuttack (7.0); high (LSI-6-7) at Gerua (6.2) and moderate (LSI-3-6) at Karjat (4.6). The selection of promising entries was done based on the data of those locations where LSI was more than 3 and therefore, all the locations were taken into account for selection of best entries. The promising entries with SI ≤ 6 and which exhibited a score of 5 or less at more than 60% of the locations are presented in Table 61. Some of the promising entries were IET # 25834, 25826 and 25846.

Table 60: Location severity index (LSI) and frequency distribution of bacterial blight scores of NSN-H, *Kharif* 2016

Score	Location/Frequency of scores (0-9)				
	CTK	**GER**	**IIRR**	**KJT**	**PNT**
0	0	0	0	0	0
1	0	0	0	1	2
2	0	0	0	0	0
3	1	0	1	29	2
4	0	0	0	0	0
5	24	19	6	38	10
6	0	0	0	0	0
7	35	28	33	14	25
8	0	0	0	0	0
9	26	0	46	1	47
Total	**86**	**47**	**86**	**83**	**86**
LSI	**7.0**	**6.2**	**7.9**	**4.6**	**7.6**
Screening Method	**A**	**A**	**A**	**A**	**A**

(N-Natural; A-Artificial)

Table 61: NSN-H entries with low susceptibility index (SI ≤6) with score ≤5 to BB at more than 60% of the locations

Ent. No.	IET No.	Locations/Score (0-9)					SI	PI (< =5)*
		CTK	**GER**	**IIRR**	**KJT**	**PNT**		
28	25834	5	-	5	5	5	**5.0**	**100**
69	25826	7	5	5	7	1	**5.0**	**60**
45	25846	5	7	7	5	3	**5.4**	**60**
6	24197	5	-	9	3	5	**5.5**	**75**
55	25814	5	-	5	3	9	**5.5**	**75**
17	24207	3	-	9	3	7	**5.5**	**50**
36	25841	5	-	7	3	7	**5.5**	**50**
59	25153 (Repeat)	5	5	7	3	9	**5.8**	**60**
60	25818	7	5	5	3	9	**5.8**	**60**
4	24188	5	-	9	5	5	**6.0**	**75**
85	RP-Bio-226 (R)	5	7	3	3	1	**3.8**	**80**
78	T(N1) (S)	9	7	9	9	9	**8.6**	**0**
LSI		**7.0**	**6.2**	**7.9**	**4.6**	**7.6**		

(SI-Susceptibility index; Promising index (PI) based on number of locations where the entry scored ≤5)

- **NHSN**

The nursery was evaluated at 19 locations across the country. However, the disease did not develop at Upper Shillong and the data were not considered for analysis. The entries were evaluated under artificially inoculated conditions at all the remaining locations. The frequency distribution of the disease scores and location severity indices are presented in Table 62. The disease pressure was very high (LSI > 7) at Aduthurai (9.0), IIRR (7.8), Maruteru (7.7) and Pantnagar (7.4); high (LSI-6-7) at Raipur (6.8), Moncompu (6.5), Pattambi (6.4), Navsari (6.3), Patna (6.2) and Gerua (6.0); moderate (LSI-3-6) at Gangavati (5.8), Masodha, Faizabad (5.6), Ludhiana (5.5), Chatha (5.4), Kaul (5.2), Chinsurah (4.9), Karjat (4.4) and Nawagam (3.8). The selection of promising entries was done based on the data of those locations where LSI was more than 4. Accordingly, the data of Nawagam was not considered for selection of promising entries. The promising entries with SI ≤ 5.5 and which exhibited a score of 5 or less at more than 60% of the locations are presented in Table 63.

None of the entries were on par with the resistant check RP Bio 226 (Improved Samba Mahsuri). Some of the promising entries identified in the trial were IET # 25796, 25745, 24888, 25788, 24891, 24892, 25784, 25785 and 25738.

- **DSN**

The nursery was evaluated at 20 locations across the country. No disease was observed at Upper Shillong and the data were not considered for analysis. The entries were evaluated under artificially inoculated conditions at all the remaining locations. The frequency distribution of the disease scores and location severity indices are presented in Table 64. The disease pressure was very high (LSI > 7) at Aduthurai (8.8), Chiplima (7.6), IIRR, Hyderabad (7.5), Cuttack (7.3) and Pantnagar (7.1); high (LSI-6-7) at Pattambi (6.7), Navsari (6.5), Maruteru (6.4), Patna (6.3) and Raipur (6.3); moderate (LSI 3-6) at Gerua (5.8), Gangavati (5.6), Ludhiana (5.4), Moncompu (5.3), Chatha (5.3), Masodha, Faizabad (5.1), Karjat (5.1) and Kaul (3.6) and low (LSI <3) at Nawagam (1.9).

The selection of promising entries was done based on the data of those locations where LSI was more than 4. Accordingly, the data of Kaul and Nawagam were not considered for selection of promising entries. The promising entries with SI ≤ 5.5 and which exhibited a score of 5 or less at more than 60% of the locations are presented in Table 65. None of the entries were on par with the resistant check RP Bio-226 (Improved Samba Mahsuri). Some of the promising entries identified in the trial were RMS-BL-1, RMS-BL-22, RMS-BL-2, RMS-BL-11, RMS-BL-21, RMS-BL-13 and RMS-BL-16.

Table 62: Location severity index (LSI) and frequency distribution of bacterial blight scores of NHSN, *Kharif* 2016

Score	Location/Frequency of scores (0-9)																	
	ADT	**CHN**	**CHT**	**GER**	**GNV**	**IIRR**	**KJT**	**KUL**	**LDN**	**MNC**	**MSD**	**MTU**	**NVS**	**NWG**	**PNT**	**PTB**	**PTN**	**RPR**
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	2	1	20	1	3	1	0	0	0	11	1	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	50	25	6	40	14	34	34	36	10	12	0	9	76	13	7	18	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	52	65	60	39	12	59	60	40	27	76	9	50	44	27	53	53	18
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	36	53	57	29	14	30	44	51	94	50	79	67	14	19	65	45	127
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	138	6	2	5	35	103	0	2	13	13	3	56	19	0	85	20	29	0
Total	**139**	**145**	**145**	**128**	**145**	**144**	**143**	**141**	**143**	**145**	**141**	**144**	**145**	**145**	**145**	**145**	**145**	**145**
LSI	**9.0**	**4.9**	**5.4**	**6.0**	**5.8**	**7.8**	**4.4**	**5.2**	**5.5**	**6.5**	**5.6**	**7.7**	**6.3**	**3.8**	**7.4**	**6.4**	**6.2**	**6.8**
Screening Method	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N-Natural; A-Artificial)

Table 63: NHSN entries with low susceptibility index (SI ≤5.5) with score ≤5 to BB at more than 60% of the locations

Ent. No.	IET NO.	Locations/Score (0-9)																	SI	PI (< =5)*
		ADT	CHN	CHT	GER	GNV	IIRR	KJT	KUL	LDN	MNC	MSD	MTU	NVS	PNT	PTB	PTN	RPR		
100	25796	9	3	7	3	7	3	3	1	1	7	3	5	7	3	5	7	5	**4.6**	**64.71**
44	25745	9	3	3	5	5	3	1	7	5	7	5	5	7	5	3	3	7	**4.8**	**70.59**
112	24888	9	3	3	5	5	3	3	5	1	7	7	5	5	5	7	5	7	**5.0**	**70.59**
91	25788	9	3	5	-	3	5	1	3	3	7	7	7	5	7	5	5	7	**5.1**	**62.50**
103	24891	9	3	3	5	3	5	5	3	3	5	5	7	7	9	5	7	5	**5.2**	**70.59**
111	24892	9	3	5	7	5	3	5	3	3	5	5	7	7	5	7	5	5	**5.2**	**70.59**
87	25784	9	3	3	7	5	5	3	5	7	5	5	7	5	5	7	5	5	**5.3**	**70.59**
88	25785	9	3	5	7	3	5	3	7	3	7	5	7	5	5	7	5	5	**5.3**	**64.71**
36	25738	9	3	5	5	9	5	3	3	5	7	5	7	5	3	5	7	7	**5.4**	**64.71**
144	RP-Bio-226 (R)	9	3	3	5	3	3	5	3	1	3	3	5	5	5	5	3	7	**4.1**	**88.24**
137	T(N1) (S)	9	7	5	-	9	9	7	5	7	7	9	9	7	9	7	7	7	**7.5**	**12.50**
LSI		**9.0**	**4.9**	**5.4**	**6.0**	**5.8**	**7.8**	**4.4**	**5.2**	**5.5**	**6.5**	**5.6**	**7.7**	**6.3**	**7.4**	**6.4**	**6.2**	**6.8**		

(SI-Susceptibility index; Promising index (PI) based on number of locations where the entry scored ≤5)

Table 64: Location severity index (LSI) and frequency distribution of bacterial blight scores of DSN, *Kharif* 2016

Score	Location/Frequency of scores (0-9)																		
	ADT	**CHP**	**CHT**	**CTK**	**GER**	**GNV**	**IIRR**	**KJT**	**KUL**	**LDN**	**MNC**	**MSD**	**MTU**	**NVS**	**NWG**	**PNT**	**PTB**	**PTN**	**RPR**
0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
1	0	0	1	0	0	1	2	5	5	0	8	0	0	0	60	0	0	0	0
2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	1	19	1	4	33	12	23	62	41	20	15	2	5	48	7	2	13	7
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2	21	51	22	50	31	4	46	30	4	16	61	34	33	1	26	28	36	25
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	8	31	34	43	40	23	28	34	1	64	57	22	69	54	0	28	66	38	77
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	93	55	2	43	2	21	63	1	0	0	4	0	4	17	0	47	13	22	0
Total	**103**	**108**	**108**	**109**	**96**	**109**	**109**	**109**	**98**	**109**	**109**	**98**	**109**	**109**	**109**	**108**	**109**	**109**	**109**
LSI	**8.8**	**7.6**	**5.3**	**7.3**	**5.8**	**5.6**	**7.5**	**5.1**	**3.6**	**5.4**	**5.3**	**5.1**	**6.4**	**6.5**	**1.9**	**7.1**	**6.7**	**6.3**	**6.3**
Screening Method	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

(N-Natural; A-Artificial)

Table 65: DSN entries with low susceptibility index (SI ≤ 5.5) with score ≤5 to BB at more than 60% of the locations

Ent. No.	Designation	Locations/Score (0-9)																	SI	PI (< 5)*
		ADT	CHP	CHT	CTK	GER	GNV	IIRR	KJT	LDN	MNC	MSD	MTU	NVS	PNT	PTB	PTN	RPR		
23	RMS-BL-1	9	7	5	7	5	7	3	3	3	1	3	5	7	3	5	7	3	**4.8**	**64.71**
44	RMS-BL-22	9	5	3	7	5	7	3	3	3	5	5	5	7	5	5	5	5	**5.1**	**76.47**
24	RMS-BL-2	9	9	7	7	5	3	3	5	3	5	7	5	5	3	5	5	3	**5.2**	**70.59**
33	RMS-BL-11	5	5	5	7	7	5	7	3	3	3	3	5	7	3	7	9	5	**5.2**	**64.71**
43	RMS-BL-21	9	7	3	5	5	9	3	5	3	1	5	5	9	5	5	7	5	**5.3**	**70.59**
35	RMS-BL-13	7	5	7	5	5	3	5	5	3	5	3	5	7	5	7	7	7	**5.3**	**64.71**
38	RMS-BL-16	9	7	5	9	5	5	3	1	5	3	-	5	7	3	5	9	7	**5.5**	**62.50**
79	RP-BIO-226 (R)	9	5	5	5	5	3	3	3	3	5	3	3	7	3	5	7	3	**4.5**	**82.35**
72	TN1 (S)	-	9	5	9	-	7	7	5	7	7	-	7	5	9	7	5	7	**6.8**	**28.57**
LSI		**8.8**	**7.6**	**5.3**	**7.3**	**5.8**	**5.6**	**7.5**	**5.1**	**5.4**	**5.3**	**5.1**	**6.4**	**6.5**	**7.1**	**6.7**	**6.3**	**6.3**		

(SI-Susceptibility index; Promising index (PI) based on number of locations where the entry scored ≤5)

❖ RICE TUNGRO DISEASE

➢ NSN-1

The screening nursery was evaluated at 3 locations *viz*., Coimbatore, IIRR and Gerua. At IIRR and Coimbatore, the nursery was evaluated by artificial inoculation with the aid of leafhopper transmission in the glass house and at Gerua the trial was conducted under natural conditions. The frequency distribution of disease scores and location severity indices are presented in Table 66. The disease pressure was high at IIRR (LSI 6.4) followed by Gerua (LSI 6.0) and moderate at Coimbatore (LSI 5.0).

Table 66: Location severity index (LSI) and frequency distribution of rice tungro virus scores for NSN-1, *Kharif* 2016

Score	Location/Frequency of score (0-9)		
	CBT	**GER**	**IIRR**
1	29	0	0
3	100	3	6
5	122	22	102
7	75	17	265
9	39	4	0
Total	**365**	**46**	**373**
LSI	**5.0**	**6.0**	**6.4**
Screening method	**A**	**N**	**A**

(N-Natural; A-Artificial)

The selection of promising entries was done based on the data from locations where the disease pressure was moderate to high. Some of the entries performed better than the resistant check Vikramarya and the entries that are showing moderate resistance to rice tungro disease are IET # 24338, 25123, 24505 and 24519 (Table 67).

Table 67: NSN-1 entries with low susceptibility index (SI ≤ 5) against rice tungro disease, *Kharif* 2016

Ent. No	IET No.	Locations/score (0-9)			SI	<=5*	PI (<=5)**
		CBT	**GER**	**IIRR**			
219	24338	1	-	3	**2**	**2**	**100.0**
6	25123	3	5	5	**4**	**3**	**100.0**
19	24505	3	5	5	**4**	**3**	**100.0**
20	24519	3	5	5	**4**	**3**	**100.0**
364	Vikramarya	3	-	3	**3**	**2**	**100.0**
365	T(N1)	5	-	7	**6**	**1**	**50.0**
LSI		**5.0**	**6.0**	**6.4**			

(SI-Susceptibility Index; * No. of locations where the entry has scored ≤ 5; ** Promising index (PI) based on no. of location where the entry has scored ≤ 5)

- **NSN- 2**

The screening nursery was evaluated at 2 locations *viz.,* Gerua and IIRR. The screening was done by artificial inoculation in the glass house at IIRR whereas at Gerua it was done under natural field conditions. The disease pressure recorded was high at IIRR (LSI 6.3) and it was moderate at Gerua (LSI 5.0). The frequency distribution of disease scores and location severity index are presented in the Table 68.

Table 68: Location severity index (LSI) and frequency distribution of rice tungro virus scores for NSN-2, *Kharif* 2016

Score	Location/Frequency of score (0-9)	
	GER	IIRR
1	0	0
3	1	14
5	1	219
7	1	427
9	0	0
Total	**3**	**660**
LSI	**5.0**	**6.3**
Screening Method	**N**	**A**

(N-Natural; A-Artificial)

The performance of the entries was evaluated based on the data from the locations where disease pressure was moderate to high. None of the entries were found to be resistant to rice tungro disease at both the centres.

- **NSN- H**

The NSN-hills trail consisting of 86 entries was conducted only at Gerua with high location severity index of 6.3. Of the total 86 entries, only one entry IET # 25769 exhibited score 3; 16 entries showed score 5 and rest of the entries were susceptible to RTD.

- **NHSN**

The screening nursery was evaluated at 3 centres *viz*., Coimbatore, Gerua and IIRR. The frequency distribution of disease scores and LSI are presented in Table 69. The disease pressure was high at Gerua (6.5) followed by IIRR (6.1) and moderate at Coimbatore (5.6).

The best entries which showed overall SI< 5 are listed in Table 70. The best entries are: IET # 25769, 25717, 25752, 25770, 25710, 25789, 25792, 25804, 25806 and 25810.

Table 69: Location severity index (LSI) and frequency distribution of rice tungro virus scores for NHSN, *Kharif* 2016

Score	Location/Frequency of score (0-9)		
	CBT	GER	IIRR
1	3	0	0
3	31	2	6
5	50	30	55
7	36	91	84
9	23	5	0
Total	**143**	**128**	**145**
LSI	**5.6**	**6.5**	**6.1**
Screening Method	**A**	**N**	**A**

(N-Natural; A-Artificial)

Table 70: NHSN entries with low susceptibility index (SI <=5) against rice tungro virus, *Kharif* 2016

Ent. No	IET NO.	Locations/score (0-9)			SI	<=5*	PI (<=5)**
		CBT	GER	IIRR			
129	KRH-4 (OBCH-3)	1	5	5	**3.7**	**3**	**100.0**
70	25769	3	-	5	**4.0**	**2**	**100.0**
138	Nidhi	3	-	5	**4.0**	**2**	**100.0**
11	25717	3	5	5	**4.3**	**3**	**100.0**
52	25752	3	5	5	**4.3**	**3**	**100.0**
125	DRRH-3 (NCH)	5	3	5	**4.3**	**3**	**100.0**
135	Tetep	3	5	5	**4.3**	**3**	**100.0**
71	25770	3	7	3	**4.3**	**2**	**66.7**
4	25710	3	5	7	**5.0**	**2**	**66.7**
92	25789	3	5	7	**5.0**	**2**	**66.7**
93	Pantdhan-19	3	5	7	**5.0**	**2**	**66.7**
96	25792	3	7	5	**5.0**	**2**	**66.7**
118	25804	3	5	7	**5.0**	**2**	**66.7**
119	BPT-5204	3	7	5	**5.0**	**2**	**66.7**
122	25806	3	5	7	**5.0**	**2**	**66.7**
127	25810	3	7	5	**5.0**	**2**	**66.7**
136	Vikramarya	3	7	3	**4.3**	**2**	**66.7**
137	T(N1) (S)	5	-	7	**6.0**	**1**	**50.0**
LSI		**5.6**	**6.5**	**6.1**			

(SI-Susceptibility Index; * No. of locations where the entry has scored ≤ 5; ** Promising index (PI) based on no. of location where the entry has scored ≤ 5)

- **DSN**

The nursery was evaluated at 3 locations *viz.*, Coimbatore, IIRR and Gerua. The frequency distribution of disease scores and LSI are presented in Table 71. The disease pressure was high at Gerua (LSI 6.2) followed by IIRR (LSI 6.0), moderate at Coimbatore (LSI 5.1) and the data from all the centres were considered for the selection of promising entries.

Table 71: Location severity index (LSI) and frequency distribution of rice tungro virus scores for *Kharif* 2016

Score	Location/Frequency of RTD score (0-9)		
	CBT	GER	IIRR
1	5	0	0
3	23	6	2
5	48	30	52
7	26	56	55
9	6	4	0
Total	**108**	**96**	**109**
LSI	**5.1**	**6.2**	**6.0**
Screening Method	**A**	**N**	**A**

(N-Natural; A-Artificial)

The DSN entries showed a moderate level of resistance to rice tungro virus are listed in Table 72. These promising entries included CB 05022, VL-31430, VL-31817, PRDF-214-10, RMS-BL-3, RMS-BL-13, CB 09123, Vikramarya, RP-Patho-6, CB 1107, RP-Patho-9, VL-31598, RMS-BL-9, CB 14932, CB 13532, RP-Bio-Patho-3, VL-32197, VL-32216 and KMP-220.

Table 72: DSN entries with low susceptibility index (SI <=5) against rice tungro virus, *Kharif* 2016

Ent. No.	Designation	Locations/score (0-9)			SI	<=5*	PI (<=5)**
		CBT	GER	IIRR			
57	CB 05022	1	3	5	**3.0**	**3**	**100.0**
3	VL-31430	3	3	5	**3.7**	**3**	**100.0**
9	VL-31817	3	-	5	**4.0**	**2**	**100.0**
107	HR-12	1	-	7	**4.0**	**1**	**50.0**
21	PRDF-214-10	3	5	5	**4.3**	**3**	**100.0**
25	RMS-BL-3	3	5	5	**4.3**	**3**	**100.0**
35	RMS-BL-13	3	5	5	**4.3**	**3**	**100.0**
58	CB 09123	3	5	5	**4.3**	**3**	**100.0**
71	Vikramarya	5	5	3	**4.3**	**3**	**100.0**
89	RP-Patho-6	3	5	5	**4.3**	**3**	**100.0**
59	CB 1107	3	3	7	**4.3**	**2**	**66.7**
92	RP-Patho-9	1	7	5	**4.3**	**2**	**66.7**
5	VL-31598	5	5	5	**5.0**	**3**	**100.0**

Ent. No.	Designation	Locations/score (0-9)			SI	<=5*	PI (<=5)**
		CBT	GER	IIRR			
31	RMS-BL-9	5	5	5	**5.0**	**3**	**100.0**
54	CB 14932	5	5	5	**5.0**	**3**	**100.0**
56	CB 13532	5	5	5	**5.0**	**3**	**100.0**
98	RP-Bio-Patho-3	5	5	5	**5.0**	**3**	**100.0**
14	VL-32197	7	3	5	**5.0**	**2**	**66.7**
15	VL-32216	5	3	7	**5.0**	**2**	**66.7**
19	KMP-220	5	3	7	**5.0**	**2**	**66.7**
72	T(N1)	-	7	-	**7.0**	**0**	**0**
LSI		**5.1**	**6.2**	**6.0**			

(SI-Susceptibility Index; * No. of locations where the entry has scored ≤ 5; ** Promising index (PI) based on no. of location where the entry has scored ≤ 5)

➢ MULTIPLE DISEASE RESISTANCE

Among the test entries evaluated for resistance against various diseases in NSN-1, only one entry (IET # 25501) showed resistance to three diseases *viz.*, sheath blight, bacterial leaf blight and rice tungro disease. Four entries had shown resistance to two diseases *viz.*, IET # 23930 (resistance to neck blast and bacterial leaf blight), IET # 24519 (resistance to neck blast and sheath rot) and IET # 24956 (resistance to leaf blast and glume discoloration), IET # 25278 (resistance to leaf blast and neck blast) (Table 73).

Table 73: Multiple disease resistant lines in NSN-1, *Kharif* 2016

IET. No	Disease/Susceptiblity Index						
	LB	NB	ShBL	GD	BLB	RTD	ShR
25501	-	-	5.3	-	4.6	3.0	-
23930	-	2.8	-	-	4.7	-	-
24519	-	2.8	-	-	-	-	4.0
24956	3.7	-	-	3.0	-	-	-
25278	3.6	2.8	-	-	-	-	-

(BL-Blast; NBL-Neck blast; ShBL-Sheath blight; BS-Brown spot; ShR-Sheath rot; GD- Grain discolouration; BLB-Bacterial leaf blight; RTD- Rice tungro disease)

In NSN-2 IET # 25186 showed multiple disease resistance to neck blast, brown spot and sheath rot. Few lines showed resistantance to more than one disease. They are IET # 25186, 25894, 25895, 25918, 25927, 25935 and 26045 (Table 74).

Table 74: Multiple disease resistance in NSN-2, *Kharif* 2016

IET. No	Disease/ Susceptiblity Index				
	LB	NB	BS	BLB	ShR
25186	-	2.0	4.7	-	4.4
25894	-	2.7	4.8	-	-
25895	-	3.0	-	4.9	-
25918	-	3.0	-	4.9	-
25927	-	4.9	-	4.6	-
25935	3.6	-	-	4.4	-
26045	-	3.0	4.9	-	-

(BL-Blast; NBL-Neck blast; ShBL-Sheath blight; BS-Brown spot; ShR-Sheath rot; GD- Grain discolouration; BLB-Bacterial leaf blight; RTD- Rice tungro disease)

Under NSN-H, 6 lines showed resistance to two diseases *viz*., IET # 25813 (resistance to neck blast and sheath blight), IET # 25167 (leaf blast and neck blast), IET# 25826 (neck blast and bacterial leaf blight), IET # 25834 (resistance to brown spot and bacterial leaf blight), IET # 25840 and 25841 (leaf blast and neck blast) (Table 75).

Table 75: Multiple disease resistance in NSN-H, *Kharif* 2016

IET. No	Disease/ Susceptiblity Index				
	LB	NB	ShBL	BS	BLB
25813	-	3.8	4.0	-	-
25167	3.9	3.8	-	-	-
25826	-	3.5	-	-	5.0
25834	-	-	-	4.3	5.0
25840	3.4	3.4	-	-	-
25841	3.6	3.8	-	-	-

(BL-Blast; NBL-Neck blast; ShBL-Sheath blight; BS-Brown spot; ShR-Sheath rot; GD- Grain discolouration; BLB-Bacterial leaf blight; RTD- Rice tungro disease)

In NHSN, entries which show resistance to two diseases included IET Nos. 25739, 25748, 25750 and 25790 (resistance to leaf blast and glume discoloration) (Table 76).

Table 76: Multiple disease resistance in NHSN, *Kharif* 2016

IET. No	Disease/ Susceptiblity Index							
	LB	NB	ShBL	BS	GD	BLB	RTD	ShR
25739	3.4	-	-	-	4.0	-	-	-
25748	3.2	-	-	-	4.0	-	-	-
25750	3.7	-	-	-	4.0	-	-	-
25790	3.8	-	-	-	4.0	-	-	-

(BL-Blast; NBL-Neck blast; ShBL-Sheath blight; BS-Brown spot; ShR-Sheath rot; GD- Grain discolouration; BLB-Bacterial leaf blight; RTD- Rice tungro disease)

In DSN screening nurseries entry which showed resistance to three diseases were VL-31430 (leaf blast, glume discoloration and rice tungro disease). Few lines resistant to two diseases were CB 1107 and CB 05022 (sheath blight and rice tungro disease), RMS-BL-13 (rice tungro disease and leaf scald) and RP-Patho-6 (against neck blast and rice tungro disease) (Table 77).

Table 77: Multiple disease resistance in DSN *Kharif* 2016

Designation	Disease/Susceptible Index								
	LB	**NB**	**ShBL**	**BS**	**GD**	**BLB**	**RTD**	**ShR**	**LS**
CB 1107	-	-	5.2	-	-	-	4.3	-	-
CB 05022	-	-	4.5	-	-	-	3.0	-	-
RMS-BL-13	-	-	-	-	-	-	4.3	-	3.0
RP-Patho-6	-	3.3	-	-	-	-	4.3	-	-
VL-31430	3.6		-	-	4.0	-	3.7	-	-

(BL-Blast; NBL-Neck blast; ShBL-Sheath blight; BS-Brown spot; LS-Leaf Scald; GD- Grain discolouration; BLB-Bacterial leaf blight; RTD- Rice tungro disease)

2. GERMPLASM SCREENING NURSERY (AGRO BIODIVERSITY)

In Agro Biodiversity (Germplasm) screening nursery, a total of 1214 germplasm accessions along with checks were evaluated in *Kharif* 2016 for resistance against major rice diseases at seven locations. The details of test locations and severity of the diseases at locations are mentioned in the Table 78 and 79 respectively.

Table 78: Evaluation of Agro Biodiversity (germplasm) for disease resistance at different locations, *Kharif* 2016

S. No.	Location	Proposed for screening against	Disease /Data received					Total
			Blast	Sheath Blight	Brown spot	Bacterial leaf blight	Rice tungro disease	
1	Almora (ALM)	Blast	✓					**1**
2	Coimbatore (CBT)	Blast & Brown spot	✓		✓			**2**
3	Cuttack (CTK)	Blast, Sheath blight, Brown spot, BLB & RTD		✓				**1**
4	Hazaribagh (HZB)	Blast & Brown spot	✓					**1**
5	Indian Institute of Rice Research (IIRR)	Blast, Sheath blight, Brown spot, BLB & RTD	✓	✓		✓	✓	**4**
6	Pantnagar (PNT)	BLB		✓		✓		**2**
7	Titabar (TTB)	Sheath blight		✓		✓		**2**
Total			**4**	**3**	**1**	**3**	**1**	

Table 79: Location Severity Index (LSI) at test locations for entries evaluated in agro biodiversity project, *Kharif* 2016

S. No.	Location	Disease/Location severity index					Total
		Blast	Sheath Blight	Brown spot	BLB	RTD	
1.	Almora (ALM)	6.4					**1**
2.	Coimbatore (CBT)	5.6		6.1			**2**
3.	Cuttack (CTK)		7.2				**1**
4.	Hazaribagh (HZB)	5.7					**1**
5.	Indian Institute of Rice Research (IIRR)	7.0	7.4		7.3	6.0	**4**
6.	Pantnagar (PNT)		3.2		7.7		**2**
7.	Titabar (TTB)		2.3		4.9		**2**

- **Blast**

The accessions were evaluated at Almora, Coimbatore, Hazaribagh and IIRR and with LSI 6.4, 5.6, 5.7 and 7.0 respectively. The location severity index along with frequency distribution of disease scores are presented in the Table 80. The entries that scored less disease are presented in the Table 81. They are IC Nos. 245865, 246277, 246403, 246274, 454167, 121865, 199562, 218270, 245927, 246012, 246228, 246273 and 246659.

Table 80: Location severity index and frequency distribution of leaf blast disease scores of entries evaluated in agro biodiversity project, *Kharif* 2016

Score	Location / Frequency of score (0-9)			
	ALM	**CBT**	**HZB**	**IIRR**
0	0	0	17	0
1	0	0	84	1
2	0	0	110	6
3	22	16	131	45
4	0	313	76	91
5	570	324	82	157
6	26	230	94	97
7	294	138	162	357
8	2	180	176	34
9	272	8	249	416
-	28	5	33	10
Effective Sample	**1186**	**1209**	**1181**	**1204**
Total	**1214**	**1214**	**1214**	**1214**
LSI	**6.4**	**5.6**	**5.7**	**7.0**
Inoculation	**N**	**A**	**-**	**A**

(N-Natural, A- Artificial)

Table 81: Entries evaluated in agro biodiversity project with low susceptibility index and high promising index to leaf blast disease, *Kharif* 2016

Ent. No.	IC No	Location/Score (0-9)				SI	<=5*	PI**
		ALM	**CBT**	**HZB**	**IIRR**			
1075	IC245865	3	4	0	4	**2.8**	**4**	**100**
1171	IC246277	5	5	0	2	**3.0**	**4**	**100**
1191	IC246403	3	4	1	4	**3.0**	**4**	**100**
1170	IC246274	7	4	0	2	**3.3**	**3**	**75**
102	IC454167	5	4	1	4	**3.5**	**4**	**100**
307	IC121865	5	4	1	4	**3.5**	**4**	**100**
327	IC199562	5	4	1	4	**3.5**	**4**	**100**
911	IC218270	5	5	2	2	**3.5**	**4**	**100**

Ent. No.	IC No	Location/Score (0-9)				SI	<=5*	PI**
		ALM	CBT	HZB	IIRR			
1101	IC245927	3	5	1	5	**3.5**	**4**	**100**
1118	IC246012	5	4	1	4	**3.5**	**4**	**100**
1160	IC246228	5	4	2	3	**3.5**	**4**	**100**
1169	IC246273	5	4	3	2	**3.5**	**4**	**100**
1255	IC246659	5	4	2	3	**3.5**	**4**	**100**
1304	Tetep	5	3	1	1	**2.5**	**4**	**100**
1303	Rasi	7	3	7	3	**5.0**	**2**	**50**
1301	HR-12	5	8	7	9	**7.3**	**1**	**25**
1312	CO -39	7	9	8	7	**7.8**	**0**	**0**
LSI		**6.4**	**5.6**	**5.7**	**7.0**			

(SI-Susceptibility Index;*No. of locations where the entry has scored ≤ 5 ;Promising index (PI) based on no. of locations where the entry had scored ≤ 5)**

- **Sheath blight**

The accessions were evaluated at four centres *viz*., Cuttack, IIRR, Pantnagar and Titabar. At IIRR very high disease pressure was recorded with LSI 7.4. The location severity indices along with the frequency of disease scores are presented in the Table 82. The entries that scored less disease are presented in the Table 83. They were IC # 458442, 454167, 458491X, 210824, 458464, 459446, 17051X, 17122X, 462046, 121904, 216905, 216946, 217203 and 217625.

Table 82: Location severity index and frequency distribution of sheath blight disease scores for entries evaluated in agro biodiversity project *Kharif* 2016

Score	Location / Frequency of score (0-9)			
	CTK	IIRR	PNT	TTB
0	0	0	217	199
1	0	0	38	357
2	1	0	0	0
3	96	3	523	445
4	1	0	0	0
5	154	135	339	132
6	0	0	0	0
7	487	683	56	36
8	0	0	0	0
9	474	391	16	7
-	1	2	25	38
Effective Sample	**1213**	**1212**	**1189**	**1176**
Total	**1214**	**1214**	**1214**	**1214**
LSI	**7.2**	**7.4**	**3.2**	**2.3**
Inoculation	**A**	**A**	**A**	**A**

(N-Natural, A- Artificial)

Table 83: Entries evaluated in agro biodiversity project with low susceptibility index and high promising index to sheath blight disease, *Kharif* 2016

Ent. No.	IC No	Location/Score (0-9)		SI	<=5*	PI**
		IIRR	CTK			
197	IC458442	5	2	**3.5**	**2**	**100**
102	IC454167	5	3	**4.0**	**2**	**100**
153	IC458491X	5	3	**4.0**	**2**	**100**
163	IC210824	5	3	**4.0**	**2**	**100**
210	IC458464	5	3	**4.0**	**2**	**100**
238	IC459446	5	3	**4.0**	**2**	**100**
276	IC17051X	5	3	**4.0**	**2**	**100**
278	IC17122X	5	3	**4.0**	**2**	**100**
283	IC462046	5	3	**4.0**	**2**	**100**
310	IC121904	5	3	**4.0**	**2**	**100**
534	IC216905	5	3	**4.0**	**2**	**100**
546	IC216946	5	3	**4.0**	**2**	**100**
627	IC217203	5	3	**4.0**	**2**	**100**
762	IC217625	5	3	**4.0**	**2**	**100**
1314	Swarnadhan	5	5	**5.0**	**2**	**100**
1306	TN -1	9	7	**8.0**	**0**	**0**
LSI		**7.4**	**7.2**			

(SI-Susceptibility Index;*No. of locations where the entry has scored ≤3 ;Promising index (PI) based on no. of locations where the entry had scored ≤ 3)**

- **Brown Spot**

The accessions were evaluated at Coimbatore with LSI 6.1. The two accessions that scored less disease are IC No's 245963 and 454212.

- **Bacterial leaf blight**

The accessions were evaluated at 3 centres (Pantnagar, IIRR and Titabar). A very high disease pressure was recorded at IIRR and Pantnagar (Table 84). A few accessions that recorded low disease score are presented in the Table 85 included IC No's. 454257X, 458491X, 211170, 211192, 211209, 216505, 216520, 216655, 245667, 246214 and 246677.

Table 84: Location severity index and frequency distribution of bacterial leaf blight disease scores for entries evaluated in agro biodiversity project *Kharif*, 2016

Location	PNT	IIRR	TTB
Score/Inoculation	**A**	**A**	**-**
0	0	0	0
1	3	0	2
2	0	0	0
3	24	4	229
4	0	0	1

Location	PNT	IIRR	TTB
5	211	83	702
6	0	0	0
7	263	857	188
8	0	0	0
9	688	264	3
-	25	6	89
Effective Sample	**1189**	**1208**	**1125**
Total	**1214**	**1214**	**1214**
LSI	**7.7**	**7.3**	**4.9**

(N-Natural, A- Artificial)

Table 85: Entries evaluated in agro biodiversity project with low susceptibility index and high promising index to bacterial leaf blight disease, *Kharif* 2016

Ent. No.	IC No	Location/Score (0-9)			SI	<=5*	PI**
		PNT	IIRR	TTB			
115	IC454257X	3	5	5	**4.3**	**3**	**100**
153	IC458491X	3	7	3	**4.3**	**2**	**67**
347	IC211170	5	3	5	**4.3**	**3**	**100**
360	IC211192	3	7	3	**4.3**	**2**	**67**
371	IC211209	3	5	5	**4.3**	**3**	**100**
387	IC216505	5	5	3	**4.3**	**3**	**100**
394	IC216520	5	5	3	**4.3**	**3**	**100**
451	IC216655	3	7	3	**4.3**	**2**	**67**
1041	IC245667	5	5	3	**4.3**	**3**	**100**
1153	IC246214	7	3	3	**4.3**	**2**	**67**
1263	IC246677	5	5	3	**4.3**	**3**	**100**
1313	ISM	9	3	-	**6.0**	**1**	**50**
1306	TN – 1	7	9	-	**8.0**	**0**	**0**
LSI		**7.7**	**7.3**	**4.9**			

(SI-Susceptibility Index;*No. of locations where the entry has scored ≤5 ;Promising index (PI) based on no. of locations where the entry had scored ≤ 5)**

- **Rice Tungro Disease**

The nursery was evaluated at IIRR (LSI 6.0). A few accessions that scored less disease are IC Nos. 216526, 216753, 216862, 217143, 217277, 217330, 217421, 217606, 217721, 217952, 218372, 218862, 245899, 246078, 246283, 246435, 246567, 246691 and 246795.

Multiple disease resistant entries in Agro biodiversity lines, *Kharif*, 2016

Two entries showed resistance to more than one disease included, IC No. 454167 resistant against blast and sheath blight and IC No 458491X tolerant against sheath blight and BLB disease.

II. FIELD MONITORING OF VIRULENCE

1. *Pyricularia oryzae*

The aim of the experiment is to monitor virulence pattern in the population of blast pathogen. The nursery included twenty five cultivars consisting of international differentials, donors and commercial cultivars. The experiment was conducted at twenty three locations with different dates of sowing during the crop season to monitor the blast reaction on different host genotypes. The disease pressure was very high (LSI > 6) at Imphal and Umiam. It was moderate at Almora, Coimbatore, Cuttack, Gudalur, Ghaghraghat, Jagadalpur, Lonavala, Malan, New Delhi, Navsari, Ponnampet and Pattambi. It was low at Gangavati, IIRR, Khudwani, Karjat, Mugad Mandya, Nellore, Rajendranagar and Upper Shillong. The data from these locations are presented in Table 86.

Tetep, Tadukan and Raminad str-3 were resistant across most of the locations. However, Tetep was recorded susceptible reaction at Ghaghraghat and Umiam. Tadukan was susceptible at Almora, Cuttack, Ghaghraghat, Imphal and Umiam. Raminad str-3 was highly susceptible at Ghaghraghat and Navsari and also susceptible at Coimbatore and Gudalur, Imphal, Ponnampet and Umaiam. The susceptible checks like HR 12 and CO39 recorded low disease score at Mugad and Karjat. The resistant check Rasi recorded high disease score at Cuttack, Imphal, Ponnampet, Umiam and Upper Shillong.

The difference in disease reaction score of susceptible and resistant checks reveals, shift in the pathogen population. The reaction pattern of genotypes at all the locations was grouped into six major groups. The reaction pattern at Almora, Cuttack, Ghaghraghat, Imphal, Varanasi, Navsari, Umiam, Ponnampet, Pattambi and Gangavati were in group one; Jagadalpur, Khudwani and Malan in group two; Coimbatore and Gudalur in group 3; Lonavala and New Delhi in group 4; Karjat, Nellore, IIRR, Mugad, Mandya and Upper Shillong in group 5 and Rajendranagar in group 6. (Figure 1).

Table 86: Reaction of rice genotypes to *Pyricularia oryzae* across the locations, *Kharif* 2016

S. No	Differentials	ALM	CBT	CTK	GDL	GGT	GNV	IIRR	IMP	JDP	KHD	KJT	LNV	MGD	MLN	MND	NDL	NLR	NVS	PNP	PTB	RNR	UMM	USG	SI	<=3*	<=5*
		N	A	A	N	N	A	A	N	N	N	A	N	N	N/A	N/A	A	N	N/A	N	N	N/A	N	N			
22	Tetep	3.5	2.0	4.0	2.0	7.5	2.3	1.0	2.8	2.3	2.0	1.8	1.0	3.0	1.0	0.8	1.0	1.5	4.5	2.8	2.0	3.0	5.5	1.0	**2.5**	**18**	**21**
20	Tadukan	4.3	3.0	4.0	3.0	5.0	3.0	3.0	6.0	2.5	2.5	1.0	1.0	2.5	1.5	1.8	2.0	1.5	6.5	2.8	3.0	3.0	5.0	1.5	**3.0**	**17**	**19**
12	Raminad STR-3	2.0	4.0	6.0	4.0	7.0	2.3	2.0	5.3	2.3	1.5	1.8	2.0	1.5	1.0	1.5	0.0	1.8	7.0	4.5	2.0	3.0	5.0	3.0	**3.1**	**15**	**18**
6	RIL-29	5.0	5.0	4.0	4.0	5.0	3.3	2.5	6.0	2.3	2.0	1.8	5.0	2.0	5.3	0.5	4.0	2.3	3.0	5.0	4.0	4.0	3.5	1.3	**3.5**	**9**	**16**
21	IR-64	5.0	3.0	6.0	3.0	5.0	4.8	3.0	7.5	2.5	2.5	1.8	7.3	2.5	1.0	1.5	5.0	3.3	5.5	4.8	3.0	3.0	1.0	2.0	**3.6**	**13**	**16**
14	NP-125	3.0	3.0	4.0	4.0	6.0	3.8	3.0	7.5	4.5	4.0	2.0	1.8	1.5	1.0	1.3	7.0	2.0	4.0	5.8	4.0	3.0	5.5	3.0	**3.7**	**11**	**18**
13	Zenith	5.0	3.0	4.0	3.0	5.0	4.8	3.0	5.8	3.5	4.0	2.5	2.5	1.8	5.5	1.0	2.0	2.0	7.0	5.0	6.0	3.0	5.0	2.0	**3.8**	**11**	**15**
17	Kanto-51	5.3	3.0	4.0	3.0	5.0	2.8	2.0	6.3	4.0	6.0	1.8	4.8	2.5	4.0	1.8	7.0	2.0	5.5	4.0	3.0	3.0	4.5	2.5	**3.8**	**11**	**17**
8	BL-122	5.3	4.0	6.0	4.0	5.0	3.0	3.0	7.0	4.8	2.5	4.3	6.3	2.8	1.0	1.0	3.0	1.8	7.0	4.0	4.0	4.0	4.5	2.0	**3.9**	**9**	**17**
7	*O.minuta*	5.3	5.0	3.5	4.0	5.0	4.5	3.0	7.8	2.3	4.5	4.0	5.0	1.5	2.5	1.3	1.0	1.5	6.5	4.3	5.0	3.0	8.0	2.8	**4.0**	**9**	**15**
16	Dular	8.5	3.0	4.0	3.0	5.0	3.3	3.0	6.8	5.5	2.5	1.0	1.8	1.3	7.0	1.5	7.0	1.5	5.5	5.8	3.5	4.0	6.0	0.8	**4.0**	**10**	**14**
4	C 105 TTP-4-123	5.3	4.0	4.0	3.0	4.5	3.3	3.0	7.8	3.5	3.5	2.0	5.5	2.8	4.0	2.0	6.0	2.0	6.5	3.0	6.5	3.8	5.0	2.3	**4.0**	**8**	**16**
1	C 101 LAC	5.3	4.0	6.0	3.0	5.0	3.0	2.0	6.8	3.0	3.0	5.3	4.5	2.5	1.3	1.5	6.0	2.8	7.0	3.5	4.0	3.0	8.0	4.8	**4.1**	**10**	**15**
2	C 101 A51	5.0	4.0	4.0	4.0	4.0	2.0	2.0	8.0	3.5	4.5	4.3	6.0	2.0	4.8	3.5	5.0	3.3	5.0	3.0	5.0	3.0	7.0	2.5	**4.1**	**6**	**16**
9	BL-245	5.8	5.0	6.0	4.0	5.0	4.5	2.5	7.3	5.3	3.0	2.0	4.5	2.3	3.3	2.3	6.0	2.5	5.0	5.0	5.5	3.0	4.5	1.5	**4.2**	**8**	**13**
11	C 101 KPT	5.3	3.0	4.0	4.0	5.0	3.5	3.0	8.0	5.0	6.5	4.3	7.3	1.5	1.5	1.0	5.0	4.0	6.0	4.8	5.5	3.0	6.5	2.5	**4.3**	**7**	**13**
5	RIL-10	5.5	4.0	4.0	4.0	5.0	4.5	3.0	8.3	3.5	4.0	2.8	6.0	1.0	7.8	0.5	5.0	2.8	4.0	4.0	4.0	3.0	8.5	6.5	**4.4**	**6**	**15**
10	A 57	5.3	4.0	6.0	4.0	5.5	3.5	3.0	7.8	5.3	4.5	3.3	8.8	2.5	2.0	1.8	4.0	3.5	5.0	5.3	5.5	4.0	6.0	3.5	**4.5**	**4**	**13**
24	Rasi	5.8	3.0	6.0	3.0	5.5	4.5	4.5	8.5	3.0	3.5	2.8	3.0	2.5	4.3	3.5	3.0	3.8	5.0	6.8	4.5	3.0	9.0	6.8	**4.6**	**8**	**15**
15	USEN	4.8	7.0	4.0	7.0	5.0	4.8	2.5	8.0	3.8	3.0	4.8	8.0	1.8	5.8	1.5	7.0	4.0	6.0	6.0	4.0	3.0	7.5	2.5	**4.8**	**6**	**13**
19	Calaro	5.3	7.0	4.0	7.0	5.0	5.3	2.5	8.8	4.0	5.5	1.0	8.8	2.5	6.0	2.0	3.0	1.8	6.0	6.0	6.5	3.0	9.0	5.5	**5.0**	**7**	**9**
3	C 104 PKT	6.0	7.0	3.5	7.0	4.0	2.8	3.0	7.5	4.5	4.5	4.5	8.8	2.5	6.8	4.0	6.5	3.5	4.5	6.0	7.0	3.0	9.0	7.5	**5.4**	**4**	**12**
18	Shi-tia-rao	8.0	8.0	6.0	9.0	5.0	4.0	5.0	7.8	6.0	5.0	4.3	2.8	2.5	8.8	3.0	3.0	5.8	5.5	4.8	7.0	7.0	8.5	3.5	**5.7**	**4**	**8**
25	CO 39	7.3	9.0	8.0	9.0	7.0	5.0	7.0	8.5	8.0	7.0	4.8	9.0	1.8	6.0	4.5	9.0	6.3	5.0	8.0	9.0	8.0	9.0	8.3	**7.1**	**1**	**3**
23	HR-12	6.8	9.0	8.0	9.0	7.0	8.0	9.0	8.3	7.8	7.0	4.3	9.0	5.0	8.5	5.5	8.0	6.5	6.0	8.3	7.0	9.0	7.0	7.8	**7.5**	**0**	**1**
LSI		**5.3**	**4.6**	**4.9**	**4.6**	**5.3**	**3.8**	**3.2**	**7.2**	**4.1**	**3.9**	**2.9**	**5.2**	**2.2**	**4.1**	**2.0**	**4.6**	**2.9**	**5.5**	**4.9**	**4.8**	**3.8**	**6.3**	**3.5**			

(SI-Susceptibility index; *Promising index (PI) based on no. of locations where the entry scored <u>≤</u> 3 and <u><5)</u>

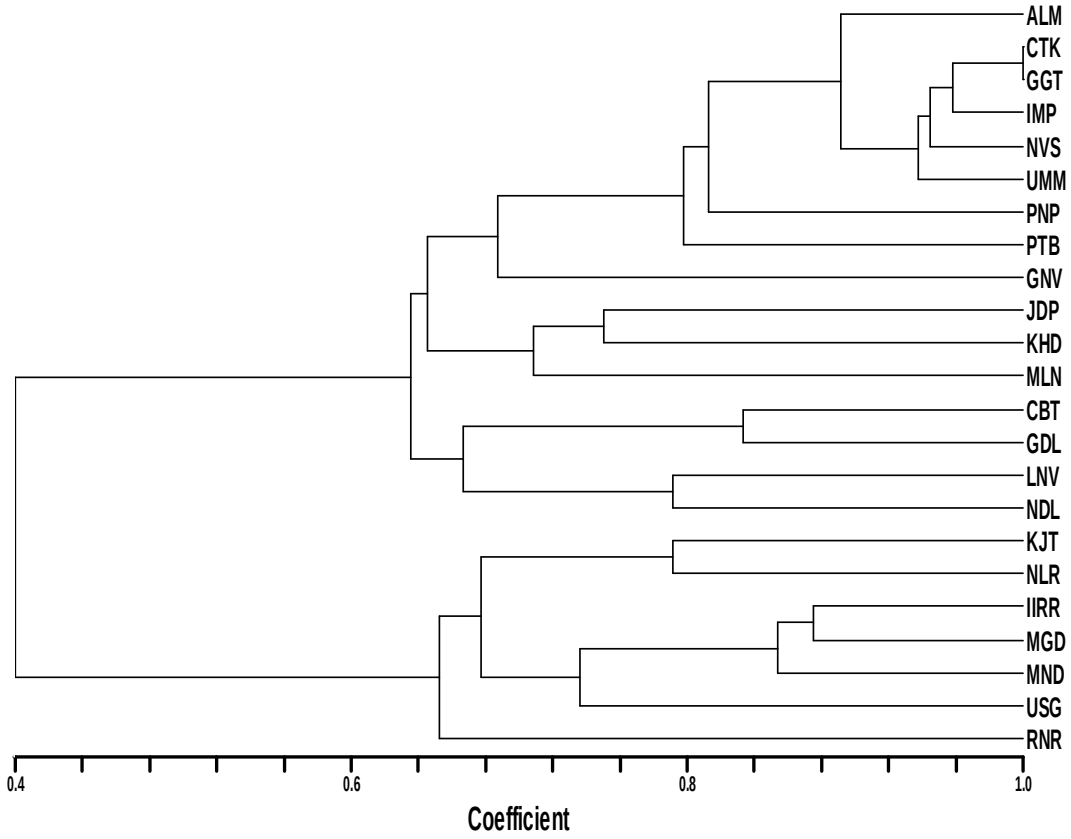


Figure 1: Dendrogram showing relatedness of different reactions of *P. oryzae* at hot spot locations during *Kharif* 2016

2. *Xanthomonas oryzae* pv. *oryzae*

The trial on virulence monitoring of *Xanthomonas oryzae* pv. *oryzae* was proposed at 25 hot spot locations across India for *Kharif* season of 2016. However, the data were received from 24 locations. The rice differentials used in this trial consisted of twenty eight near isogenic lines (IRBB lines) possessing different bacterial blight resistant genes (singly) or various combination 5 BB resistance genes *viz., Xa4, xa5, Xa7, xa13* and *Xa21* in the background of rice cultivar IR 24. The differentials like DV 85, TN1 (susceptible check) and Improved Samba Mahsuri (RP Bio 226) (resistant check) were also included in the trial. The isolates from Pantnagar, Nellore, Karjat and Moncompu were less virulent with LSI less than 4 (with the assumption that the inoculation was done under highly conducive conditions). These isolates produced susceptible scores (score > 5) on 4-9 entries. The isolates from Aduthurai, Navsari, New Delhi, Chiplima, Maruteru and Gerua were highly virulent with LSI > 6. These isolates produced susceptible score (score > 5) in 23-30 differentials. The isolate from Aduthurai was entirely different and all the differentials used in the trial showed highly susceptible reaction with a score of 9. The isolate did not show any differential reaction. Similarly, the isolate from Navsari also behaved very differently and produced susceptible score in 28 of the differentials used in the present study. The other isolates from the highly virulent category (NDL, CHP, MTU and GER) produced moderate to high susceptibility on most of the differentials. The isolates from IIRR, Hyderabad, Patna, Pattambi, Gangavati, Coimbatore, Faizabad, Cuttack, Rajendranagar, Nawagam, Ludhiana, Chinsurah, Titabar, Kaul and Raipur were moderately virulent with LSI ranging from 4.1-5.7. These isolates produced susceptible reaction (score > 5) in 2-17 differentials (Table 87). If we see the overall reaction of the differentials, *xa13* was susceptible in 10 locations while *Xa21* was susceptible in 11 locations (Figure 2). Among the 2-gene combinations, IRBB 55 (xa13 + Xa21) showed susceptibility at many places (Figure 2). Most of the 3, 4 and 5 genes combinations lines also showed susceptibility at some places indicating shift towards higher virulence.

Cluster analysis of *Xanthomonas oryzae* pv. *oryzae* reaction on different genotypes at various locations was done and is presented in Figure 3. Four isolates from highly virulent group *viz.*, Aduthurai (ADT), Navsari (NVS), Gerua (GER) and Maruteru (MTU) formed distinct cluster and were totally different from rest of the isolates. Other two isolates from highly virulent group i.e. NDL (New Delhi) and CHP (Chiplima) grouped with the isolate from IIRR. Most of the isolates from moderate to less virulent and group formed a big cluster.

Table 87: Reaction of rice differentials to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif* 2016

Differentials	Gene combination	Highly virulent						Moderately virulent					
		ADT	NVS	NDL	CHP	MTU	GER	IIRR	PTN	PTB	GNV	CBT	FZB
IRBB-1	*Xa1*	9	8	8	9	7	6	9	5	7	7	5	7
IRBB-3	*Xa3*	9	7	9	8	8	6	9	4	5	9	5	6
IRBB-4	*Xa4*	9	8	8	8	7	7	9	6	5	5	5	8
IRBB-5	*xa5*	9	9	9	9	7	8	9	5	5	3	3	7
IRBB-7	*Xa7*	7	5	7	9	7	7	9	7	7	1	7	5
IRBB-8	*xa8*	9	6	5	9	7	7	7	8	7	3	5	5
IRBB-10	*Xa10*	9	6	6	9	7	7	9	7	5	7	7	7
IRBB-11	*Xa11*	9	8	8	9	-	8	9	6	5	9	5	7
IRBB-13	*xa13*	9	6	7	7	8	7	3	5	7	9	3	7
IRBB-14	*Xa14*	9	7	8	8	8	6	9	5	7	5	5	6
IRBB-21	*Xa21*	9	7	5	6	7	8	3	7	5	1	3	4
IRBB-50	*Xa4+xa5*	7	4	7	7	5	7	7	7	5	1	5	5
IRBB-51	*Xa4+xa13*	9	8	9	7	7	6	3	3	5	7	3	4
IRBB-52	*Xa4+Xa21*	9	8	9	6	5	5	5	4	7	3	7	5
IRBB-53	*xa5+xa13*	9	7	6	4	7	6	7	5	5	7	3	5
IRBB-54	*xa5+Xa21*	9	8	7	7	5	5	7	4	7	7	5	5
IRBB-55	*xa13+Xa21*	9	8	6	6	8	7	3	6	5	9	7	5
IRBB-56	*Xa4+xa5+xa13*	9	8	7	5	5	7	3	8	5	9	5	5
IRBB-57	*Xa4+xa5+Xa21*	-	6	6	6	4	9	3	4	5	5	5	4
IRBB-58	*Xa4+xa13+Xa21*	9	7	6	4	5	7	1	5	5	3	7	4
IRBB-59	*xa5+xa13+Xa21*	9	7	3	5	5	7	1	5	3	3	5	3
IRBB-60	*Xa4+xa5+xa13+Xa21*	9	8	3	4	6	6	3	7	3	3	3	3
IRBB-61	*Xa4 + xa5 + Xa7*	7	8	3	5	6	7	7	6	5	3	-	5
IRBB-62	*Xa4 + Xa7 + Xa21*	9	9	6	4	6	5	7	4	5	3	-	5
IRBB-63	*xa5 +Xa7 + xa13*	9	7	6	6	7	3	7	5	5	3	-	5
IRBB-64	*Xa4 + xa5 + Xa7 + Xa21*	9	7	6	4	6	5	7	7	5	3	-	5
IRBB-65	*Xa4 + Xa7 + xa13 + Xa21*	9	6	6	3	8	5	3	7	5	9	-	5
IRBB-66	*Xa4 + xa5 + Xa7 + xa13 + Xa21*	9	8	5	5	4	6	3	5	3	9	-	3
DV-85		9	6	5	5	6	5	5	5	9	9	7	5
ISM		9	4	5	4	4	4	1	3	5	7	5	3
TN1		9	8	9	9	8	7	9	9	9	9	9	9
LSI		**8.8**	**7.1**	**6.5**	**6.4**	**6.3**	**6.3**	**5.7**	**5.6**	**5.5**	**5.5**	**5.2**	**5.2**
Min Score		7	4	3	3	4	3	1	3	3	1	3	3
Max Score		9	9	9	9	8	9	9	9	9	9	9	9
# entries > score 5		30	28	23	19	21	23	17	14	9	15	7	9

Table 87: Reaction of rice differentials to *Xanthomonas oryzae* pv. *oryzae* at different locations during *Kharif* 2016 (Table Continued)

Differen-tials	Gene combination	Moderately virulent								Less Virulent			
		CTK	RNR	NWG	LDN	CHN	TTB	KUL	RPR	PNT	NLR	KJT	MNC
IRBB-1	*Xa1*	5	7	3	7	6	7	5	5	3	3	6	1
IRBB-3	*Xa3*	7	5	5	7	6	3	3	5	5	3	6	2
IRBB-4	*Xa4*	7	5	5	6	5	5	4	5	7	1	4	0
IRBB-5	*xa5*	5	5	3	7	5	3	4	5	3	2	6	2
IRBB-7	*Xa7*	3	7	5	7	4	6	4	5	3	3	4	4
IRBB-8	*xa8*	3	5	3	7	4	3	5	5	5	5	4	4
IRBB-10	*Xa10*	7	5	5	9	8	5	3	8	3	7	7	4
IRBB-11	*Xa11*	3	7	5	7	8	5	3	5	3	4	6	5
IRBB-13	*xa13*	3	5	3	3	4	5	3	5	7	4	2	2
IRBB-14	*Xa14*	7	7	5	8	7	5	5	7	9	3	6	3
IRBB-21	*Xa21*	3	7	3	6	6	4	6	4	9	1	4	4
IRBB-50	*Xa4+xa5*	5	5	5	3	3	3	5	3	9	1	2	3
IRBB-51	*Xa4+xa13*	3	3	3	3	3	3	6	4	3	2	1	1
IRBB-52	*Xa4+Xa21*	3	3	3	4	3	3	5	3	1	3	1	2
IRBB-53	*xa5+xa13*	7	1	5	3	3	5	5	4	1	5	4	4
IRBB-54	*xa5+Xa21*	3	5	5	3	3	4	5	3	1	7	1	4
IRBB-55	*xa13+Xa21*	5	7	3	3	5	4	5	5	3	7	7	2
IRBB-56	*Xa4+xa5+xa13*	3	7	3	3	3	3	5	1	3	4	2	2
IRBB-57	*Xa4+xa5+Xa21*	3	5	7	3	3	3	4	2	1	3	1	5
IRBB-58	*Xa4+xa13+Xa21*	5	3	5	1	3	3	3	2	0	1	1	2
IRBB-59	*xa5+xa13+Xa21*	5	1	7	1	3	2	5	3	3	5	2	1
IRBB-60	*Xa4+xa5+xa13+Xa21*	5	1	3	2	3	2	2	5	0	3	3	3
IRBB-61	*Xa4 + xa5 + Xa7*	7	5	5	3	3	5	3	3	-	-	2	1
IRBB-62	*Xa4 + Xa7 + Xa21*	5	3	7	3	3	3	-	2	-	-	2	6
IRBB-63	*xa5 +Xa7 + xa13*	3	5	5	3	3	4	3	3	-	-	4	4
IRBB-64	*Xa4 + xa5 + Xa7 + Xa21*	5	3	5	1	3	3	4	2	-	-	4	6
IRBB-65	*Xa4 + Xa7 + xa13 + Xa21*	7	5	5	3	8	5	3	7	-	-	6	6
IRBB-66	*Xa4 + xa5 + Xa7 + xa13 + Xa21*	7	0	5	1	3	4	4	2	-	-	1	6
DV-85		3	7	1	7	3	5	3	5	7	5	2	2
ISM		5	1	5	3	0.5	7	3	2	0	4	2	1
TN1		9	9	7	9	8.5	7	5	7	9	7	6	6
LSI		**4.9**	**4.6**	**4.5**	**4.4**	**4.3**	**4.2**	**4.1**	**4.1**	**3.9**	**3.7**	**3.5**	**3.0**
Min Score		3	0	1	1	0.5	2	2	1	0	1	1	0
Max Score		9	9	7	9	8.5	7	6	8	9	7	7	6
# entries > score 5		9	9	4	12	8	4	2	4	7	4	9	5

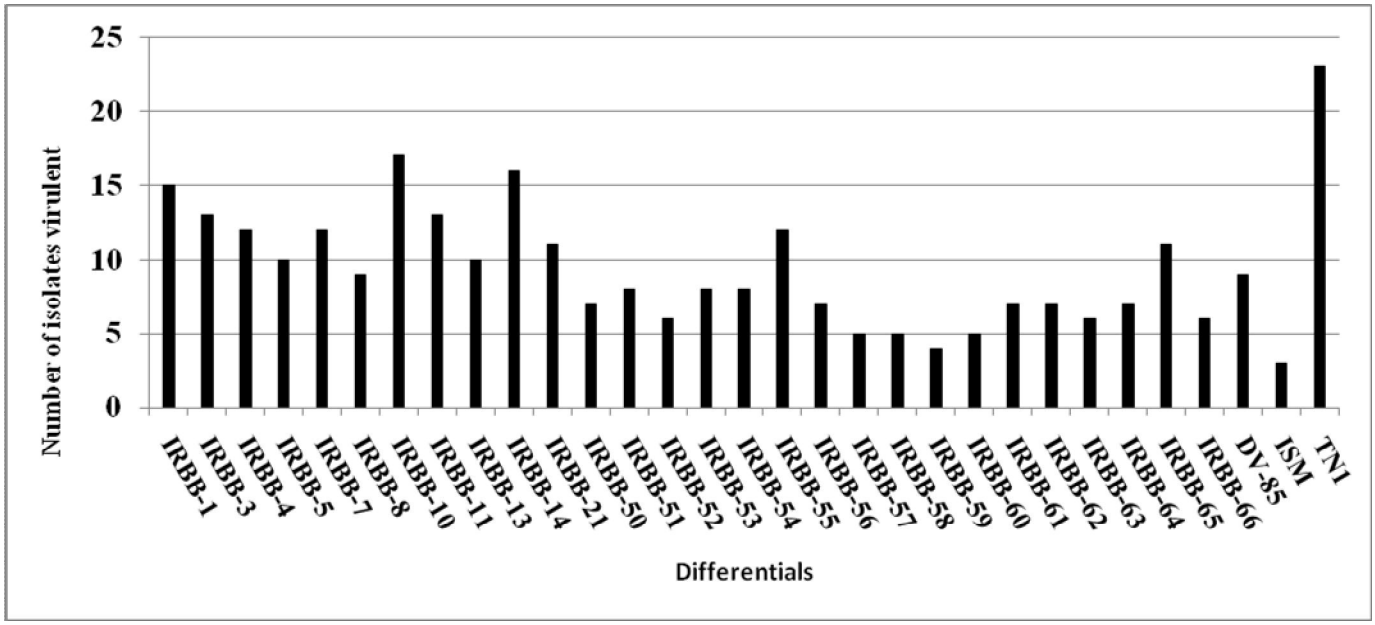


Figure 2: Number of *Xoo* isolates showing moderate to high virulence on different BB resistance genes and their combinations

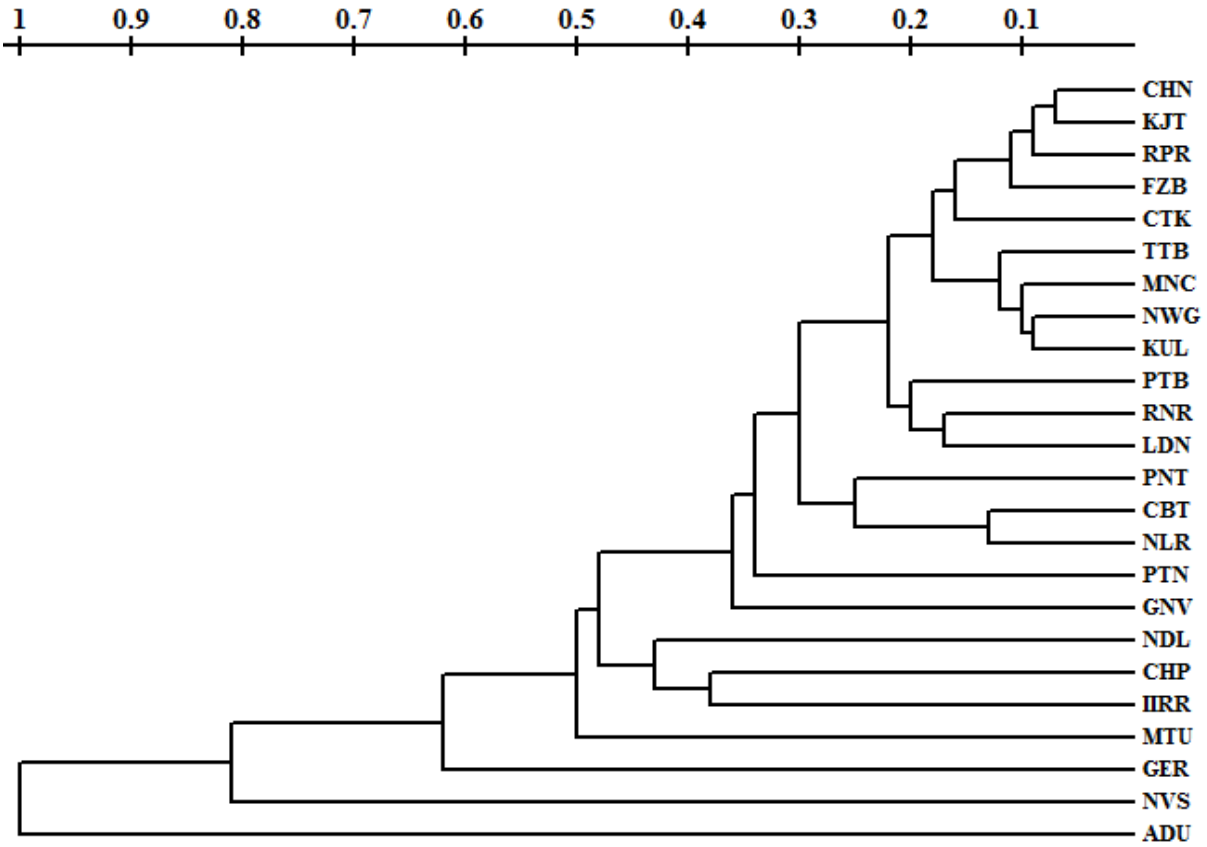


Figure 3: **Dendrogram showing the relatedness of different *Xanthomonas oryzae* pv. *oryzae* isolates from various locations during *Kharif* 2016**

III. DISEASE OBSERVATION NURSERY- *Kharif* 2016

Availability of susceptible host and prevalence of favourable weather condition play important role in the process of disease development. Knowledge on the occurrence of particular disease on specific location based on susceptible host and time of sowing may help us to formulate the management strategy. Hence, the trial was formulated with susceptible variety to take up sowing in three different dates to collect the information on the disease appearance and data was recorded as percent disease index/disease severity of various rice diseases throughout the cropping period in a particular locality. The trial was proposed at 7 locations (Chinsurah, Gerua, Malan, Mandya, Moncompu, Nawagam and Maruteru) and data was received from 7 locations *viz.*, Chinsurah, Chiplima, Malan, Mandya, Maruteru, Moncompu and Pusa. At Nawagam, trial was taken up but disease did not appeared. The salient features of this study are presented on location-wise below (Table 88).

Chinsurah: The variety MTU 7029 was used as test variety to study the disease progress of sheath blight, sheath rot, brown spot, false smut and bacterial leaf blight. Three different sowing dates *viz.*, 15.06.2016, 04.07.2016 and 19.07.2016 were carried out and transplanting was done at 12.07.2016, 26.07.2016 and 12.08.2016. Early sown crop recorded the maximum disease severity of sheath blight (22.5%), brown spot (37.5%) whereas less disease severity (sheath blight - 6.5%; brown spot-10%) was recorded in the normal sown crop. The sheath rot disease was maximum (32.5%) in the late sown crop. With respect to false smut, disease severity was low both in the normal and late sown crop (0.75%-1.5%). In case of bacterial leaf blight disease severity was maximum (13.5%) in the early sown crop.

Chiplima: The susceptible variety MTU 1001 was sown on the different dates *viz.*, 16th June, (early), 1st July (normal) and 16th July, 2016 (late) and transplanted on 1st July, 25th July and 12th August, 2016 respectively. Early sown variety recorded maximum percent disease index (33.33%) of sheath blight disease. The delayed sowing of crop resulted in maximum percent disease index of sheath rot (51.11%), wherein early sowing resulted in maximum incidence (78.89%) of bacterial leaf blight.

Malan: The susceptible variety HPU 2216 was sown on three different dates *viz.*, 21st May, 5th June, 20th June, 2016 and transplanted on 15th June, 30th June and 17th July, 2016 respectively to record the percent disease index of leaf blast. Early sown crop recorded less percent disease index (14.3%) and delayed sowing increased the percent disease index upto 95.2%.

Mandya: Two rice varieties *viz.*, Jaya and MTU 1001 were sown on 6th July, 25th July and 10th September, 2016. Observations were recorded as percent disease index for neck blast, sheath blight and brown spot. With respect to neck blast, early sowing of Jaya and MTU 1001 recorded maximum percent disease index of 72.8% and 62.6% respectively. Similarly early sowing also favoured sheath blight disease development and recorded maximum percent disease index (Jaya-68.89%; MTU 1001- 60.00%). Brown spot percent disease index was maximum in the late sown crop of Jaya (55.0%) and MTU 1001 (23.33%).

Maruteru: The susceptible rice variety Swarna was sown on three different dates viz., 8th June, 23rd June and 4th July, 2016 to record the disease severity of neck blast, sheath blight, sheath rot, false smut and bacterial leaf blight. Neck blast disease recorded maximum disease severity (53.90%) in the late

sown crop. Normal date sowing of Swarna recorded maximum disease severity of sheath blight up to 75.55%. Other diseases like sheath rot, false smut and bacterial leaf blight recorded as low level both in early and late sown crop.

Moncompu: Three varieties *viz.,* Shreyas, Prathyasa and Uma were sown on 14th May, 4th June and 24th June, 2016 and transplanted on 3rd June, 24th June and 14th July, 2016 respectively. Sheath blight disease was recorded as percent disease index. Across the varieties, delayed sowing favoured disease development and recorded maximum percent disease index of 49.19% in Shreyas, 73.11% in Prathyasa and 52.91% in Uma.

Pusa: To study the disease development of brown spot, two varieties namely Rajendra Bhagwati and Sugandha were sown on 10th June, 1st July, 1st August 2016 and transplanted on 5th July, 30th July, 17th August, 2016 respectively. Brown spot disease severity was recorded on all the three date of sowing in two varieties. Across the varieties, late sowing favoured disease development. Even in the moderately resistant variety-Rajendra Bhagwati, disease severity was 51.25% and 68% in Sugandha.

Table 88: Occurrence of different rice diseases in disease observation nursery at different test locations, *Kharif* 2016

Location/ Date of sowing	Stage of the crop	Percentage of Disease Severity/Percent Disease Index																	
		Leaf blast			Sheath blight			Sheath rot			Brown spot			False smut			Bacterial leaf blight		
		(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)	(E)	(N)	(L)
Chinsurah**																			
V-MTU7029	Tillering stage				22.5	6.50	10.0										13.5	2.0	10.0
E: 15.6.16	Flowering stage										37.5	10.0	17.5						
N: 04.07.16	Grain filling stage							26.5	27.5	32.5									
L: 19.07.16	Maturing stage													-	0.75	1.5			
Chiplima**	Heading stage				8.89												78.89		
V: MTU1001	Flowering stage																		
E: 16.6.16	Grain filling stage				33.33	Very low	<5											51.11	53.34
N: 01.07.16	Ripening stage (ShR)								46.11	51.11									
L: 16.07.16	Harvesting stage							42.23											
Malan**																			
V: HPU 2216	Maximum Tillering stage																		
E: 21.05.16	Panicle Initiation stage			95.2															
N: 05.06.16	Booting stage																		
L: 20.06.16	Flowering stage	14.3	58.0																
Location/ Date of sowing	**Stage of the crop**	**Neck blast**			**Sheath blight**			**Sheath rot**			**Brown spot**			**False smut**			**Bacterial leaf blight**		
		(E)	**(N)**	**(L)**	**(E)**	**(N)**	**(L)**	**(E)**	**(N)**	**(L)**	**(E)**	**(N)**	**(L)**	**(E)**	**(N)**	**(L)**	**(E)**	**(N)**	**(L)**
Mandya**																			
V: Jaya	Panicle Emergence stage						9.44					32.78	55.00						
E: 06.07.16	Dough stage				68.89	67.20					15.91								
N: 25.07.16	Maturity stage	72.8	45.0																
L: 10.09.16	Grain filling stage			0															
V: MTU 1001																			
E: 06.07.16	Panicle Emergence stage						14.99					13.64	23.33						
N: 25.07.16	Dough stage				60.00	55.00					7.23								
L: 10.09.16	Maturity stage	62.6	56.7																
	Grain filling stage			3.33															
Maruteru*	Panicle Initiation stage																		
V: Swarna	Booting stage																		
E: 08.06.16	Advanced booting stge				72.0														
N: 23.06.16	Flowering stge													-	-	1.7			
L: 04.07.16	Milkystage							10.06	-	-							9.33		
	Grain hardening stage			53.90		75.55	62.70		3.21									1.33	

E- Early sowing; N- Normal sowing; L- Late sowing; ** - disease recorded as PDI (percent disease index); * - disease recorded as disease severity

Table 88: Occurrence of different rice diseases in disease observation nursery, *Kharif* 2016 (Table continued)

Location/ Date of sowing	Stage of the crop	Percentage of Disease Severity/Percent Disease Index					
		Sheath blight			Brown spot		
		(E)	(N)	(L)	(E)	(N)	(L)
Moncompu**	Active tillering		19.61	49.19			
V: Shreyas	Panicle Initiation						
E: 14.05.16	Booting	29.99					
N: 04.06.16	Panicle emergence						
L: 24.06.16	Maturity stage						
Moncompu**	Active tillering		61.66	73.11			
V: Prathyasa	Panicle Initiation						
E: 14.05.16	Booting						
N: 06.04.16	Panicle emergence						
L: 24.06.16	Flowering						
	Maturity stage	19.66					
Moncompu**	Active tillering	49.43		52.91			
V: Uma	Panicle Initiation		40.16				
E: 14.05.16	Booting						
N: 06.04.16	Panicle emergence						
L: 24.06.16	Flowering						
	Maturity stage						
Pusa	Tillering						
V-Rajendra Bhagwati	Vegetative-lag phase						
E:10.06.16	Panicle initiation						
N: 01.07.16	Milk						
L: 01.08.16	Dough						
	Maturation				42.50	27.75	51.25
Pusa	Tillering						
V-Sugandha	Vegetative-lag phase						
E:10.06.16	Panicle initiation						
N: 01.07.16	Milk						
L: 01.08.16	Dough						
	Maturation				52.75	42.75	68.0

**** - disease recorded as PDI (percent disease index);**

IV. DISEASE MANANGMENT TRIALS

1. EVALUATION OF FUNGICIDES AGAINST LOCATION SPECIFIC DISEASES

The trial was conducted with an objective to evaluate new combination fungicidal product *viz.*, tricyclazole 20%+ tebuconazole 16% SC at two different concentration (2.0 ml & 2.25 ml/l) in comparison with individual molecule of tricyclazole 75% WP and tebuconazole 25% against fungal diseases of rice which are locally important in a particular rice growing region. Commercially available popular fungicides like hexaconazole 5% EC and carbendazim 50% SC used as standard checks.

The trial was proposed at 31 centres *viz.*, Aduthurai, Bankura, Chatha, Chinsurah, Chiplima, Coimbatore, Cuttack, IIRR, Faizabad, Ghaghraghat, Jagdalpur, Karaikal, Kaul, Khudwani, Lonavala, Ludhiana, Malan, Mandya, Maruteru, Moncompu, Mugad, Navsari, Nawagam, Pantnagar, Pattambi, Ponnampet, Raipur, Rajendranagar, Rewa, Titabar and Varanasi across the country. It was conducted at 29 centres against location specific rice diseases except Karaikal and Khudwani. The experiment was conducted on locally popular rice varieties at each testing location. In general, sowings were taken up during June and July across the locations except in Aduthurai where sowing was done in the month of September. At Titabar sowing was done late in the month of October and at Ludhiana and Moncompu where sowing was done at early in the month of May. The details related to diseases against the chemicals 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 89. In general fungicides were sprayed after noticing the initial symptoms at most of the locations. The fungicides were evaluated against leaf blast (nine locations), neck blast (seven locations), node blast (one location), sheath blight (thirteen locations), sheath rot (seven locations), brown spot (seven locations), grain discoloration (two locations), leaf scald (one location) and false smut (one location).

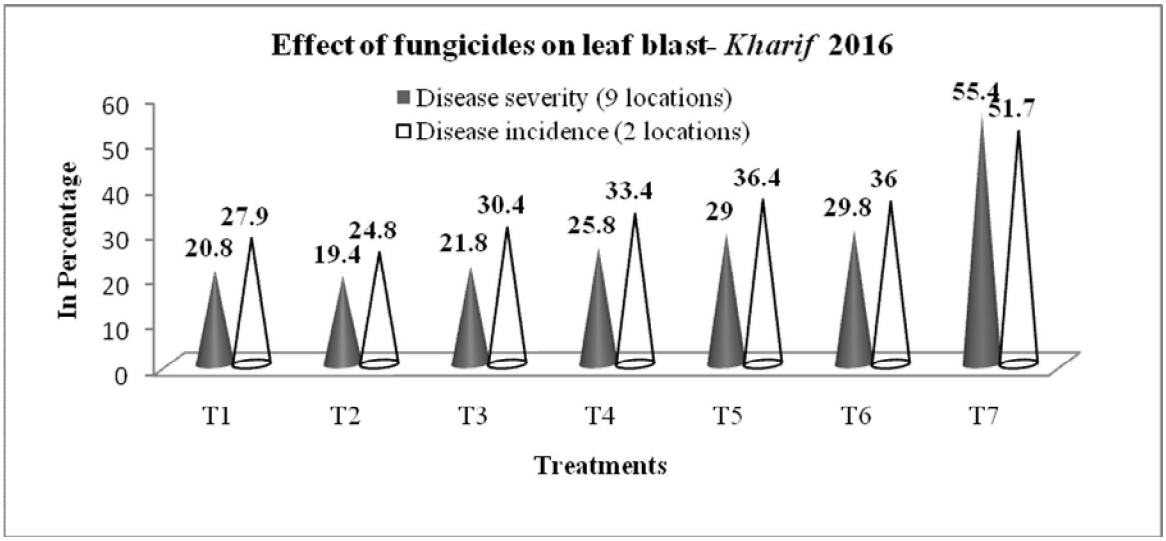
Leaf Blast: The test fungicides were evaluated against leaf blast disease at 9 locations across the rice growing region of the country. Disease severity was recorded at all the test locations. Besides, disease incidence was also observed at 2 locations *viz.*, Lonavla and Rewa. The test fungicidal products were evaluated against the disease under natural condition at most of the locations except IIRR and Rewa. Disease severity at test locations in check plots varied from 19.6% (Rewa) to 100% (IIRR). Severity on check plot was very high (>50%) at IIRR (100%), Ghaghraghat (72.2%), Malan (64.5%), Ponnampet (63.3%) and Jagdalpur (56.6%); high (>30-50%) at Mugad (47.3%) and Lonavala (45.0%); moderate (20-30%) at Coimbatore (29.3%); and less at Rewa (19.6%).

Table 89: Experimental details of fungicidal evaluation against location specific diseases of rice during, *Kharif* 16

S. No	Location	Disease recorded	Test variety	Screening	Date of activities						
					Sowing/ Transplanting	Inoculation	Initial symptom	Sprays	Spraying	Observation	Harvesting
1	**Aduthurai**	Sheath blight, Sheath rot, B spot	ADT (R) 46	Natural	01.09.2016 06.10.2016	-	-	1	22.12.2016	23.01.2017	01.02.2017
2	**Bankura**	Brown spot Sheath blight	Swarna (MTU-7029)	Natural	18.07.2016 12.08.2016	-	12.09.2016/ 22.09.2016	2	04.10.2016 19.10.2016	03.10.2016 18.10.2016 02.11.2016	06.12.2016
3	**Chatha**	Brown spot	Basmati-370	Natural	24.06.2016 22.07.2016	-	27.09.2016	2	30.09.2016 15.10.2016	-	02.12.2016
4	**Chinsurah**	Sheath blight	Swarna (MTU 7029)	Artificial	15.06.2016 14.07.2016	23.08.2016	05.09.2016	2	07.09.2016 22.09.2016	-	28.11.2016
		Sheath rot	Swarna (MTU 7029)	Artificial	19.07.2016 12.08.2016	20.10.2016	02.11.2016	2	04.11.2016 18.11.2016	-	29.11.2016
5	**Chiplima**	Sheath blight	Swarna	Artificial	14.07.2016 16.08.2016	05.10.2016	17.10.2016	2	19.10.2016 04.11.2016	19.11.2016	15.12.2016
6	**Coimbatore**	Leaf blast	CO 39	Natural	10.06.2017 26.10.2017	-	25.11.2016	2	30.11.2016 18.12.2016	23.12.2016 28.12.2016	20.01.2017
		Brown spot	CO 39	Natural	10.06.2017 26.10.2017	-	25.11.2016	2	30.11.2016 18.12.2016	23.12.2016 28.12.2016	20.01.2017
7	**Cuttak**	Sheath blight	Tapaswini	Artificial	12.07.2016 21.8.2016	24.09.2016	05.10.2016	2	15.10.2016 25.10.2016	26.10.2016 7.11.2016	08.12.2016
8	**Faizabad**	Sheath blight	Pusa Basmati-1	Artificial	21.06.2016 20.07.2016	21.09.2016	10.10.2016	2	10.03.2016 15.10.2016	13.10.2016 02.11.2016	15.11.2016
9	**Ghaghraghat**	Leaf blast /N.blast	Jalpriya	-	-	-	-	-	-	18.11.2016	18.12.2016
10	**IIRR**	Leaf blast	HR-12	Artificial	15.06.2016 14.07.2016	29.7.2016	10.8.2016	3	10.8.2016;8.8.2016 25.8.2016	15.8.2016;22.8.2016 29.8.2016	15.10.2016
		Sheath blight	BPT 5204	Artificial	13.06.2016 13.07.2016	28.9.2016	30.9.2016	2	30.9.2016;26.10.2016	6.10.2016;19.10.2016 3.11.2016	18.11.2016
11	**Jagdalpur**	Leaf blast	Swarna	Natural	20.06.2016 23.07.2016	-	16.08.2016	4	20.08.2016 ; 09.05.2016 20.09.2016 ;10.06.2016	09.05.2016 ;15.09.2016 10.04.2016	12.05.2016
		Neck blast	Swarna	Natural	-	-	-	-	-	2.12.2016	12.05.2016
12	**Kaul**	Neck blast	Basmati CSR 30	Natural	15.06.2016 20.07.2016	-	13.10.2016	2	18.08.2016 03.10.2016	03.11.2016	08.11.2016
13	**Lonavala**	Leaf blast/ Leaf scald	EK-70	Natural	26.06.2016 08.08.2016	-	12.09.2016	3	12.09.2016 ;27.09.2016 10.10.2016	12.09.2016 ; 25.09.2016 5.10.2016	02.11.2016
		Neck blast	EK-70	Natural	26.06.2016 08.08.2016	-	25.09.2016	3	12.09.2016 ; 27.09.2016 10.10.2016	25.09.2016 17.10.2016	02.11.2016
		Node blast	EK-70	Natural	26.06.2016 08.08.2016		27.09.2016	3	12.09.2016 ;27.09.2016 10.10.2016	27.09.2016 02.11.2016	02.11.2016
		Sheath rot	EK-70	Natural	26.06.2016 08.08.2016	-	23.09.2016	3	12.09.2016 ;27.09.2016 10.10.2016	23.09.2016 02.11.2016	02.11.2016
13	**Lonavala**	Brown spot	EK-70	Natural	26.06.2016 08.08.2016	-	21.09.2016	3	12.09.2016;27.09.2016 10.10.2016	21.09.2016 02.11.2016	02.11.2016
		Grain discolouration	EK-70	Natural	26.06.2016 08.08.2016	-	26.09.2016	3	12.09.2016 ;27.09.2016 10.10.2016	26.09.2016 02.11.2016	02.11.2016

S. No	Location	Disease recorded	Test variety	Screening	Date of activities						
					Sowing/ Transplanting	Inoculation	Initial symptom	Sprays	Spraying	Observation	Harvesting
14	**Ludhiana**	Sheath blight	PR114	Artificial	25.05.2016 26.06.2016	24.08.2016	27.08.2016	2	27-08-2016 ;06-09-2016	22-09-2016;	10.10.2016
15	**Malan**	Leaf blast / Neck blast	HPU2216	Natural	14.6.2016 08.07.2016	-	10.08.2016	2	19.08.2016 ;03.09.2016	19.08.2016 ; 03.09.2016 14.09.2016	18.10.2016
16	**Mandya**	Sheath blight	MTU1001	Artificial	25.07.2016 28.07.2016	05.10.2016	16.10.2016	2	20.10.2016 06.11.2016	05.11.2016 20.11.2016	02.01.2017
		Neck blast	MTU1001	Natural	25.07.2016 28.07.2016	-	-	1	25.11.2016	24.11.2016; 09.12.2016	02.01.2017
17	**Maruteru**	Sheath blight	Swarna (MTU 7029)	Artificial	20.06.2016 19.07.2016	22.08.2016	01.09.2016	2	06.09.2016 23.09.2016	17.09.2016 ; 04.10.2016 24.10.2016	08.11.2016
18	**Monocompu**	Sheath blight	Uma	Natural	13.05.2016 06.04.2016	-	23.09.2016	1	25.09.2016	10.02.2016	10.10.2016
		Grain discolouration	Uma	Natural	13.05.2016 06.04.2016	-	08.12.2016	1	14.08.2016	08.12.2016 09.10.2016	10.10.2016
19	**Mugad**	Leaf blast	Intan	Natural	20..06.2016	-	26.07.2016	2	15.08.2016 30.08.2016	09.10.2016 25.10.2016	11.05.2016
20	**Navasari**	Sheath rot	Jaya	Natural	04.06.2016 02.07.2016	-	13.08.2016	3	22.08.2016 ; 02.09.2016 13.10.2016	29.08.2016 ;09.09.2016 21.10.2016	03.11.2016
21	**Nawagam**	Sheath rot	Gurjari	Natural	18.07.2016 29.08.2016	-	20.10.2016	2	18.10.2016 04.11.2016	17.10.2016 15.11.2016	29.11.2016
22	**Pantnagar**	Sheath blight	Pant Dhan-4	Artificial	01.06.2016 21.06.2016	02.09.2016	05.09.2016	2	08.09.2016 23.09.2016	08.09.2016 23.09.2016	21.10.2016
23	**Pattambi**	Brown spot	Uma	Natural	04.07.2016 27.07.2016	-	16.09.2016	2	20.09.2016 01.10.2016	19.09.2016 25.10.2016	18.11.2016
24	**Ponnampet**	Leaf blast / Neck blast	Intan	Natural	08.07.2016 10.08.2016	-	14.08.2016	3	24.09.2016 ;20.10.2016 28.11.2016	22.09.2016 ;19.10.2016 26.11.2016	09.01.2017
25	**Raipur**	Sheath blight	Swarna	Artificial	07.07.2016 06.08.2016	26.09.2016	30.09.2016	2	03.10.2016 10.10.2016	08.10.2016 19.10.2016	01.12.2016
26	**Rajendra nagar**	Neck blast/ sheath rot	Satya	Natural	01.07.2016 04.08.2016	-	25.09..2016	2	03.10.2016 21.10.2016	11.11.2016	19.11.2016
27	**Rewa**	Leaf blast	PS -4	Natural / Artificial	02.07.2016 22.07.2016	05.09.2016	12.09.2016 10.09.2016	3	12.09.2016 ; 25.09.2016 7.10.2016	15.09.2016 ; 27.09.2016 10.10.2016	15.11.2016
		Brown spot	PS -4	Natural / Artificial	02.07.2016 22.07.2016	05.09.2016	12.09.2016	3	14.09.2016 ; 25.9.2016 15.10.2016	15.09.2016;27.09.2016 10.10.2016	15.11.2016
28	**Titabar**	Sheath rot	Gitesh	Artificial	07.10.2016 08.11.2016	25.09.2016	10.10.2016	4	10.11.2016 ; 21.10.2016 01.11.2016 ; 11.11.2016	11.10.2016 ; 21.10.2016 01.11.2016 ; 11.11.2016	12-12-2016
29	**Varanasi**	False smut	HUBR 10-9	Natural	20.06.2016 16.07.2016	-	30.09.2016	2	06.10.2016 21.10.2016	07.11.2016	15.11.2016

Disease incidence at test locations in check plots varied between 69.6% (Lonavla) and 33.8% (Rewa). All fungicides treatments significantly reduced the disease severity and incidence at all the test locations when compared to control. Tricyclazole 20%+ tebuconazole 16% SC (2.25 ml /l) combination product formulation significantly reduced the severity at six locations (Coimbatore, Jagdalpur, Lonavala, Malan, Ponnampet and Rewa) and incidence at two locations (Lonavala and Rewa). Similarly, the combination product tricyclazole 20% + tebuconazole 16% SC (2.0 ml/l) found effective in reducing the disease severity at Mugad and IIRR when compared to other single molecule products. Dose of 2.25 ml/l tricyclazole 20%+ tebuconazole 16% SC was found better in reducing the mean disease severity (19.4%) from all nine locations when compared to the lower concentration (2.0 ml/l) of the same product and other standard fungicides such as tricyclazole 75% WP, tebuconazole 25%, hexaconazole 5% EC and carbendazim 50% WP (Table 90 and Fig.4).



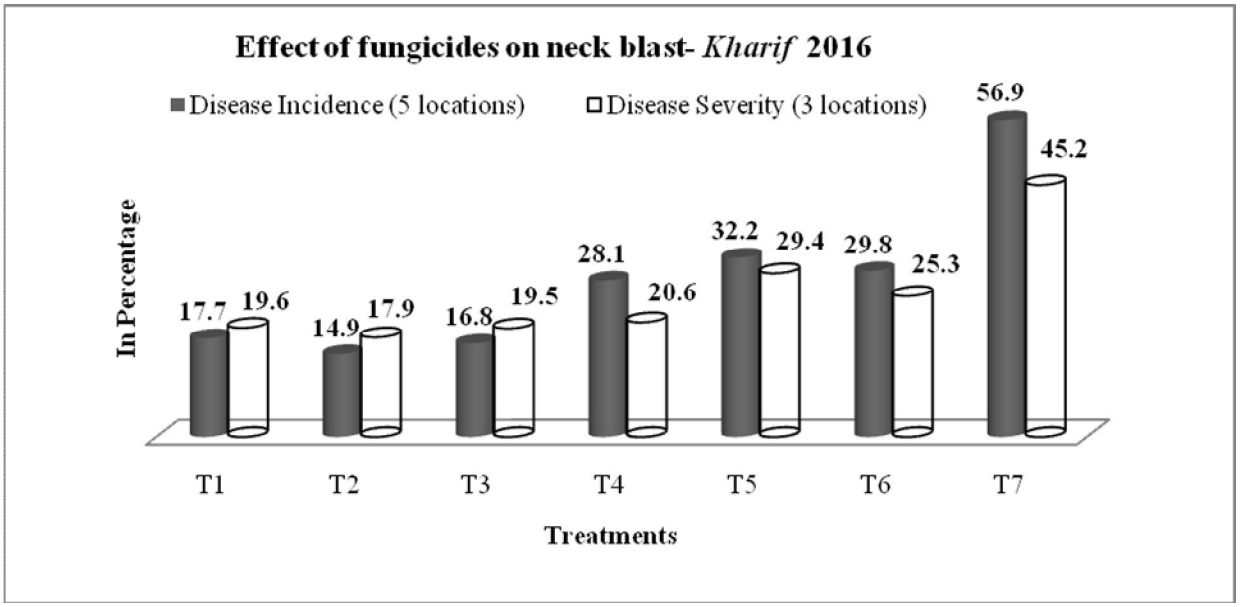
T1 - Tricyclazole 20% SC+ tebuconazole 16% SC (36 SC); T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36 SC); T3 - Tricyclazole 75% WP; T4 - Tebuconazole 25% EC; T5 - Hexaconazole 5% EC; T6 - Carbendazim 50% WP; T7 - Control

Figure 4: **Effect of fungicides against leaf blast, *Kharif* 2016**

The grain yield data was recorded at 8 locations, except Mugad and it was observed that yield in all treated plots was superior to check plot (2616 Kg/ha). The treatment tricyclazole 20% + tebuconazole 16% SC (2.25 ml/l) was superior in increasing the y ield (3792 Kg/ha) followed by 2.0 ml/l of tricyclazole 20%+ tebuconazole 16% SC compared to the other treatments (Table 91). The same treatment (T2) showed highest yield in eight different geographical test locations.

Neck blast: The trail was conducted at eight locations to know the efficacy of the test product against neck blast disease. Among the 8 centers, disease severity was recorded at three centers namely, Ghagraghat, Mandya and Rajendranagar and disease incidence was recorded in the remaining five centers *viz.*, Jagdalpur, Kaul, Lonavala, Malan, and Ponnampet. The test fungicidal products were evaluated against the disease under natural condition at all the centres. The severity in check plots was very high (>50%) at Mandya (57.8%); moderate (30-50%) at

Ghagraghat (41.9%) and Rajendranagar (36.0%). Incidence was very high (>50%) at Malan (74.8%), Lonavala (68%), Jagdalpur (60.2%) and Ponnampet (56.4%); and moderate (20-30%) at Kaul (25.3%). The performance of all the six fungicidal treatments were superior in reducing the neck blast severity and incidence at all test locations compare to control plot (DI: 56.9% and DS: 45.2%). The formulations *viz.*, tricyclazole 20%+ tebuconazole 16% SC (2.25 ml/l) significantly reduced the incidence of the neck blast at two locations (Lonavala and Ponnampet) when compare to standard check tricyclazole 75% WP and the same treatment was on par with check fungicide in reducing the disease incidence at Jagdalpur and Malan. However, in two locations (Kaul and Malan) standard commercial fungicide tricyclazole 75% WP significantly reduced the disease incidence followed by tricyclazole 20%+ tebuconazole 16%SC (2.25 ml/l). In case of disease severity, tebuconazole 25% WP significantly reduced severity at Ghaghraghat (10.3) and Rajendranagar (15.7). Both the concentrations (2.0 and 2.25 ml/l) of the test product significantly reduced the severity at Mandya (14.4%) and was found to be on par with other check fungicides at Rajendranagar. The average disease severity (19.4%) and incidence (24.8) reduction was lowest for the treatment with the higher concentration (2.25 ml/l) of test product sprayed plots (Table 92 and Fig.5). The mean yield across the locations in check plot was 2822 kg/ha. Among the treatments, tricyclazole 20%+ tebuconazole 16% 2.25 ml/l showed higher yield at four locations and location average yield of 3759 kg/ha compare to other treatments, followed by tricy clazole 75% WP treatment (3745 kg/ha) (Table 93).



T1 - Tricyclazole 20% SC+ tebuconazole 16% SC (36 SC); T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36 SC); T3 - Tricyclazole 75% WP; T4 - Tebuconazole 25% EC; T5 - Hexaconazole 5% EC; T6 - Carbendazim 50% WP; T7 – Control

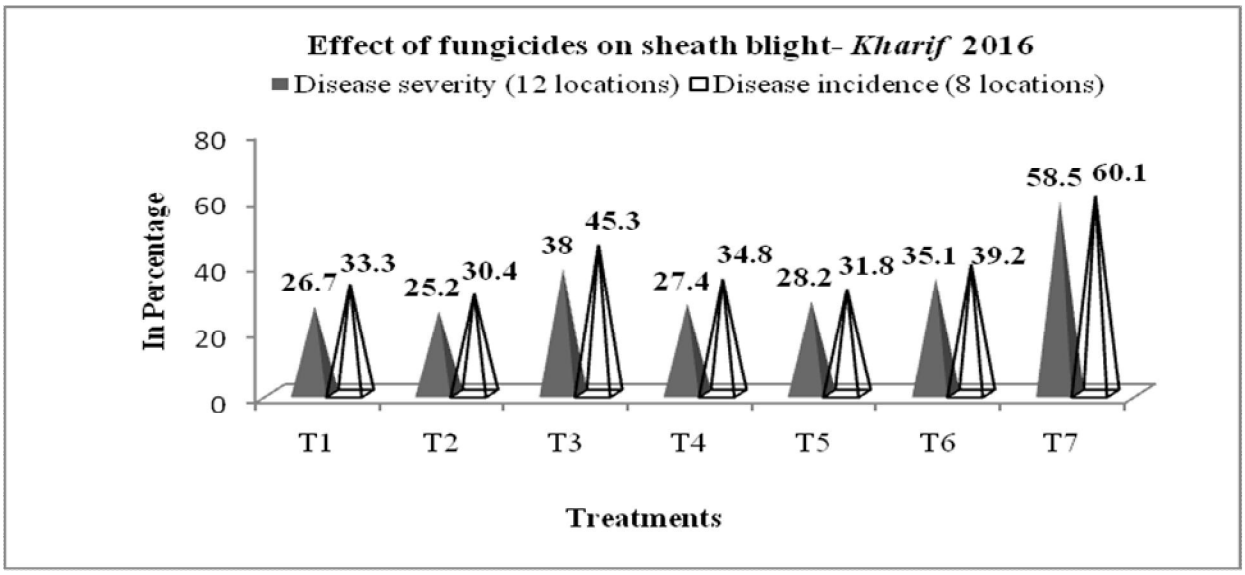
Figure 5: Effect of fungicides against neckblast, *Kharif* 2016

Node Blast: Node blast incidence was recorded at only Lonavala centre. Disease incidence of 49.1% was recorded in control plot. However, significantly less disease incidence (15.8%) was

observed from tricyclazole 20%+ tebuconazole 16% (2.25 ml/l) treated plot followed by 2.0 ml/l concentration of same product (Table 92). Similarly grain yield was recorded as 2319 kg/ha in 2.25 ml/l of test fungicide sprayed plots compared to 1051 kg/ha in check plot (Table 93).

Sheath blight: A new combination product was evaluated against sheath blight disease at 13 hot spot locations. The experiment was conducted under artificial inoculation at all the locations except Aduthurai, Bankura and Moncompu. Both disease severity and incidence was observed at seven locations *viz.*, Bankura, Cuttack, Faizabad (Masodha), Ludhiana, Mandya, Maruteru, and Pantnagar. Only disease incidence was recorded at Moncompu whereas, only disease severity was recorded at Audthurai, Chinsurah, Chiplima, IIRR and Raipur. Severity in check plots was varied between 5.03% and 82.2%. Disease severity on untreated plot was very high (>50%) at Raipur (82.2%), Pantnagar (80.5%), Faizabad (78.3%), Chinsurah (76.9%), Cuttack (71.6%), Maruteru (60.7%), IIRR (60.3%) and Chiplima (59.4%); high (30-50%) at Audthurai (43%), Ludhiana (42.6%) and Mandya (41.0%); and less at Bankura (5 %). Disease incidence was varied from 7.1% to 100%. It was very high at Ludhiana (100%), Pantnagar (99.0%), Cuttack (79.4%), Mandya (64.4%), Maruteru (64.3%) and Faizabad (52.1%); and less (>20%) at Moncompu (14.2%) and Bankura (7.1%). All fungicidal applications significantly reduced the disease compared to control at all the test location.

The combi-product tricyclazole 20%+ tebuconazole 16% (2.25 ml/l) significantly reduced the severity at two locations (Cuttack and Mandya) and on par with check fungicides (tebuconazole and hexaconazole) at four locations (Cuttack, Faizabad, Ludhiana and Raipur). On the other hand, even at lower concentration (2 ml/l) of test product significantly reduced the severity at two locations (Chinsurah and Chiplima). Test molecule at higher concentration (2.25 ml/l) significantly reduced the intencity at three locations (Cuttack, Faizabad and Mandya) and on par with check fungicides at Pantnagar. However, standard check fungicides *viz.*, hexaconazole (2 ml/l) and tebuconazole (1.5 ml/l), showed significant disease reduction (either severity and/or incidence) at three locations (Maruteru, Pantnagar and Moncompu) and one location (Aduthurai), respectively. Eventually, mean disease severity from all 12 locations was less (DS: 25.3%) at treatment (T2) having test product at 2.25 ml/l when compared to other treatments. Minimum average incidence (DI: 30.8) was observed at the same treatment (T2) from 8 locations (Table 94 and Fig.6).



T1 - Tricyclazole 20% SC+ tebuconazole 16% SC (36 SC); T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36 SC); T3 - Tricyclazole 75% WP; T4 - Tebuconazole 25% EC; T5 - Hexaconazole 5% EC; T6 - Carbendazim 50% WP; T7 – Control

Figure 6: Effect of fungicides against sheath blight, *Kharif*, 2016

Grain yield in the experimental plots were recorded at all the test locations, and it was observed that grain yield was more in fungicide treated plots compared to check plot (3971Kg/ha). Highest yield was recorded in the plots where tricyclazole 20%+ tebuconazole 16% (2.25 ml/l) sprayed (5501 Kg/ha) followed by lower concentration (2.0 ml/l) of the same product (Table 95).

Sheath rot: The test molecule was compared against sheath rot disease at seven locations *viz.*, Aduthurai, Chinsurah, Lonavala, Navasari, Nawagam, Rajendranagar and Titabar. Both disease severity and incidence was recorded at Lonavala, Navasari, Nawagam and Titabar. Whereas only disease severity or disease incidence was recorded at Chinsurah and Rajendranagar. The test fungicide was evaluated against the disease under natural condition at most of the locations except Chinsurah and Titabar. Disease severity in check plots was very high (>50%) at Lonavala (63.0%) and Chinsurah (61.1%); high (30-50%) at Nawagam (43.7%) and Navasari (34.1%); and moderate at Titabar (24.8%). Incidence in check plots was varied from 99.0% (Lonavala) to 36.6% (Rajendranagar). Incidence was very high at Lonavala (99.0%) and Nawagam (82.0%); high at Titabar (45.6%), Aduthurai (43.3%), Navasari (42.6%) and Rajendranagar (30.6%).

Table 90: Evaluation of fungicides against leaf blast disease of rice, *Kharif* 2016

Treatments	Dosage/L	Disease severity										Disease incidence		
		CBT	GGT	IIRR	JDP	LNV	MGD	MLN	PNP	REW	Mean	LNV	REW	Mean
Inoculation		**N**	**A**	**A**	**N**	**N**	**N**	**N**	**N**	**N/A**		**N**	**N/A**	
T1 - Tricyclazole 20% SC+ tebuconazole 16% SC (36 SC)	**2 ml**	13.3 (21.3)	23.3 (28.9)	28.5 (32.2)	31.1 (33.8)	19.3 (26)	14.5 (22.4)	25.7 (30.4)	22.6 (28.3)	8.6 (2.9)	**20.8**	43.9 (41.5)	11.9 (20.1)	**27.9**
T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36 SC)	**2.25 ml**	10 (18.3)	22.2 (28.2)	30.7 (33.6)	28.8 (32.4)	16.6 (23.9)	14.9 (22.6)	24.1 (29.3)	20.5 (26.8)	6.4 (2.5)	**19.4**	40.9 (39.7)	8.8 (17.2)	**24.8**
T3 - Tricyclazole 75% WP	**0.6 g**	13.3 (21.3)	17.1 (24.4)	32.2 (34.5)	30.28 (33.3)	24.0 (29.3)	19.2 (25.9)	25.2 (30.1)	24.6 (29.7)	9.8 (3.1)	**21.8**	46.2 (42.8)	14.6 (22.4)	**30.4**
T4 - Tebuconazole 25% EC	**1.5 ml**	14.6 (22.4)	16.2 (23.7)	37.0 (37.4)	34.17 (35.7)	28.8 (32.4)	17.9 (25.0)	42.4 (40.5)	28.4 (32.1)	12.3 (3.5)	**25.8**	49.4 (44.6)	17.3 (24.5)	**33.4**
T5 - Hexaconazole 5% EC	**2 ml**	17.6 (24.8)	25.3 (30.2)	43.3 (41.1)	31.67 (34.2)	31.4 (34)	18.3 (25.3)	48.3 (44)	31.1 (33.8)	14.0 (3.7)	**29.0**	53.9 (47.2)	18.9 (25.7)	**36.4**
T6 - Carbendazim 50% WP	**1 g**	17 (24.3)	23.2 (28.7)	55.9 (48.3)	36.3 (37)	29.2 (32.7)	32.1 (34.5)	33.3 (35.2)	26.8 (31.2)	14.8 (3.8)	**29.8**	51.3 (45.7)	20.7 (27)	**36.0**
T7 - Control		29.3 (32.7)	72.2 (58.1)	100 (89.9)	56.6 (48.8)	45.0 (42.1)	47.3 (43.4)	64.5 (53.4)	63.3 (52.7)	19.6 (4.4)	**55.4**	69.6 (56.6)	33.8 (35.5)	**51.7**
General mean		**16.4**	**28.5**	**46.8**	**35.6**	**27.8**	**23.5**	**37.6**	**31.0**	**12.2**		**50.7**	**18.0**	
CV		7.61	1.63	1.9	1.41	7.67	3.89	3.33	6.32	3.84		5.64	1.13	
LSD at 5%		1.46	0.36	0.7	0.36	1.71	0.90	1.02	1.49	0.10		1.81	3.11	
Transformation		AT	AT	AT	AT	AT	AT	AT	AT	ST		AT	AT	

(Figures in parenthesis indicate transformed means; AT - Arc sine transformation; ST- Square root transformation)

Table 91: Effect of fungicides on grain yield with respect to rice leaf blast, *Kharif* 2016

Treatments	Dosage/L	Yield (kg/ha)								
		CBT	GGT	IIRR	JDP	LNV	MLN	PNP	REW	Mean
T1- Tricyclazole 20%+ tebuconazole 16% (36% SC)	**2 ml**	4483	2065	4077	4869	2666	4074	2871	4265	**3671**
T2- Tricyclazole 20% + tebuconazole 16% (36% SC)	**2.25 ml**	4633	2180	3837	5206	2827	4198	2918	4540	**3792**
T3-Tricyclazole 75% WP	**0.6 g**	4423	2544	4343	5020	2651	4074	2840	4105	**3750**
T4-Tebuconazole 25% EC	**1.5 ml**	4283	2630	4173	4744	2399	3457	2451	3787	**3491**
T5-Hexaconazole 5% EC	**2 ml**	4190	1821	4127	4788	2307	2778	2481	3670	**3270**
T6-Carbendazim 50% WP	**1 g**	4116	2304	3943	4554	2346	3580	2515	3485	**3355**
T7-Control		3200	1520	2900	4319	1746	2407	1831	3008	**2616**
General mean		**4190**	**2152**	**3914**	**4786**	**2420**	**3510**	**2558**	**3837**	
CV		3.8	1.8	5.8	11.2	22.6	6.7	7.8	3.3	
LSD at 5%		130.6	26.7	184.2	380.0	291.3	191.9	205.8	102.7	

Table 92: Evaluation of fungicides against neck and node blast disease of rice, *Kharif* 2016

Treatment	Neck blast										Node blast
	Dosage/L	Disease incidence					Mean	Disease Severity			Mean	DI
		JDP	KUL	LNV	MLN	PNP		GGT	MND	RNR		LNV
Inoculation		N	N	N	N	N		-	N	N		N
T1 - Tricyclazole 20% SC+ tebuconazole 16% SC (36 SC)	**2 ml**	24.1 (29.2)	12.7 (3.5)	20.0 (26.2)	12.6 (20.7)	18.9 (25.6)	**17.7**	22.7 (28.4)	18.21 (25.1)	18.0 (24.8)	**19.6**	17.5 (24.6)
T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36 SC)	**2.25 ml**	17.6 (24.7)	11.0 (3.3)	18.0 (24.9)	10.9 (19.2)	16.7 (23.9)	**14.9**	21.75 (27.7)	14.4 (22.0)	17.4 (24.5)	**17.9**	15.8 (23.1)
T3 - Tricyclazole 75% WP	**0.6 g**	22.1 (27.8)	8.7 (2.9)	24.0 (29.1)	10.3 (18.6)	18.9 (25.7)	**16.8**	11.3 (19.6)	31.4 (34.0)	15.8 (23.4)	**19.5**	20.4 (26.8)
T4 - Tebuconazole 25% EC	**1.5 ml**	29.6 (29.1)	14.6 (3.8)	27.0 (31.1)	46.3 (42.8)	23.2 (28.7)	**28.1**	10.38 (18.7)	35.8 (36.7)	15.7 (23.2)	**20.6**	22.7 (28.3)
T5 - Hexaconazole 5% EC	**2 ml**	28.5 (31.7)	16.2 (4.0)	37.0 (36.7)	53.2 (46.8)	26.1 (30.7)	**32.2**	20.56 (26.9)	49.2 (44.5)	18.50 (25.4)	**29.4**	30.7 (33.5)
T6 - Carbendazim 50% WP	**1 g**	45.1 (41.9)	13.5 (3.6)	35.0 (35.8)	35.4 (36.4)	20.2 (26.7)	**29.8**	18.26 (25.2)	44.3 (41.7)	13.2 (21.1)	**25.3**	28.1 (31.9)
T7 - Control		60.2 (51.1)	25.3 (5.0)	68.0 (55.7)	74.8 (59.8)	56.4 (48.6)	**56.9**	41.9 (40.3)	57.8 (49.5)	36.0 (36.8)	**45.2**	49.1 (44.4)
General mean		**32.5**	**14.6**	**32.7**	**34.8**	**25.8**			**21.0**	**19.2**		**30.3**
CV		30.0	6.7	20.8	5.2	7.8		1.1	9.3	9.3	5.2	10.7
LSD at 5%		7.2	0.2	5.0	1.5	1.7		0.2	2.8	1.7	0.9	2.31
Transformation		AT	ST	AT	AT	AT		AT	AT	AT	AT	AT

(Figures in parenthesis indicate transformed means; AT - Arc sine transformation; ST- Square root transformation)

Table 93: Effect of fungicides on grain yield with respect to rice neck blast and node blast, *Kharif* 2016

Treatment	Dosage /L	Neck blast - Grain yield (kg/ha)								Node blast
		GGT	JDP	KUL	LNV	MLN	PNP	RNR	Mean	LNV
T1- Tricyclazole 20%+ tebuconazole 16% (36% SC)	**2 ml**	2065	4869	4767	2196	4074	2871	4667	**3644**	2196
T2- Tricyclazole 20% + tebuconazole 16% (36% SC)	**2.25 ml**	2180	5206	4733	2319	4198	2918	4759	**3759**	2319
T3- Tricyclazole 75% WP	**0.6 g**	2544	5020	5000	1965	4074	2840	4773	**3745**	1965
T4-Tebuconazole 25% EC	**1.5 ml**	2630	4744	4600	1834	3457	2451	4775	**3499**	1834
T5- Hexaconazole 5% EC	**2 ml**	1821	4788	4267	1626	2778	2481	4759	**3217**	1626
T6- Carbendazim 50% WP	**1 g**	2304	4554	4467	1772	3580	2515	4686	**3411**	1772
T7- Control		1520	4319	4033	1051	2407	1831	4592	**2822**	1051
General mean		**2152**	**4786**	**4552**	**1823**	**3510**	**2558**	**4716**		1823
CV		1.8	11.2	4.3	22.6	6.7	7.8	7.5		23.6
LSD at 5%		26.7	380.0	161.0	291.3	191.9	205.8	250.1		291.3

Table 94: Evaluation of fungicides on sheath blight disease of rice, *Kharif* 2016

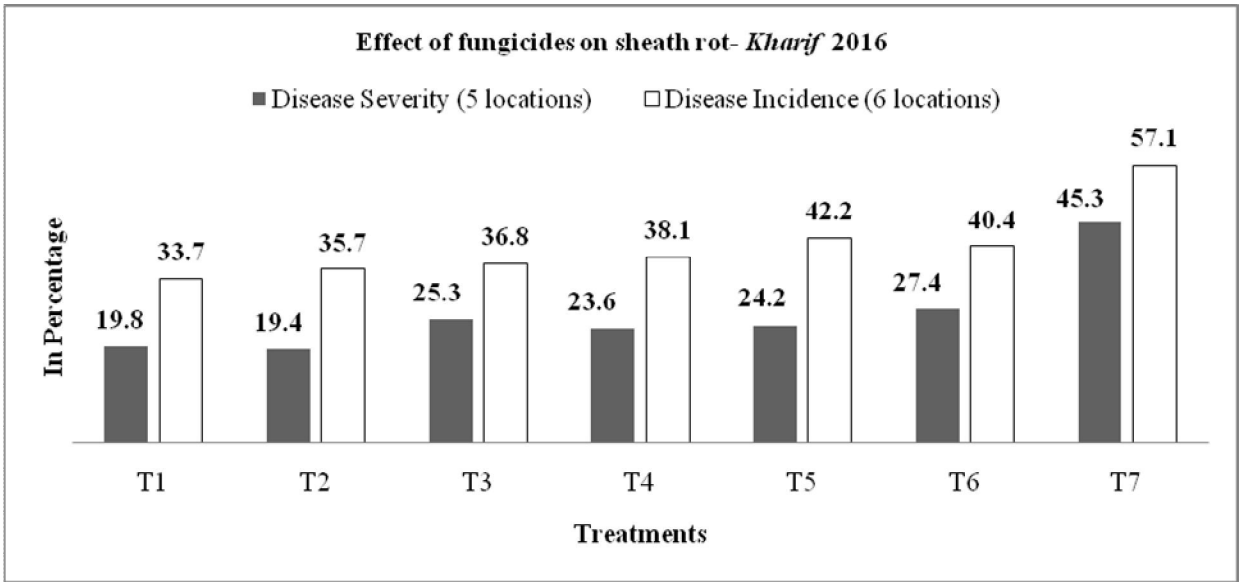
Treatment	Dosage/L	Disease severity													Disease incidence								
		ADT	BNK	CHN	CHP	CTK	FZB	IIRR	LDN	MND	MTU	PNT	RPR	Mean	BNK	CTK	FZB	LDN	MNC	MND	MTU	PNT	Mean
		N	N	A	A	A	A	A	A	A	A	A	A		N	A	A	A	N	A	A	A	
T1	**2 ml**	15.6 (23.2)	2.12 (1.8)	22.5 (28.3)	15.6 (23.0)	19.8 (26.2)	34.0 (35.7)	60.0 (51.3)	6.2 (14.3)	7.5 (15.9)	52.3 (46.4)	48.7 (44.2)	35.8 (36.5)	**26.7**	3.97 (2.0)	28.6 (32.2)	35.4 (36.5)	55.0 (47.9)	8.4 (2.9)	13.3 (21.4)	45.2 (42.2)	76.2 (60.8)	**33.3**
T2	**2.25 ml**	23.3 (28.8)	2.51 (1.6)	23.2 (28.8)	20.6 (26.7)	16.4 (23.8)	29.5 (32.9)	50.7 (45.4)	5.3 (13.2)	5.5 (13.5)	48.9 (44.3)	46.6 (43.1)	29.6 (32.9)	**25.2**	4.8 (2.1)	23.8 (29.2)	30.4 (33.4)	53.3 (46.9)	10.5 (3.2)	9.6 (17.9)	36.7 (37.1)	73.9 (59.2)	**30.4**
T3	**0.6 g**	22.2 (28.1)	1.72 (1.3)	47.5 (43.4)	31.4 (34.0)	50.6 (45.3)	48.3 (44.0)	54.7 (47.7)	31.5 (34.1)	23.3 (28.8)	53.4 (47.0)	52.2 (46.2)	38.9 (38.5)	**38.0**	3.7 (1.9)	54.2 (47.4)	42.8 (40.8)	88.3 (70.7)	8.2 (2.8)	41.6 (40.1)	42.0 (40.3)	81.3 (64.4)	**45.3**
T4	**1.5 ml**	12.2 (20.4)	2.38 (1.5)	24.1 (29.4)	21.9 (27.7)	32.7 (34.8)	38.6 (38.3)	51.3 (45.7)	4.7 (12.4)	18.8 (25.7)	33.2 (34.7)	55.7 (48.3)	32.9 (35.0)	**27.4**	4.2 (2.0)	38.4 (38.3)	37.6 (37.8)	51.7 (45.9)	9.6 (3.1)	26.7 (31.0)	24.7 (28.3)	85.7 (67.7)	**34.8**
T5	**2 ml**	37 (37.2)	2.12 (1.5)	24.9 (29.8)	25.8 (30.4)	41.9 (40.3)	30.6 (33.6)	56.0 (48.4)	7.0 (15.4)	17.7 (24.9)	24.2 (28.9)	45.7 (42.6)	25.2 (30.1)	**28.2**	3.7 (1.9)	43.5 (41.2)	31.2 (33.9)	56.7 (48.8)	6.7 (2.6)	23.7 (29.1)	16.4 (22.8)	72.7 (58.5)	**31.8**
T6	**1 g**	36 (36.6)	3.17 (1.8)	27.3 (31.5)	30.6 (33.5)	42.3 (40.5)	43.9 (41.5)	58.0 (50.4)	9.7 (18.1)	24.4 (29.5)	51 (45.5)	57.8 (49.5)	37.9 (37.4)	**35.1**	6.1 (2.4)	46.2 (42.8)	39.2 (38.7)	48.3 (44.0)	7.7 (2.7)	34.0 (35.7)	39.7 (38.8)	92.9 (74.6)	**39.2**
T7		43 (41.1)	5.03 (2.3)	76.9 (61.2)	59.4 (50.5)	71.6 (57.8)	78.3 (62.3)	60.3 (51.5)	42.6 (40.7)	41.0 (39.8)	60.7 (51.2)	80.5 (63.8)	82.2 (66.9)	**58.5**	7.1 (2.6)	79.4 (63.3)	52.1 (46.2)	100 (90.0)	14.2 (3.8)	64.4 (53.4)	64.3 (53.9)	99.0 (85.5)	**60.1**
Mean		**27.0**	**2.7**	**35.2**	**29.3**	**39.3**	**43.3**	**55.9**	**15.3**	**19.7**	**46.2**	**55.3**	**40.4**		**4.8**	**44.9**	**38.4**	**64.8**	**9.3**	**30.5**	**38.4**	**83.1**	
CV		3.39	12.04	1.7	13.77	8.44	3.54	19.2	7.24	8.2	14.3	1.42	15.8		12.29	9.32	3.27	6.41	10.2	7.89	23.6	2.4	
LSD at 5%		0.73	0.13	0.43	3.14	2.29	1.03	7.6	1.25	1.7	6.1	0.55	5.11		0.19	2.76	0.88	2.94	0.21	2.1	4.3	1.36	
Transformation		AT	ST	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT		ST	AT	AT	AT	ST	AT	AT	AT	

(Figures in parenthesis indicate transformed means; AT - Arc sine transformation; ST- Square root transformation)

Table 95: Effect of fungicides on grain yield with respect to rice sheath blight, *Kharif* 2016

Treatment	Dosage/L	Grain Yield (kg/ha)													
		ADT	BNK	CHN	CHP	CTK	FZB	IIRR	LND	MNC	MND	MTU	PNT	RPR	Mean
T1- Tricyclazole + tebuconazole (36% SC)	**2 ml**	5685	3570	5389	5120	5450	3713	4077	6740	7100	5420	6535	6415	6033	**5481**
T2- Tricyclazole + tebuconazole (36% SC)	**2.25 ml**	4917	3563	5309	4558	5674	4113	3837	6803	7960	5263	6612	6756	5993	**5489**
T3- Tricyclazole 75%WP	**0.6 g**	5440	3482	2914	3778	4082	3088	4343	5120	8100	3727	6452	6332	6083	**4842**
T4- Tebuconazole 25%	**1.5 ml**	6020	3563	4999	4418	4838	3395	4173	6597	8820	4837	6736	6060	5863	**5409**
T5- Hexaconazole 5%EC	**2 ml**	4887	3648	4822	4148	4644	3950	4127	6270	7530	5070	6870	6966	5990	**5302**
T6- Carbendazim 50%WP	**1 g**	4720	3400	4009	3843	4476	3338	3943	5727	9250	4194	6557	5997	5870	**5025**
T7- Control		4252	3252	2330	3215	3362	2588	2900	4653	6020	2554	5460	5381	5656	**3971**
General mean		**5132**	**3497**	**4253**	**4154**	**4647**	**3455**	**3914**	**5987**	**7826**	**4438**	**6460**	**6272**	**5927**	
CV		5.5	3.4	4.0	8.5	15.4	3.6	5.8	5.2	15.8	7.6	6.9	1.0	4.4	
LSD at 5%		198.4	84.8	120.3	250.1	506.4	88.1	184.2	252.5	872.5	273.9	314.0	50.5	212.4	

All the fungicidal products significantly reduced the disease incidence and severity compared to check and also increased the yield. The new combination fungicide tricyclazole 20%+ tebuconazole 16% (2.25 ml/l or 2.0 ml/l) significantly reduced the sheath rot severity at four locations (Lonavala, Navasari, Nawagam and Titabar) as well as incidence at four locations (Aduthurai, Lonavala, Navasari and Titabar). Test product reduced the incidence on par with commercial products (Hexaconazole 5% EC and carbendazim 50% WP) at Nawagam and Rajendranagar. However, both the concentration of test product *viz.,* 2 ml/l and 2.25 ml/l have showed minimum mean sheath rot incidence from all six test locations was about 33.7% and 35.7%, respectively, compared to other fungicides. On the other hand 2 ml/l and 2.25 ml/l of test product showed mean severity from five test locations was about 19.8% and 19.4%, respectively. There is no significant difference between the two concentrations (2.25 and 2.0 ml/l) of test product in terms of reducing disease severity and incidence (Table 96 and Figure 7).



T1 - Tricyclazole 20% SC+ tebuconazole 16% SC (36 SC); T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36 SC); T3 - Tricyclazole 75% WP; T4 - Tebuconazole 25% EC; T5 - Hexaconazole 5% EC; T6 - Carbendazim 50% WP; T7 – Control

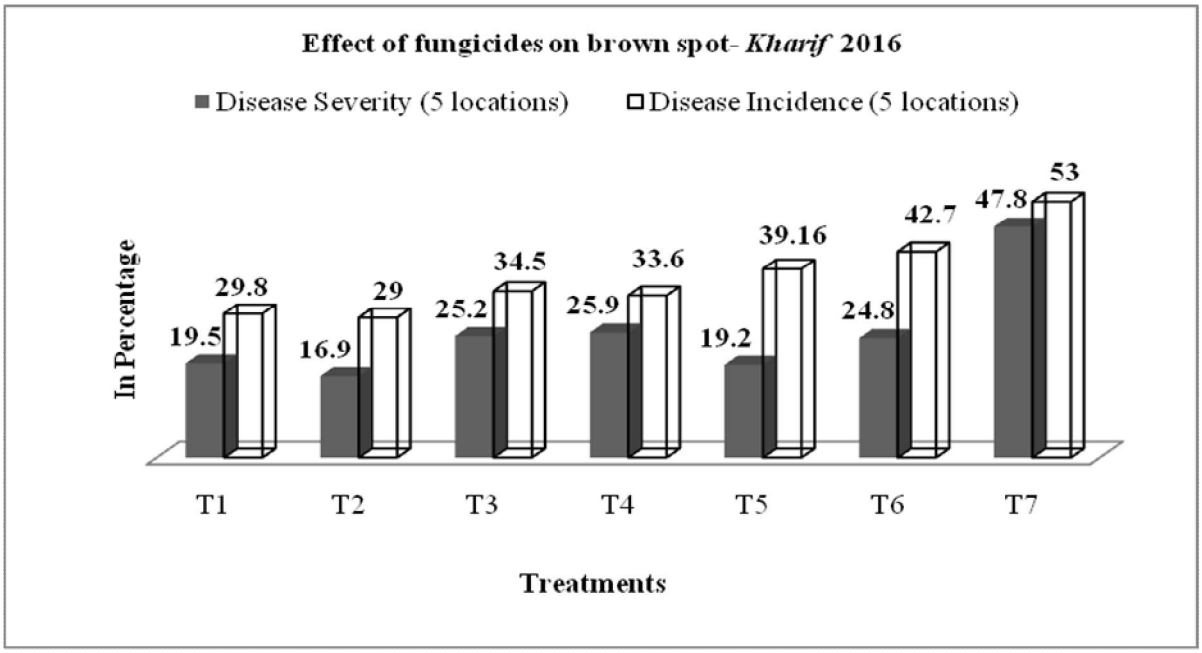
Figure 7: Effect of fungicides against sheath rot, *Kharif* 2016

The mean yield across the experimental locations in check plot was 4229 kg/ha. Among the treatments, combi-product tricyclazole 20%+ tebuconazole 16% (2.0 ml/l) yielded more (5353kg/ha) followed by 2.25 ml/l spray of the test fungicide (Table 97).

Brown spot: Test fungicide was evaluated against brown spot at seven different locations. Both disease incidence and severity was recorded at Bankura, Lonavala and Rewa. Only severity was recorded from Chatha and Pattambi whereas only incidence was recorded at Aduthurai and Coimbatore. Severity was very high (>50%) at Lonavala (56.8%), Chatha (54.8%) and Rewa (54%); and high at Pattambi (48.7%); and moderate at Bankura (24.8%). Incidence was very

high at Lonavala (92%); high at Rewa (63.5%) and Aduthurai (51.1%); and moderate at Bankura (29.8%) and Coimbatore (29.0%). Bio-efficacy of the fungicides was tested under natural infection at all the centres except at Rewa where artificial inoculation method was followed. All six fungicidal products performed better in reducing the brown spot at all the test location compared to untreated control.

Among all the treatment, the new combination fungicide tricyclazole 20%+ tebuconazole 16% (2.25 ml/l) was significantly reduced the disease severity at three locations (Bankura (13.1%), Lonavala (23%) and Rewa (14%)) compared to commercial checks viz., Hexaconazole 5% EC and carbendazim 50% WP. However, Hexaconazole 5% EC and carbendazim 50% WP significantly reduced the brown spot severity at Pattambi and Chatha compared to both the concentrations (2.0 ml and 2.25 ml/l) test product. Average disease severity (16.9%) was less from all five test locations where tricyclazole 20% + tebuconazole 16% (2.25 ml/l) sprayed compare to other treatments. Besides the same treatment (T2) reduced the disease intensity on par with the other check fungicides at four locations (Bankura, Coimbatore, Lonavala, and Rewa) except Auduthurai where tebuconazole was effective (DI: 13.3%). The mean disease intensity from all locations was about 29.0% and 29.8% by 2.25ml/l and 2.0ml/l concentration of test product (36% SC) compare to other fungicides (Table 98 and Figure 8). Fungicide sprayed plots showed significantly higher yield compare to control plot (3035 Kg/ha). Highest yield (4027 Kg/ha) was obtained from plots where tricyclazole 20%+ tebuconazole 16% (2.0 ml/l) sprayed (Table 99). Experimental results showed that higher concentration (2.25 ml/l) of test product reduced the disease incidence and severity better than lower concentration (2.0 ml/l) and other fungicides.



T1 - Tricyclazole 20% SC+ tebuconazole 16% SC (36 SC); T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36 SC); T3 - Tricyclazole 75% WP; T4 - Tebuconazole 25% EC; T5 - Hexaconazole 5% EC; T6 - Carbendazim 50% WP; T7 – Control

Figure 8: Effect of fungicides against brown spot *Kharif*, 2016

Table 96: Evaluation of fungicides against sheath rot disease of rice, *Kharif* 2016

Treatments		Disease severity						Disease incidence						
	Dosage/L	CHN	LNV	NVS	NWG	TTB	Mean	ADT	LNV	NVS	NWG	RNR	TTB	Mean
Inoculation		**A**	**N**	**N**	**N**	**A**		**N**	**N**	**N**	**N**	**N**	**A**	
T1 - Tricyclazole 20% SC + tebuconazole 16% SC (36% SC)	**2 ml**	22.1 (27.3)	32.6 (34.8)	16.8 (28.9)	21.2 (27.5)	6.4 (15.1)	**19.8**	13.3 (21.4)	82.0 (65.1)	23.6 (28.9)	60.2 (50.9)	13.8 (21.4)	9.4 (17.8)	**33.7**
T2 - Tricyclazole 20% SC + tebuconazole 16% SC (36% SC)	**2.25 ml**	25.6 (30.1)	29.4 (32.7)	15.3 (27.9)	21.9 (27.9)	5.2 (13.1)	**19.4**	28.8 (32.4)	79.0 (62.7)	22.0 (27.9)	63.7 (52.9)	12.3 (20.4)	8.6 (17.1)	**35.7**
T3 - Tricyclazole 75%WP	**0.6 g**	38.3 (38.7)	35.8 (36.7)	19.2 (32.1)	25.1 (30.1)	8.2 (17)	**25.3**	22.2 (28.1)	85.0 (67.3)	28.3 (32.1)	64.7 (53.6)	12.8 (20.7)	17.0 (24.3)	**36.8**
T4 - Tebuconazole 25% EC	**1.5 ml**	28.1 (31.8)	34.2 (35.7)	23.7 (34.7)	23.3 (28.7)	9.1 (18)	**23.6**	18.8 (25.7)	84.0 (66.9)	32.5 (34.7)	62.5 (52.2)	11.4 (19.5)	19.7 (25.9)	**38.1**
T5 - Hexaconazole 5%EC	**2 ml**	28.4 (32.0)	39.1 (38.4)	21.8 (34.3)	23.5 (29.0)	8.26 (17)	**24.2**	38.8 (38.5)	87.0 (69.4)	31.8 (34.3)	65.0 (53.7)	15.4 (23.1)	15.4 (23.1)	**42.2**
T6 - Carbendazim 50%WP	**1 g**	38.5 (38.3)	44.7 (41.9)	25.6 (37.2)	21.1 (27.3)	7.2 (16)	**27.4**	32.2 (34.5)	91.0 (72.9)	36.6 (37.2)	59.5 (50.5)	11.4 (19.5)	11.8 (20.1)	**40.4**
T7 - Control		61.1 (51.6)	63.0 (52.5)	34.1 (40.7)	43.7 (41.3)	24.8 (29.8)	**45.3**	43.3 (41.1)	99.0 (87.1)	42.6 (40.7)	82.0 (64.9)	30.6 (33.5)	45.6 (42.4)	**57.1**
General mean		**34.6**	**39.8**	**22.4**	**25.7**	**9.9**		**28.2**	**86.7**	**31.1**	**65.4**	**15.4**	**18.2**	
CV		15.06	14.4	4.94	1.49	4.87		2.4	7.5	4.9	4.29	13.52	4.4	
LSD at 5%		3.79	3.98	1.17	0.31	0.61		0.54	3.73	1.17	1.64	2.16	0.76	
Transformation		AT	AT	AT	AT	ST		AT	AT	AT	AT	AT	AT	

(Figures in parenthesis indicate transformed means; AT - Arc sine transformation; ST- Square root transformation)

Table 97: Effect of fungicides on grain yield with respect to rice sheath rot, *Kharif* 2016

Treatments	Dosage/L	Grain Yield kg/ha							
		ADT	**CHN**	**LNV**	**NVS**	**NWG**	**TTB**	**RNR**	**Mean**
T1- Tricyclazole 20%+ tebuconazole 16% SC	**2 ml**	5685	6283	2196	6173	7178	5290	4667	**5353**
T2-Tricyclazole 20% + tebuconazole 16% SC	**2.25 ml**	4917	6165	2319	6388	7261	5350	4759	**5308**
T3-Tricyclazole 75% WP	**0.6 g**	5440	5472	1965	5867	7046	4880	4773	**5063**
T4-Tebuconazole 25% EC	**1.5 ml**	6020	6125	1834	5453	7338	4850	4775	**5199**
T5-Hexaconazole 5% EC	**2 ml**	4887	6139	1626	5790	6946	4900	4759	**5007**
T6-Carbendazim 50% WP	**1 g**	4720	4875	1773	5225	7537	5200	4686	**4859**
T7-Control		4252	4465	1051	4703	6477	4065	4592	**4229**
General mean		**5137**	**5646**	**1823**	**5657**	**7112**	**4934**	**4716**	
CV		5.47	6.15	22.6	4.94	3.9	3.26	7.50	
LSD at 5%		198.4	245.4	291.3	424.8	200.8	113.7	250.1	

Table 98: Evaluation of fungicides against brown spot disease of rice, *Kharif* 2016

Treatments	Dosage/L	Disease severity						Disease incidence					
		BNK	CHT	LNV	PTB	REW	Mean	ADT	BNK	CBT	LNV	REW	Mean
Inoculation		**N**	**N**	**N**	**N**	**N/A**		**N**	**N**	**N**	**N**	**N/A**	
T1 - Tricyclazole 20% SC + tebuconazole 16% SC (36% SC)	**2 ml**	14.1 (3.7)	26.9 (31.2)	26.4 (30.9)	11.3 (19.6)	19.0 (25.4)	**19.5**	15.5 (22.1)	15.8 (23.4)	25.0 (29.6)	59.0 (50.1)	34.0 (35.6)	**29.8**
T2- Tricyclazole 20% SC + tebuconazole 16% SC (36% SC)	**2.25 ml**	13.1 (3.6)	23.3 (28.6)	23.0 (28.6)	11.1 (19.3)	14.0 (21.9)	**16.9**	25.5 (29.8)	15.4 (23.1)	21.0 (27.3)	55.0 (47.8)	28.5 (32.2)	**29.0**
T3 - Tricyclazole 75%WP	**0.6 g**	15.0 (3.8)	41.1 (39.5)	30.8 (33.7)	19.7 (26.4)	23.0 (28.0)	**25.2**	25.5 (29.8)	16.6 (24.1)	25.0 (29.6)	64.0 (53.1)	41.8 (40.2)	**34.5**
T4 - Tebuconazole 25% EC	**1.5 ml**	19.5 (4.4)	37.6 (37.8)	27.8 (31.7)	17.8 (24.9)	27.0 (31.3)	**25.9**	13.3 (21.0)	21.6 (27.7)	27.6 (31.7)	61.0 (51.3)	44.6 (41.8)	**33.6**
T5 - Hexaconazole 5%EC	**2 ml**	17.7 (4.2)	12.6 (20.1)	32.4 (34.6)	4.7 (12.5)	29.0 (32.7)	**19.2**	36.6 (36.7)	20.1 (26.6)	20.6 (27)	69.0 (56.3)	49.5 (44.7)	**39.2**
T6 - Carbendazim 50%WP	**1 g**	20.7 (4.5)	10.1 (18.1)	36.6 (37.2)	21.7 (27.8)	35.0 (36.4)	**24.8**	39.9 (38.7)	23.4 (28.8)	24.6 (29.7)	73.0 (58.8)	53.0 (46.7)	**42.7**
T7 - Control		24.8 (4.9)	54.8 (47.7)	56.8 (49.0)	48.7 (44.2)	54.0 (47.0)	**47.8**	51.1 (45.3)	29.8 (33.1)	29.0 (32.5)	92.0 (78.2)	63.5 (52.8)	**53.0**
General mean		**17.8**	**29.5**	**33.4**	**19.3**	**28.7**		**29.6**	**20.4**	**24.7**	**67.6**	**45.0**	
CV		7.4	13.3	12.1	6.5	4.5		8.1	4.8	6.6	10.2	3.2	
LSD at 5%		0.2	3.0	3.0	1.1	0.8		1.8	0.9	1.6	4.1	1.1	
Transformation		ST	AT	AT	AT	AT		AT	AT	AT	AT	AT	

Table 99: Effect of fungicides on grain yield with respect to rice brown spot, *Kharif* 2016

Treatments	Dosage/L	Grain yield kg/ha							
		ADT	**BNK**	**CBT**	**CHT**	**LNV**	**PTB**	**REW**	**Mean**
T1-Tricyclazole+tebuconazole (36% SC)	2 ml	5685	3570	4483	2200	2196	5792	4265	**4027**
T2-Tricyclazole+tebuconazole (36% SC)	2.25 ml	4917	3563	4633	2288	2319	5768	4540	**4004**
T3-Tricyclazole 75% WP	0.6 g	5440	3482	4423	2138	1965	5468	4105	**3860**
T4-Tebuconazole 25% EC	1.5 ml	6020	3563	4283	2488	1834	5283	3787	**3894**
T5-Hexaconazole 5% EC	2 ml	4887	3648	4190	2575	1626	5912	3670	**3787**
T6-Carbendazim 50% WP	1 g	4720	3400	4116	2675	1773	5116	3485	**3612**
T7-Control		4252	3260	3200	1975	1051	4503	3008	**3035**
General mean		**5132**	**3497**	**4190**	**2334**	**1823**	**5406**	**3837**	
CV		5.5	3.4	3.8	7.2	22.6	5.1	3.3	
LSD at 5%		198.4	84.8	130.6	118.3	291.3	207.0	102.7	

Glume/grain discolouration: The new chemicals along with standard checks were evaluated against glume discoloration at Lonavala and Mancompu. Disease incidence was 1.49% at Mancompu and 83% at Lonavala. At Mancompu very low level of disease severity (10.4%) was observed. All the fungicides reduced the disease incidence and severity compared to check. Treatment (T2) tricyclazole 20%+ tebuconazole 16% 2.25 ml/l minimised the disease incidence (17%) over other treatments. However, disease severity (4.8%) was less in the tebuconazole (1.5ml/l) treated (T3) plot at Moncompu. Highest grain yield (5394 Kg/ha) was recorded in plots where tricyclazole 20%+ tebuconazole 16% 2.25 ml/l was sprayed compared to check (3883 Kg/ha) (Table 100).

Leaf Scald: The fungicides were tested against leaf scald incidence and severity at Lonavala. The disease incidence and severity in control plot was 96% and 57.8%, respectively. Fungicidal molecules reduced the disease severity and incidence compared to untreated check. Among the treatments, low disease severity (26.6%) and incidence (67.0%) were recorded in the plot where tricyclazole 20%+ tebuconazole 16% 2.25 ml/l received, followed by tebuconazole (1.5ml/l). New combi-product showed the result on par with the commercially existing tebuconazole 25 EC (1.5ml/l) fungicide and recorded the highest yield (2827 Kg/ha) compared to check plot (1746 Kg/ha) from the same treatment (Table 100).

False smut: The fungicides were tested against false smut disease of rice at Varanasi. Infected panicles (35.2%) and infected spikelets were moderate in check plot. Among all treatments, significantly low panicle infection (14.0%) and spikelet infection (11.4%) was recorded in plots where tebuconazole 25% EC (1.5 ml/l) was sprayed followed by tricyclazole 20%+ tebuconazole 16% 2.25ml/l treatment.` However, highest grain yield 4449 Kg/ha was recorded in plots where tebuconazole 25% EC (1.5 ml/l) was sprayed compared to check (4154 Kg/ha) (Table 100). Tebuconazole was found superior when compare to all the fungicidal products.

Table 100: Evaluation of fungicides against glume discoloration leaf scald and false smut disease of rice, *Kharif* 2016

Treatments	Dosage /L	Glume discoloration							Leaf scald			False smut		
		Incidence			Severity	Yield (kg/ha)			Incidence	Severity	Yield (kg/ha)	% IP	% IS	Yield (kg/ha)
		LNV	MNC	Mean	MNC	MNC	LNV	Mean	LNV	LNV	LNV	VRN	VRN	VRN
Inoculation		N	N		N	N	N		N	N		N	N	
T1	2 ml	37.5 (37.7)	1.0 (0.9)	**19.3**	5.1 (2.2)	7100	2666	**4883**	70.0 (56.8)	29.56 (32.8)	2666	18.6 (25.2)	17.4 (24.2)	4332
T2	2.25 ml	33.3 (35.1)	0.79 (0.8)	**17.0**	5.5 (2.3)	7960	2827	**5394**	67.0 (55.0)	26.56 (30.9)	2827	17.8 (24.9)	14.2 (21.6)	4402
T3	0.6 g	46.0 (42.6)	0.71 (0.8)	**23.0**	5.5 (2.3)	8100	2651	**5375**	74.0 (59.4)	34.67 (36.0)	2651	20.3 (26.7)	19.5 (25.7)	4306
T4	1.5 ml	42.0 (40.2)	0.65 (0.8)	**21.0**	4.8 (2.1)	8820	2399	**5610**	72.0 (58.0)	32.0 (34.4)	2399	14.1 (22.0)	11.4 (19.3)	4449
T5	2 ml	48.0 (43.8)	0.77 (0.8)	**24.0**	5.4 (2.3)	7530	2307	**4918**	78.0 (62.2)	40.33 (39.3)	2307	27.0 (31.3)	22.2 (27.7)	4117
T6	1 g	56.0 (48.5)	1.2 (1.0)	**34.0**	5.7 (2.3)	9250	2346	**5798**	76.0 (60.7)	36.67 (37.2)	2346	31.3 (34.0)	23.8 (28.6)	4187
T7		83.0 (65.8)	1.49 (1.2)	**28.2**	10.4 (3.1)	6020	1746	**3883**	96.0 (82.0)	57.78 (49.4)	1746	35.2 (36.3)	25.98 (30.3)	4154
Mean		49.4	0.9		6.1	7826	2420		76.1	36.8	2420	23.5	19.2	4278
CV		13.2	9.30		9.73	872.5	22.6		8.0	6.29	22.6	5.12	25.7	5.13
LSD at 5%		4.18	0.06		0.16	15.7	291.3		3.54	1.65	291.3	1.03	4.62	154.1
Transformation		AT	ST		ST				AT	AT		AT	AT	

(Figures in parenthesis indicate transformed means; AT - Arc sine transformation; ST- Square root transformation)

2. INTEGRATED DISEASE MANAGEMENT, *Kharif* 2016

Integrated Disease Management (IDM) practices emphasis on the use of available resistant/moderately resistant varieties or hybrids against major diseases in particular location and timely application of required quantity of fertilizers and minimum quantity of fungicides. Based on the importance of plant susceptibility and management practices, the trial was formulated in split plot design with three cultivars *viz.*, susceptible variety, moderately resistant variety and hybrid along with two management practices (with and without management practices). In case of bacterial blight, the trial was laid out with the cultivation of different level of host susceptibility in combination with split application of nitrogen fertilizers.

The trial was proposed at 13 locations and data was received from 11 locations. IDM trial was conducted on sheath blight at Faizabad, Pantnagar, Pattambi; on foot rot/bakanae at Kaul; on leaf, neck and node blast at Lonavala; on leaf and neck blast at Malan; on neck blast and sheath blight at Mandya; on sheath blight and bacterial leaf blight at Maruteru and Moncompu; on leaf, neck blast and sheath rot at Rajendranagar and on leaf blast and brown spot at Rewa. Though IDM trial was conducted under natural disease pressure at almost all the locations, the artificial disease pressure was also created at Faizabad, Kaul and Maruteru (Table 101).

Masodha (Faizabad): Cultivars PB-1 (susceptible variety), NDR-359 (moderately resistant variety) and Arize 6444 (hybrid) were evaluated with and without management practices against sheath blight. Among the cultivars, PB-1 recorded high disease incidence (48.70%) and high disease severity (72.18%). Across all the cultivars, adoption of integrated management practices reduced the disease severity from 51.62% to 35.96% and disease incidence from 40.40% to 34.83%. When disease management practices had been adopted, the grain yield was increased across all the three cultivars and the highest grain yield of 6463 kg/ha recorded in the cultivar Arize 6444 (Table 102).

Kaul: At this location, trail was conducted for the integrated management of foot rot with the cultivars *viz.*, Pusa Basmati-1121 (susceptible variety), Haryana Basmati-2 (moderately resistant variety) and Haryana Sankardhan-1 (hybrid). Among the three cultivars, Haryana Sankardhan-1 was completely free from disease even without any management practices. Adoption of seed treatment practice significantly reduced disease incidence from 4.41% to 0.51% in Pusa Basmati 1121 and from 3.96% to 0% in Haryana Basmati-2. With respect to yield, Haryana Sankardhan-1 recorded the highest grain yield of 5875 kg/ha (Table 103).

Lonavala: Three cultivars *viz.*, EK 70 (susceptible variety), Indrayani (moderately resistant variety) and Sahyadri-2 (hybrid) were evaluated against leaf, neck and node blast under natural disease pressure. All the three diseases were recorded in terms of either disease severity or disease incidence. Out of three cultivars, Sahyadri-2 performed well without disease management (NDM) Practices (LB-DS-8.89%; LB-DI-38.00%; NB-DS-11.00%; NB-DI-9.60%) and with disease management practices (LB-DS-3.78%; LB-DI-23.00%; NB-DS-4.00%; NB-DI-4.04%) followed by Indrayani and EK70. However, adoption of integrated management practices significantly increased the grain yield from 3407 kg/ha to 5513 kg/ha in Sahyadri-2; from 3436 to 5416 kg/ha in Indrayani (Table 104).

Table 101: Integrated Disease Management *Kharif* 2016: Details of the trial

Location	Variety	Diseases Recorded	Sowing & Transplanting	Disease Development	Date Initial Symptom Observed	Date of Spray	Date of Observation	Date of Harvest
Faizabad (Masodha)	V1-PB-1 V2-NDR 359 V3-Arize 6444	Sheath Blight	22.06.16 20.07.16	A	05.10.16	08.10.16	I-07.10.16 II-28.10.16	17.11.16
Kaul	V1 - Pusa Basmasti 1122 V2 - Haryana Basmathi 2 V3 - Haryana Sankardhan 1	Foot rot/ Bakanae	04.06.16 27.06.16	A	18.06.16	-	24.06.16 25.06.16	-
Lonavala	V1 – EK 70 V2 - Indrayani V3 - Sahyadri 2	Leaf blast blast	04.07.16 04.08.16	N	12.09.16 (LB) 27.09.16 (NB) 25.09.16 (NodB)	12.09.16 27.09.16 10.10.16	V1- 03.10.16 - LB V1- 02.11.16 - NB & NodB V2 - 21.11.16 –NB& NodB V3 - 03.12.16 – NB & NodB	V1 - 02.11.16 V2 - 21.11.16 V3 - 03.12.16
Malan	V1-HPU 2216 V2-HPR 2612 V3-Arize 6129	Leaf blast Neck blast	16.06.16 16.07.16	N	18.08.16	26.08.16 12.09.16	22.09.16 (LB) 17.10.16(NB)	08.11.16
Mandya	V1-MTU 1001 V2-BR 2655 V3-KRH 4	Neck blast Sheath blight	-	N	14.11.16 (SHB) 02.12.16 (NB)	15.11.16	01.12.16 (SHB) 15.12.16 (NB)	03.01.17
Maruteru	V1-MTU 7029 V2-MTU 1061 V3-Arize 6444 gold	Sheath blight	20.06.16 19.07.16	A	31.08.16	06.09.16 23.09.16 13.10.16	26.10.16 (SHB)	08.11.16 (SHB)
Maruteru	V1-MTU 2077 V2-MTU 4870 V3-Arize 6444 gold V4-MTU 7029	Bacterial leaf blight	20.6.16 19.7.16	A	19.9.16	06.09.16 23.09.16 13.10.16	04.11.16 (BLB)	10.11.16 (BLB)
Moncompu	V1- Jyothi V2- Shreyas V3- Uma	Sheath blight	06.08.16 22.06.16	N	09.12.16	14.9.16	09.12.16 10.04.16	11.02.16
Moncompu	V1- Jyothi V2- Shreyas V3- Uma	Bacterial leaf blight		N	22.09.16	23.09.16	22.09.16 18.10.16	11.12.16
Pantnagar	V1- Pant Dhan 4 V2- Pant Dhan 10 V3 –LG-94-02	Sheath blight	06.07.16 01.08.16	N	14.10.16	14.10.16 24.10.16	24.10.16	16.11.16
Pattambi	V1- Jyothi V2- Aiswarya V3- Aathira	Sheath blight	04.07.16 27.07.16	N	1.10.16	07.10.16	31.10.16	17.11.16
Rajendranagar	V1- Tellahamsa V2-RNR 15048 V3-KRH-2	Leaf blast Neck blast Sheath rot	04.07.16 12.08.16	N	25.09.16 (LB) 13.10.16 (NB) 29.09.16 (SHR)	27.09.16 15.10.16	23.09.16 (LB) 16.10.16 (NB) 17.10.16 (SHR)	20.12.16
Rewa	V1- PS-4 V2- Shahbhagi V3- JRH -5	Leaf blast Brown spot	01.07.16 23.07.16	N	15.09.16	20.09.16 30.09.16	05.10.16	05.11.16

Table 102: Integrated disease management of Sheath blight, *Kharif* 2016

Main plot	FZB						Yield		
	Sub plot/ treatment (SHB DS %)			Sub plot/ treatment (SHB DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
PB - 1	35.85 (36.75)	72.18 (58.16)	47.45	36.20 (36.95)	48.70 (44.23)	40.59	3563	2463	3012
NDR 359	32.45 (34.69)	54.13 (47.35)	41.02	30.40 (33.43)	42.10 (40.40)	36.92	4513	3688	4100
Arize 6444	35.33 (36.44)	57.53 (49.33)	42.88	31.50 (34.10)	40.60 (39.57)	36.84	6463	5238	5850
Mean	35.96	51.62		34.83	40.40		4845	3795	
CD (5%)									
For main plot (v) means averaged over sub-plots	1.96			2.09			366		
For subplot (M) averaged over all main plot	2.57			1.94			376		
For means at same level of variety	4.46			3.35			651		
For means at different level of variety	3.71			3.16			588		
CV(rep*Var)	3.66			4.48			6.93		
CV(rep*Var*N)	6.36			5.51			9.43		
Transformation	AT			AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DS - Disease severity; DI - Disease incidence)

Table 103: Integrated disease management of Foot rot, *Kharif* 2016

Main plot	KUL			Yield		
	Sub plot/ treatment (FR DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
Pusa Basmati -1121	0.51 (0.97)	4.41 (2.21)	1.59	5150	4900	5025
Haryana Basmati - 2	0.0 (0.71)	3.96 (2.09)	1.40	5300	5100	5200
Haryana Sankardhan -1	0.0 (0.71)	0.0 (0.71)	0.71	5875	5625	5750
Mean	0.79	1.67		5441	5208	
CD (5%)						
For main plot (V) means averaged over sub-plots	0.26			213		
For subplot (M) averaged over all main plot	0.17			194		
For means at same level of variety	0.30			337		
For means at different level of variety	0.33			320		
CV(rep*Var)	16.82			3.28		
CV(rep*Var*N)	15.26			3.96		
Transformation	ST					

(Figures in parenthesis indicate transformed means; ST- Square root transformation; DI - Disease incidence).

Table 104: Integrated disease management of Blast (Leaf, Neck and Node blast), *Kharif* 2016

Main plot	LNV												Yield		
	Sub plot/ treatment (LB DS %)			Sub plot/ treatment (LB DI %)			Sub plot/ treatment (NB DS %)			Sub plot/ treatment (NoB DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
EK 70	31.67 (34.20)	47.89 (43.77)	38.98	55.00 (47.88)	73.00 (58.75)	53.32	33.00 (34.96)	50.00 (44.98)	39.97	24.51 (29.63)	42.28 (40.45)	35.05	2982	1927	2454
Indrayani	5.00 (12.88)	11.44 (19.72)	16.30	27.00 (31.17)	44.00 (41.52)	36.34	9.00 (17.11)	19.00 (25.75)	21.43	6.65 (12.63)	12.57 (20.29)	16.46	5416	3436	4425
Sahyadri 2	3.78 (11.18)	8.89 (17.27)	14.22	23.00 (28.47)	38.00 (38.02)	33.24	4.00 (9.87)	11.00 (19.30)	14.58	4.04 (9.93)	9.60 (17.97)	13.95	5513	3407	4460
Mean	19.42	26.92		35.84	46.09		20.65	30.01		17.39	26.43		4637	2931	
CD (5%)															
For main plot (V) means averaged over sub-plots	2.51			5.14			3.51			9.43			822		
For subplot (M) averaged over all main plot	1.16			3.22			5.22			3.79			443		
For means at same level of variety	2.02			5.58			9.05			6.56			768		
For means at different level of variety	2.89			6.48			7.29			10.51			985		
CV(rep*Var)	8.89			10.27			11.33			35.35			17.79		
CV(rep*Var*N)	5.44			8.52			22.34			18.82			12.70		
Transformation	AT			AT			AT			AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DS - Disease Severity; DI-Disease Incidence)

Malan: Integrated disease management trial was conducted with three cultivars *viz.*, HPU 2216, HPR 2612 and Arize 6129 against leaf and neck blast. Diseases were recorded as disease severity for leaf blast and disease incidence for neck blast. Under natural disease pressure, the susceptible cultivar HPU 2216 was recorded high disease severity of leaf blast (66.33%) and disease incidence of neck blast (64.20%). Hybrid Arize 6129 was completely free from leaf and neck blast disease and moderately resistant cultivar HPR 2612 recorded low level of leaf blast disease severity (2.3%) and moderate level of neck blast disease incidence (26.00%). Application of integrated management practices significantly reduced both leaf and neck blast in HPR 2612 and HPU 2216 (LB-NDM-DS-21.06%; LB-DM-DS-10.85%); (NB-NDM-DI-28.06%; NB-DM-DI-10.35%). With respect to grain yield, hybrid Arize 6129 recorded the highest grain yield of 6597 Kg/ha (Table 105).

Mandya: The trail was conducted to test the performance of MTU 1001 (susceptible variety), BR2655 (moderately resistant variety) and KRH-4 (hybrid) against neck blast, sheath blight under natural and artificial disease pressure respectively. Among the three cultivars, BR2655 recorded low level of neck blast disease incidence (NDM-21.54%; DM-7.31%) and sheath blight disease severity (NDM-12.59%; DM-6.66%). Application of one spray of tebuconazole + trifloxystrobin 75 WG (50% +25% w/w) @ 0.4g/l reduced the sheath blight severity from 31.81% to 16.85% and neck blast incidence from 37.52% to 18.96% across all the three cultivars. With respect to grain yield, KRH-4 significantly recorded high (6342 kg/ha), compared to BR2655 (5022 kg/ha) and MTU 1001 (4911 kg/ha) (Table 106).

Maruteru (Sheath Blight): Susceptible variety MTU 7029 (Swarna), moderately resistant variety MTU 1061 (Indra) and locally released hybrid (Arize 6444 gold) were evaluated against sheath blight under artificial disease pressure. Without integrated management practices, moderately resistant variety MTU 1061 recorded low level of disease incidence (25.49%) and low level of disease severity (31.11%), as compared to MTU 7029 (DI-61.50%; DS-60.78%) and Arize 6444 gold (DI-34.82%; DS-49.00%). Adoption of integrated disease management practices in MTU 1061 significantly reduced the disease incidence from 25.49% to 8.05% and disease severity from 31.11% to 10.22% and therefore increased the grain yield up to 6481 kg/ha (Table 107).

Maruteru (Bacterial leaf blight): The cultivars *viz.*, MTU 2077 (Krishnaveni), MTU 4870 (Deepti), Arize 6444 gold and MTU 7029 (Swarna) were evaluated under artificial disease pressure. Fertilizer doses *viz.*, 90:40:40 NPK kg/ha (Basal - 30:40:20; Top - 30:0:0, 30:0:20) and 120:40:40 NPK kg/ha (Basal: 40:40:20; Top- 40:0:0; 40:0:20) were applied as two different disease management practices. Among the four cultivars, the susceptible variety MTU 2077 was recorded the high incidence (70.44%) and high disease severity (72.56%). Application of 90:40:40 NPK kg/ha, reduced both disease incidence and disease severity across all the cultivars. Except MTU 2077, all the other three cultivars performed on par against bacterial leaf blight disease. With respect to grain yield, the variety Swarna (MTU 7029) recorded high yield of 6549 kg/ha, when 90:40:40 NPK kg/ha was applied (Table 107).

Table 105: Integrated disease management of Leaf and Neck blast, *Kharif* 2016

Main plot	MLN						Yield		
	Sub plot/ treatment (LB DS %)			Sub plot/ treatment (NBL DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
HPU 2216	29.00 (32.54)	66.33 (54.52)	43.53	8.60 (16.97)	64.20 (53.28)	35.12	3776	2908	3342
HPR 2612	0.0 (0.0)	2.3 (8.65)	4.32	6.00 (14.08)	26.00 (30.88)	22.48	4384	4167	4275
Arize 6129	0.0 (0.0)	0.0 (0.0)	0.0	0.0 (0.0)	0.0 (0.0)	0.0	6597	6163	6380
Mean	10.85	21.06		10.35	28.06		4918	4412	
CD (5%)									
For main plot (v) means averaged over sub-plots	1.83			3.17			298		
For subplot (M) averaged over all main plot	0.60			1.75			231		
For means at same level of variety	1.05			3.04			400		
For means at different level of variety	1.97			3.82			410		
CV(rep*Var)	7.17			10.29			3.99		
CV(rep*Var*N)	3.30			7.94			4.30		
Transformation	AT			AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DS - Disease severity; DI-Disease Incidence)

Table 106: Integrated disease management of Neck blast and Sheath blight, *Kharif* 2016

Main plot	MND						Yield		
	Sub plot/ treatment (NBL DI %)			Sub plot/ treatment (SHB DS %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
MTU 1001	11.83 (19.83)	44.32 (41.72)	30.78	10.37 (18.50)	36.29 (36.96)	27.73	4911	3247	4078
BR 2655	7.31 (15.48)	21.54 (27.61)	21.55	6.66 (14.82)	12.59 (20.66)	17.73	5022	4415	5230
KRH 4	13.78 (21.57)	46.94 (43.22)	32.39	8.89 (17.25)	37.76 (37.82)	27.54	6342	4118	4718
Mean	18.96	37.52		16.85	31.81		5425	3926	
CD (5%)									
For main plot (v) means averaged over sub-plots	2.78			3.07			194		
For subplot (M) averaged over all main plot	3.15			4.92			376		
For means at same level of variety	5.45			8.52			652		
For means at different level of variety	4.75			6.75			500		
CV(rep*Var)	6.16			7.89			2.59		
CV(rep*Var*N)	9.67			17.53			6.99		
Transformation	AT			AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DI – Disease Incidence, DS - Disease severity)

Table 107: Integrated disease management of Sheath blight and Bacterial leaf blight, *Kharif* 2016

Main plot	MTU												Yield		
	Sub plot/ treatment (SHB DS %)			Sub plot/ treatment (SHB DI %)			Sub plot/ treatment (BLB DS %)			Sub plot/ treatment (BLB DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
MTU 7029/ MTU 2077*	30.11 (33.08)	60.78 (51.32)	42.19	23.03 (28.03)	61.50 (51.76)	39.89	68.67 (56.18)	72.56 (58.41)	57.29	65.46 (54.75)	70.44 (57.39)	56.07	6231 5987*	5690 5499*	5960 5743*
MTU 1061/ MTU 4870*	10.22 (18.19)	31.11 (33.66)	25.93	8.05 (15.49)	25.49 (29.53)	22.51	49.45 (44.69)	53.34 (46.94)	45.81	35.61 (36.08)	38.36 (38.13)	37.10	6481 5459*	6341 5380*	6411 5419*
Azire 6444 Gold/ Azire 6444 Gold*	24.67 (29.36)	49.00 (44.44)	36.90	14.81 (21.97)	34.82 (39.53)	28.95	44.00 (40.93	49.33 (44.45)	42.63	30.50 (31.67)	32.38 (33.55)	32.61	4330 5475*	3662 5378*	3995 5426*
MTU 7029*	-	-					39.89 (38.93)	46.00 (42.59)	40.76	24.07 (28.73)	31.36 (33.39)	31.06	6549*	6014*	6281*
Mean	26.87	43.14		21.83	39.07		45.18	48.09		37.81	40.62		5680 5867*	5230 5567*	
CD (5%)															
For main plot (v) means averaged over sub-plots	7.32			9.05			10.67			15.67			1288 1215*		
For subplot (M) averaged over all main plot	7.13			7.66			4.18			5.05			298 475*		
For means at same level of variety	12.36			13.27			9.57			10.10			517 950*		
For means at different level of variety	11.39			13.02			12.64			17.22			1339 1388*		
CV(rep*Var)	17.11			24.29			20.23			35.34			19.31 18.79*		
CV(rep*Var*N)	22.08			27.25			13.33			16.73			5.93 10.79*		
Transformation	AT			AT			AT			AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DI – Disease Incidence, DS - Disease severity; * indicates BLB trial)

Moncompu: The trail was conducted with three varieties *viz.,* Jyothi (susceptible variety), Shreyas (moderately resistant variety) and Uma (high yielding variety) for the integrated management of sheath blight and bacterial leaf blight. Diseases were recorded as disease severity (sheath blight) and disease incidence (bacterial leaf blight). Without disease management practice, Shreyas (DS - 45%) and Uma (DS - 39.63%) performed on par against sheath blight disease compared to Jyothi (53.59%). With respect to bacterial leaf blight, Shreyas recorded low disease incidence (38.89%), compared to Uma (46.02%) and Jyothi (46.39%). However, the highest grain yield of 6127 kg/ha was recorded in Uma when management practices were adopted, as compared to Jyothi (4138 kg/ha) and Shreyas (5536 kg/ha) (Table 108).

Pantnagar: The tested cultivars against sheath blight were Pant Dhan-4 (susceptible variety), Pant Dhan-10 (moderately resistant variety) and LG-94-02 (hybrid). Sheath blight was recorded as disease severity and disease incidence. Under natural disease pressure, 49.38% of disease incidence and 57.15% of disease severity was recorded in LG-94-02. Among the three cultivars, Pant Dhan-10 recorded with low disease incidence (27.49%) and low disease severity (47.26%) even without adoption of management practices. Adoption of integrated management practices significantly reduced the disease incidence from 37.48% to 22.86% and disease severity from 52.77% to 40.52% across all the cultivars. However, LG-94-02 recorded the highest grain yield of 7246 kg/ha, compared to Pant Dhan-4 (7009 kg/ha) and Pant Dhan-10 (6783 kg/ha), when management practices were adopted (Table 109).

Pattambi: Cultivars *viz.,* Jyothi (susceptible variety), Aiswarya (moderately resistant variety) and Aathira (moderately resistant variety) were tested against sheath blight under natural disease pressure. Very high disease severity (54.88%) and high percent disease index (75.00%) were recorded in the susceptible cultivar Jyothi. Application of one spray of hexaconazole (2 ml/l) reduced the disease severity from 40.42% to 30.77% and percent disease index from 49.05% to 35.00% across all the cultivars. With respect to the performance of varities against sheath blight, both Aiswarya and Aathira were on par. When management practices were adopted, the highest grain yield was recorded by moderately resistant variety-Aathira (6415 kg/ha) and lower grain yield was recorded as 3941 kg/ha in locally popular variety- Jyothi (Table 110).

Rajendranagar: Susceptible variety Tellahamsa, moderately resistant variety RNR-15048 and locally released hybrid KRH-2 were evaluated against leaf, neck blast and sheath rot diseases (under natural disease pressure) with and without integrated management practices. The cultivars RNR-15048 and KRH-2 were completely free from leaf and neck blast disease, whereas Tellahamsa recorded with 65.55% of leaf blast, 23.01% of neck blast and 15.16% of sheath rot disease. With respect to yield, application of integrated management practices, significantly increased the mean yield (across the cultivars) from 3485 kg/ha to 4000 kg/ha. When management practices were adopted the cultivars KRH-2 and RNR-15048 were recorded the grain yield of 4241 kg/ha and 4237 kg/ha respectively (Table 111).

Table 108: Integrated disease management of Sheath blight and Bacterial leaf blight *Kharif* 2016

Main plot	MNC						Yield		
	Sub plot/ treatment (SHB DS %)			Sub plot/ treatment (BLB DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
Jyothi	47.87 (43.74)	53.59 (47.06)	45.40	41.82 (40.27)	46.39 (42.90)	41.58	4138	2848	3493
Shreyas	31.76 (34.23)	45.00 (38.96)	38.17	11.11 (19.44)	38.89 (38.19)	28.82	5536	4622	5079
Uma	33.51 (35.30)	39.63 (38.96)	37.13	13.15 (21.13)	46.02 (42.69)	31.91	6127	5321	5724
Mean	37.76	42.71		26.94	41.26		5267	4264	
CD (5%)									
For main plot (v) means averaged over sub-plots	8.47			5.02			546		
For subplot (M) averaged over all main plot	4.63			3.93			412		
For means at same level of variety	8.03			6.81			713		
For means at different level of variety	10.19			6.95			743		
CV(rep*Var)	17.22			12.05			9.38		
CV(rep*Var*N)	12.48			12.49			9.36		
Transformation	AT			AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DS - Disease severity; DI – Disease incidence)

Table 109: Integrated disease management of Sheath blight, *Kharif* 2016

Main plot	PNT						Yield		
	Sub plot/ treatment (SHB DS %)			Sub plot/ treatment (SHB DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
Pant Dhan-4	42.70	53.92	48.31	16.20 (23.72)	34.91 (36.19)	29.95	7009	6918	6963
Pant Dhan-10	35.66	47.26	41.46	12.25 (20.46)	27.49 (31.60)	26.03	6783	6678	6730
LG-94-02	43.22	57.15	50.19	17.07 (24.39)	49.38 (44.62)	34.50	7246	7123	7184
Mean	40.52	52.77		22.86	37.48		7012	6906	
CD (5%)									
For main plot (v) means averaged over sub-plots	3.59			1.40			72		
For subplot (M) averaged over all main plot	0.84			0.75			45		
For means at same level of variety	1.46			1.30			78		
For means at different level of variety	3.73			1.67			90		
CV(rep*Var)	4.80			2.90			0.65		
CV(rep*Var*N)	1.57			2.16			0.56		
Transformation				AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DS - Disease severity; DI - Disease incidence)

Table 110: Integrated disease management of Sheath blight, *Kharif* 2016

Main plot	PTB						Yield		
	Sub plot/ treatment (SHB DS %)			Sub plot/ treatment (SHB PDI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
Jyothi	43.13 (41.01)	54.88 (47.79)	44.40	59.45 (50.48)	75.00 (60.06)	55.27	3941	3385	3663
Aiswarya	18.75 (25.61)	34.88 (36.17)	30.89	21.11 (27.24)	46.11 (42.74)	34.99	5554	4714	5134
Aathira	18.88 (25.70)	36.75 (37.28)	31.49	21.11 (27.27)	48.89 (44.34)	35.81	6415	5355	5885
Mean	30.77	40.42		35.00	49.05		5303	4484	
CD (5%)									
For main plot (v) means averaged over sub-plots	3.85			6.50			466		
For subplot (M) averaged over all main plot	1.31			1.86			357		
For means at same level of variety	2.27			3.23			619		
For means at different level of variety	4.17			6.89			639		
CV(rep*Var)	8.85			12.65			7.79		
CV(rep*Var*N)	4.00			4.81			7.91		
Transformation	AT			AT					

(Figures in parenthesis indicate transformed means; DS - Disease severity; PDI – Percent disease index)

Table 111: Integrated disease management of Leaf blast, Neck blast and Sheath rot, *Kharif* 2016

Main plot	RNR									Yield		
	Sub plot/ treatment (LB DS %)			Sub plot/ treatment (NB DI %)			Sub plot/ treatment (SHR DS %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
Tellahamsa	47.21	65.55	56.38	20.01 (26.17)	23.01 (28.44)	27.31	18.00	15.16	16.58	3524	2679	3101
RNR – 15048	0.0	0.0	0.0	0.0	0.0	0.0	8.43	12.29	10.36	4237	3687	3962
KRH – 2	0.0	0.0	0.0	0.0	0.0	0.0	8.58	8.80	8.69	4241	4090	4165
Mean	15.73	21.85		8.73	9.48		11.67	12.08		4000	3485	
For main plot (v) means averaged over sub-plots	6.08			5.2			6.86			302		
For subplot (M) averaged over all main plot	3.75			1.2			1.54			124		
For means at same level of variety	6.50			2.24			2.66			215		
For means at different level of variety	7.62			5.49			7.11			338		
CV(rep*Var)	26.47			47.24			47.20			6.61		
CV(rep*Var*N)	21.63			15.45			14.04			3.60		
Transformation				AT								

(Figures in parenthesis indicate transformed means; AT-Arc sine transformation; DS - Disease severity; DI- Disease incidence)

Rewa: Trial on integrated disease management on leaf blast was conducted at this location with three cultivars *viz.*, PS-4 (susceptible variety), Shahbhagi (moderately resistant variety) and JRH-5 (hybrid). With respect to cultivars, JRH-5 recorded nil disease incidence/severity of leaf blast even without disease management practices, compared to Shahbhagi (DS-4.57%; DI-8.47%) and PS-4 (DS-20.53%; DI-33.07%). Application of integrated disease management practices reduced the leaf blast disease severity /incidence in Shahbhagi and PS-4. The highest grain yield of 6667 kg/ha was recorded in JRH-5, compared to Shahbhagi (3937 kg/ha) and PS- 4 (3793 kg/ha) (Table 112).

Table 112: Integrated disease management of Leaf blast, *Kharif* 2016

Main plot	REW						Yield		
	Sub plot/ treatment (LB DS %)			Sub plot/ treatment (LB DI %)			Sub plot/ treatment (Kg/ha)		
Variety	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**	**DM**	**NDM**	**Mean**
PS -4	5.13	20.53	12.83	15.57 (23.18)	33.07 (35.07)	29.13	3793	2843	3318
Shahbhagi	2.03	4.57	3.30	3.50 (10.73)	8.47 (16.88)	13.80	3937	3300	3618
JRH -5	0.0	0.0	0.0	0.0	0.0	0.0	6667	6168	6417
Mean	2.38	8.36		11.34	17.31		4798	4103	
CD (5%)									
For main plot (v) means averaged over sub-plots	0.88			2.67			241		
For subplot (M) averaged over all main plot	1.34			0.51			145		
For means at same level of variety	2.33			0.88			251		
For means at different level of variety	1.86			2.74			299		
CV(rep*Var)	10.28			11.66			3.39		
CV(rep*Var*N)	21.69			3.11			2.83		
Transformation				AT					

(Figures in parenthesis indicate transformed means; AT- Arc sine transformation; DS - Disease severity; DI -Disease Incidence)

3. INTEGRATED PEST MANAGEMENT - SPECIAL TRIAL

The trial was formulated jointly by pathology and entomology to validate IPM practices for the management of pests in a holistic way (including insects, diseases and weeds). The treatment includes two types of practices *viz*., IPM and farmers practices. The trial was proposed at 12 locations. With respect to diseases, data was received from Gangavati, Mandya, Chinsurah, Sakoli, Coimbatore and Malan. Among these locations, the Coimbatore and Malan centres recorded only Leaf blast (LB) and Neck blast (NB) diseases and other centres recorded Sheath blight (ShB), Bacterial leaf blight (BLB), Sheath rot (ShR) and Brown spot (BS). Based on the percent disease intensity over different days after transplantation (DAT) of the crop, the area under disease progress curve (AUDPC) was calculated. The Area Under the Disease Progress Curve (AUDPC) is a quantitative measure of disease intensity with time. It is used in plant pathology to indicate and compare levels of resistance to diseases among varieties of plants.

The trapezoid method is the most common way to calculate AUDPC. It is performed by using a formula devised by Campbell and Madden (1990) or by plotting a graph of percentage of infection against time and summing the trapezoids between time intervals. This method is used to quantify disease intensity over time. The average disease severity was calculated at the midpoint between each two time points, multiply that average by the length of time between the two points and then sum those products across all time intervals (Table 113). Lower AUDPC's represent slower disease progression and greater resistance to the disease. Higher AUDPC's represent faster disease progression and higher susceptibility to the disease.

Table 113: AUDPC values based on different transplantation dates/disease severity (%)/ disease incidence (%) of different diseases at various locations.

Practice	Location/AUDPC value											
	GNV			MND		SKL						
	LB	NB	SHB	NB	SHB	LB	NB	BS	BLB	SHB	SHR	SR
IPM	219	121	368	15	36	432	10	330	874	285	159	253
FP	151	145	395	35	47	428	13	343	725	255	168	247

(IPM- Integrated pest management; FP- Farmers Practice; LB- Leaf blast; NB-Neck blast; BLB-Bacterial leaf blight; BS-Brown spot, FS- False smut; SHBL- Sheath blight; DI- Disease Incidence; DS- Disease Severity)

Table 113: AUDPC values based on different transplantation dates/disease severity (%)/ disease incidence (%) of different diseases at various locations (Table continued)

Practice	Location/AUDPC value						
	CBT	MLN		CHN			
	LB	LB	NB	LB	SHB	BS	BLB
IPM	54	164	41	0	131	112	0
FP	86	472	183	55	375	283	8

With respect to Leaf blast disease in Coimbatore centre the disease started at 78 DAT and almost ended at 106 DAT. The disease in Farmer's practice was high at about 10.40 PDI when compared to a maximum of 4.53 in IPM. In Sakoli centre the disease started at about 36 DAT and ended at 106 DAT. The disease was maximum in FP (18.95) when compared to 10.65 in IPM. In Gangavati, the disease started at 43 DAT and was seen throughout the growing season till 127 DAT. However the disease intensity was very less (7.59 and 5.47) respectively at FP and IPM (Fig.9)

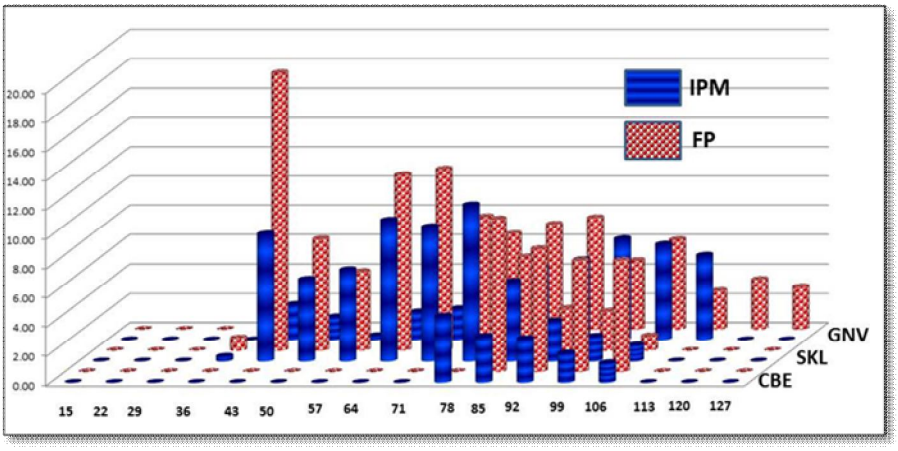


Figure 9: Incidence of Leaf Blast disease at different dates of transplantation in CBE, SKL and GNV centres under IPM and FP

Similarly the bacterial leaf blight was recorded significantly from Sakoli centre, while the other centres including Malan, Chinsurah and Mandya recorded very low levels of the disease and hence was not considered for analysis. In Sakoli, the disease started at about 43 DAT and continued through till 120 DAT. The disease was almost found to be on par with both the IPM and FP (Fig.10).

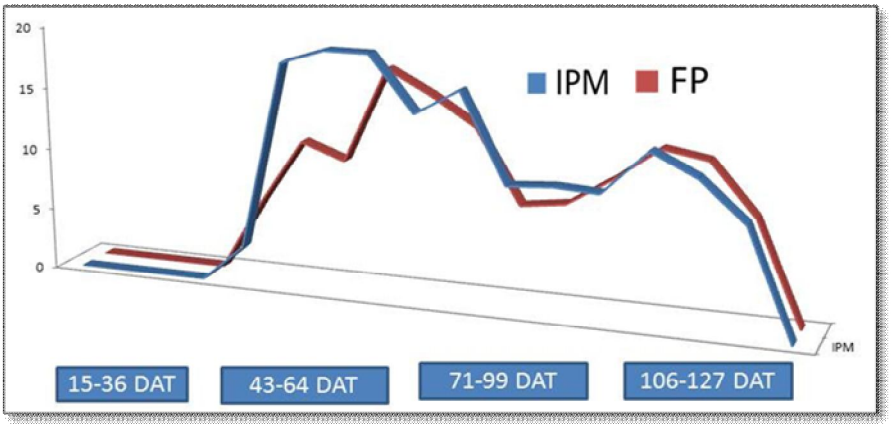


Figure 10: Incidence of BLB disease at different dates of transplantation in SKL centre under IPM and FP

With respect to the sheath blight, the disease was Sakoli, Chinsurah and Gangavati. The maximum disease was observed in Gangavati when compared to the other two centres. The disease was observed from 43 to 120 DAT in Sakoli, 36 to 92 DAT in Chinsurah and from 43 to 106 DAT in Gangavati (Fig.11).

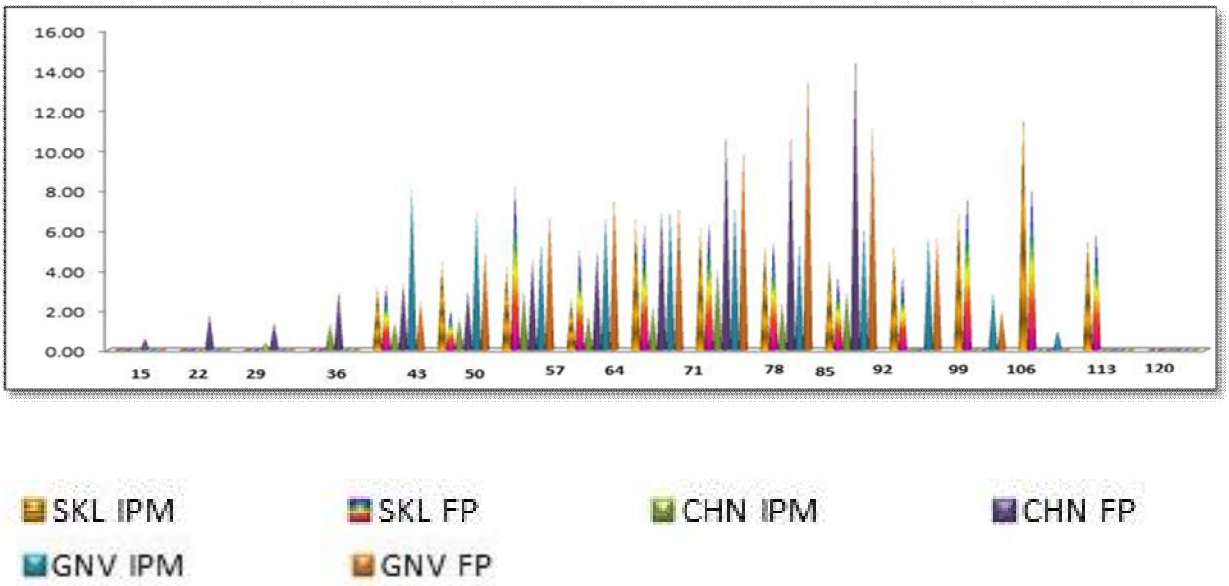


Figure 11: Incidence of SB disease at different dates of transplantation in SKL centre under IPM and FP

4. SPECIAL TRIAL ON CHEMICAL CONTROL OF FALSE SMUT

False smut is one of the most important grain diseases of rice. Under natural condition, exact mode of infection of false smut pathogen is still remains unclear. Adoption of correct control measures against this disease would help to reduce the economic loss. The stage of spraying fungicide against false smut is being very important for better management. Hence, the trial was formulated with 9 commercially available fungicides and the spraying stage was fixed as booting stage and the number of sprays was limited to 2 at 10 days interval.

The trail was proposed at 15 locations and data was received from 10 locations. Artificial disease pressure was created at Karjat, Malan and Titabar by spraying chlamydospores. Among the locations, percentage of infected panicles was high at Titabar (42.10%), Varanasi (39.87%), Ludhiana (32.73%) and Rewa (30.53%); moderate at Kaul (26.23%); low at Maruteru (9.80%) and Gangavati (8.09%); very low at Imphal (3.74%), Aduthurai (1.23%) and Karjat (0.46%). In case of infected spikelet per panicle, the percentage of infection was very high at Titabar (39.11%) and Varanasi (27.18%); moderate at Ludhiana (11.80%) and Rewa (9.53%); low at Aduthurai (3.08%), Imphal (2.58%), Gangavati (2.14%) and Kaul (1.02%); very low at Maruteru (0.31%). At Karjat, percentage of panicle infection was very low (0.46%) and at Malan, disease appeared in traces. At Nellore, trial was taken up but the disease incidence was nil. At IIRR, artificial spraying of yellow colored chlamydospores was done during the evening hours in the booting stage of the crop. However, false smut infection was nil (Table 114). The detailed discussions on location wise results are given below (Table 115, 116, 117).

Aduthurai: At this location, false smut infection was low (% of panicle infected/m^2 - 1.23%; % of infected spikelet/panicle - 3.08%). Among the various fungicides tested, spraying of difenoconazole 25 EC @ 1 ml/l (T2) reduced the percentage of infected panicles/m^2 as 0.19% and percentage of infected spikelet/panicle as 0.25 %, whereas the highest grain yield of 6070 kg/ha was recorded with spraying of azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC @ 1.0 ml/l (T3).

Gangavati: Under natural condition, the percentage of infected panicles/m^2 was 8.09% and percentage of infected spikelet/panicle was 2.14%. Among the ten treatments, spraying of azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC @ 1.0ml/l (T3) significantly reduced the percentage of infection from 8.09% to 3.43%, which was on par with metiram 55% + pyraclostrobin 5% WG (T4), where in the infection was reduced upto 4.01%. In case of percentage of infected spikelet/panicle, same T3 treatment effectively reduced the spikelet infection from 2.14% to 0.54%, which was on par with T4 (0.63%). With respect to grain yield, the grain yield range varied from 6173 kg/ha to 6290 kg/ha and there was not much variation among the treatments including control (T10).

Table 114: Special trial on false smut screening, *Kharif* 2016- Details of the trial

Location	Variety	Date of Sowing	Disease development	Date of Spraying	Initial Symptom observed date	Date of Observation	Date of Harvest
Gangavati	BPT 5204	15.07.16 22.08.16	N	30.10.16 15.11.16	25.11.16	15.12.16	22.12.16
Imphal	Ginphou	22.07.16 26.08.16	N	17.10.16 09.11.16	-	07.12.16	14.12.16
Karjat	Palghar-1	20.06.16 16.07.16	A (30.9.16) (6.10.16)	22.09.16 03.10.16	10.12.16	19.10.16 26.10.16	18.11.16
Kaul	HKR 126	01.06.16 23.06.16	N	03.09.16 13.09.16	8.9.16	04.10.16 05.10.16	08.10.16
Ludhiana	PR 116	28.05.16 28.06.16	N	25.08.16 10.09.16	-	30.09.16	10.10.16
Malan	PAC 807 (Hybrid)	15.06.16 14.07.16	A (15.09.16)	12.09.16 22.09.16	-	-	28.10.16
Maruteru	MTU-1075 (Pushyami)	20.06.16 19.07.16	N	03.10.16 13.10.16	3.12.16	16.11.16	24.11.16
Rewa	PA 6444 Gold	01.07.16 21.07.16	N	10.10.16 20.10.16	-	05.11.16	25.11.16
Titabar	Mahsuri	07.10.16 08.12.16	A (20.9.16)	05.10.16 20.10.16	04.10.16	05.10.16	21.12.16
Varanasi	HUBR 10-9	20.06.16 19.07.16	N	06.10.16 21.10.16	02.10.16	08.11.16	16.11.16

Imphal: The test variety was Ginphou. Among the treatments spraying of azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC @ 1.0ml/l (T3) significantly reduced the percentage of infected panicles from 3.74% to 1.22% and spraying of thiafluzamide 24 % SC @ 1.0ml/l (T7) significantly reduced the spikelet infection from 2.58% to 1.08%. However, with respect to grain yield, highest grain yield of 5460 kg/ha recorded, when the crop was sprayed with azoxystrobin 25 SC @ 1.0ml/l (T1), where in the spikelet infection was 1.15% as against 2.58% in control (T10).

Karjat: Palghar-1 was selected as test variety. Unfortunately very low level of disease was recorded (0.46%) even after artificial inoculation of chlamydospore was done to increase the disease infection. Among the treatments, spraying azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC @ 1.0ml/l (T3) and propiconazole 25 EC @ 1.0ml/l (T9) performed on par in reducing the percentage of infected panicles/m^2. Surprisingly, highest grain yield of 4037 kg/ha was recorded when the crop was sprayed with azoxystrobin 25 SC @ 1.0ml/l (T1).

Kaul: The susceptible variety HKR 126 was selected for the trail. Among the different treatments, spraying of propiconazole 25 EC @ 1.0 ml/l (T9) significantly reduced infected panicles/m^2 from 26.23% to 8.12% and infected spikelet/panicle from 1.02% to 0.18% and there by increased the grain yield up to 7567kg/ha.

Ludhiana: Under natural disease pressure, the susceptible variety PR 116 was recorded very high percentage of infected panicles/m^2 (32.73%) and infected spikelet/panicle (11.80%). Spraying of propiconazole 25 EC @ 1.0 ml/l (T9) significantly reduced the percentage of infected panicles/m^2 (10.54%) and number of infected spikelet/panicle (1.80%) and therefore recorded highest grain yield of 5285 kg/ha.

Maruteru: The cultivar MTU 1075 was used for the study. In general disease pressure was low (9.80%). Application of azoxystrobin 25 SC @ 1ml/l (T1) recorded the lowest percentage of infected panicles/m^2 (3.54%). With respect to infected spikelet/panicle, three fungicides *viz.*, flusilazole 25%+ carbendazim 12.5%) @ 1.0 ml/l (T8), propiconazole 25 EC @ 1.0 ml/ l (T9) and azoxystrobin 25 SC (T1) @ 1.0 ml/ l were performed on par (0.09% - 0.10%) with each other. In case of grain yield, there was no significant variation between the treatments.

Rewa: Trial was conducted with hybrid PA 6444 gold. Under natural disease pressure, 30.53% of infected panicles/m^2 and 9.53% of infected spikelet/panicle were recorded. Among the various fungicides, metiram 55% + pyraclostrobin 5% WG @ 1.5g/l (T4) performed well and significantly reduced the percentage of infected panicles/m^2 and infected spikelet/panicle as 10.73% and 3.83% respectively. Hence, the grain yield was also increased from 7260 kg/ha to 8020 kg/ha. In addition, the performance of flusilazole 25% + carbendazim 12.5% @ 1 ml/l (T8) was on par with metiram 55% + pyraclostrobin 5% WG @ 1.5 g/l (T4) treatment (% of infected panicles/m^2-12.17%; % of infected spikelet/panicle - 4.87 %; grain yield 7979 kg/ha).

Titabar: The trial was conducted with Mahsuri variety. Disease was artificially created by spraying chlamydospores suspension. Highest percentage of infected panicles/m^2 (42.10%) was recorded at

this location with 39.11% of infected spikelet/panicle. Application of two sprays of propiconazole 25 EC @ 1.0 ml/l (T9) at 15 days interval significantly reduced the percentage of infected panicles/m^2 as 6.53%; percentage of infected spikelet up to 4.50% in a panicle and increased the grain yield as 4460 kg/ha. In addition, tebuconazole 250 EC (1.25 ml/l) (T6) was also significantly reduced the percentage of infected panicles/m^2 (8.50%), percentage of infected spikelet /panicle (6.17%) and recorded grain yield of 4220 kg/ha.

Varanasi: HUBR 10-9 selected for the study, wherein 39.87% of infected panicles/m^2 and 27.18% of infected spikelets/panicle was recorded under natural condition. Spraying of azoxystrobin 18.2% + difenoconazole 11.4% w/w SC @ 1 ml/l (T3) significantly reduced the percentage of infected panicles/ m^2 up to 11.74 % and percentage of infected spikelets/panicle upto 8.70 % and ultimately increased the yield upto 4275 kg/ha.

Table 115: Evaluation of fungicides for the management of false smut (Percentage of infected panicles/m^2)

Tr. No.	Treatment	Percentage of infected panicles/m^2										
		ADT	**GNV**	**IMP**	**KJT**	**KUL**	**LDN**	**MTU**	**REW**	**TTB**	**VRN**	**Ave. (O)**
T1	Amistar (Azoxystrobin 25 SC)	0.38 (0.90)	6.29 (2.50)	1.41 (1.15)	0.37 (0.60)	17.62 (24.75)	13.60 (3.68)	3.54 (1.86)	24.60 (29.72)	16.20 (23.66)	25.69 (30.25)	**10.97**
T2	Score (Difenoconazole 25 EC)	0.19 (0.81)	6.49 (2.54)	1.80 (1.32)	0.35 (0.59)	14.96 (22.68)	20.60 (4.52)	7.26 (2.69)	22.63 (28.37)	13.01 (21.13)	16.90 (23.89)	**10.42**
T3	Amistar Top (Azoxystrobin 18.2 % + Difenoconazole 11.4 % w/w SC)	0.28 (0.87)	3.43 (1.83)	1.22 (1.09)	0.32 (0.57)	9.08 (17.43)	14.20 (3.77)	4.75 (2.17)	14.00 (21.90)	10.40 (18.79)	11.74 (19.61)	**6.94**
T4	Cabrio-Top 60% WG (Metiram 55% + Pyraclostrobin 5% WG)	0.57 (0.99)	4.01 (1.99)	1.74 (1.32)	0.42 (0.65)	20.73 (27.03)	17.33 (4.15)	6.18 (2.47)	10.73 (19.08)	20.40 (26.82)	23.70 (29.02)	**10.58**
T5	Monceren (Pencycuron 22.9 %)	0.28 (0.86)	5.22 (2.27)	2.42 (1.55)	0.52 (0.72)	18.57 (25.48)	24.13 (4.91)	6.02 (2.39)	18.13 (25.18)	17.20 (24.49)	19.72 (25.82)	**11.22**
T6	Folicur (Tebuconazole 250 EC)	1.05 (1.19)	6.04 (2.44)	1.91 (1.38)	0.41 (0.64)	14.92 (22.69)	22.00 (4.68)	6.82 (2.60)	19.73 (26.35)	8.50 (16.93)	15.91 (22.96)	**9.73**
T7	Pulsor (Thiafluzamide 24 % SC)	0.47 (0.96)	7.92 (2.81)	2.93 (1.71)	0.50 (0.70)	23.67 (29.08)	27.60 (5.25)	6.39 (2.51)	20.53 (26.92)	15.20 (22.92)	19.32 (25.64)	**12.45**
T8	Lustre 37.5 SE (Flusilazole 25%+ Carbendazim 12.5%)	1.43 (1.35)	5.08 (2.24)	1.32 (1.12)	0.43 (0.66)	16.44 (23.83)	27.07 (5.20)	5.73 (2.34)	12.17 (20.38)	23.10 (28.71)	29.22 (32.39)	**12.20**
T9	Tilt (Propiconazole 25 EC)	1.23 (1.30)	5.90 (2.42)	1.46 (1.21)	0.32 (0.56)	8.12 (16.43)	10.54 (3.24)	6.54 (2.56)	15.90 (23.47)	6.53 (14.76)	27.89 (31.28)	**8.44**
T10	Untreated control	1.23 (1.31)	8.09 (2.84)	3.74 (1.93)	0.46 (0.67)	26.23 (30.76)	32.73 (5.71)	9.80 (3.12)	30.5. (33.52)	42.10 (40.44)	39.87 (38.99)	**18.25**
	LSD (P=0.05)	**0.74**	**0.42**	**0.36**	**0.14**	**3.89**	**0.48**	**0.49**	**2.39**	**2.07**	**12.02**	
	CV (%)	**24.11**	**10.31**	**15.03**	**12.83**	**9.45**	**6.20**	**11.45**	**5.47**	**5.07**	**25.05**	
	Transformation	**ST**	**ST**	**ST**	**ST**	**AT**	**ST**	**ST**	**AT**	**AT**	**AT**	

(Figures in parenthesis indicate transformed means; ST – Square root transformation; AT - Arc sine transformation)

Table 116: Evaluation of fungicides for the management of false smut (Percentage of infected spikelets/panicle)

Tr. No.	Treatment	Percentage of infected spikelets /panicle										
		ADT	**GNV**	**IMP**	**KJT**	**KUL**	**LDN**	**MTU**	**REW**	**TTB**	**VRN**	**Ave. (O)**
T1	Amistar (Azoxystrobin 25 SC)	0.30 (0.87)	1.06 (1.02)	1.15 (1.07)	10.64 (3.17)	0.56 (0.75)	4.07 (2.0)	0.10 (0.31)	8.77 (2.96)	15.80 (3.97)	23.98 (4.88)	**6.64**
T2	Score (Difenoconazole 25 EC)	0.25 (0.85)	1.11 (1.05)	1.23 (1.09)	12.95 (3.52)	0.38 (0.62)	5.93 (2.43)	0.17 (0.41)	8.30 (2.88)	10.20 (3.19)	12.38 (3.44)	**5.29**
T3	Amistar Top (Azoxystrobin 18.2 %+ Difenoconazole 11.4 % w/w SC)	1.17 (1.24)	0.54 (0.72)	1.92 (1.36)	18.42 (4.02)	0.29 (0.54)	4.00 (1.99)	0.17 (0.41)	5.57 (2.36)	8.20 (2.86)	8.70 (2.90)	**4.90**
T4	Cabrio-Top 60% WG (Metiram 55% + Pyraclostrobin 5% WG)	1.37 (1.34)	0.63 (0.78)	1.42 (1.18)	20.22 (4.21)	0.71 (0.84)	5.07 (2.25)	0.25 (0.50)	3.83 (1.95)	18.30 (4.28)	20.84 (4.47)	**7.26**
T5	Monceren (Pencycuron 22.9 %)	0.27 (0.86)	1.11 (1.05)	1.12 (1.05)	8.65 (2.93)	0.57 (0.75)	5.93 (2.42)	0.21 (0.42)	7.23 (2.69)	14.60 (3.81)	18.58 (4.24)	**5.83**
T6	Folicur (Tebuconazole 250 EC)	1.52 (1.35)	1.21 (1.09)	1.23 (1.10)	13.59 (3.34)	0.47 (0.69)	7.40 (2.69)	0.18 (0.40)	7.73 (2.78)	6.17 (2.47)	10.32 (3.17)	**4.98**
T7	Pulsor (Thiafluzamide 24 % SC)	0.94 (1.14)	1.85 (1.36)	1.08 (1.03)	14.86 (3.69)	0.54 (0.73)	6.80 (2.60)	0.19 (0.41)	8.43 (2.90)	12.40 (3.52)	15.64 (3.86)	**6.27**
T8	Lustre 37.5 SE (Flusilazole 25%+ Carbendazim 12.5%)	1.07 (1.25)	1.70 (1.29)	1.90 (1.37)	14.26 (3.76)	0.27 (0.52)	7.80 (2.78)	0.09 (0.28)	4.87 (2.20)	17.73 (4.21)	26.26 (5.10)	**7.60**
T9	Tilt (Propiconazole 25 EC)	1.47 (1.37)	1.78 (1.33)	1.29 (1.12)	14.69 (3.54)	0.18 (0.43)	1.80 (1.33)	0.09 (0.29)	5.67 (2.38)	4.50 (2.12)	25.31 (5.00)	**5.68**
T10	Untreated control	3.08 (1.86)	2.14 (1.46)	2.58 (1.60)	15.04 (3.83)	1.02 (1.01)	11.80 (3.43)	0.31 (0.56)	9.53 (3.09)	39.11 (6.25)	27.18 (5.18)	**11.18**
	LSD (P=0.05)	**1.01**	**0.18**	**0.29**	**1.42**	**0.11**	**0.48**	**0.19**	**0.14**	**0.32**	**1.44**	
	CV (%)	**28.61**	**9.82**	**14.50**	**22.95**	**8.94**	**11.66**	**27.64**	**3.05**	**5.04**	**19.90**	
	Transformation	**ST**	**ST**	**ST**	**ST**	**ST**	**ST**	**ST**	**ST**	**ST**	**ST**	

(Figures in parenthesis indicate transformed means; ST – Square root transformation)

Table 117: Evaluation of fungicides for the management of false smut (Grain yield Kg/ha)

Tr. No.	Treatment	Grain yield (Kg/ha)										
		ADT	**GNV**	**IMP**	**KJT**	**KUL**	**LDN**	**MTU**	**REW**	**TTB**	**VRN**	**Ave. (O)**
T1	Amistar (Azoxystrobin 25 SC)	5763	6290	5460	4037	7233	5054	6024	7617	4000	3802	5528
T2	Score (Difenconazole 25 EC)	5743	6202	5448	3863	7300	4980	5837	7659	4010	3964	5501
T3	Amistar Top (Azoxystrobin 18.2 % + Difenoconazole 11.4 % w/w SC)	6070	6235	4608	3940	7500	5172	6095	7947	4150	4275	5599
T4	Cabrio-Top 60% WG (Metiram 55% + Pyraclostrobin 5% WG)	5127	6255	4871	3590	6333	4910	5473	8020	3970	3779	5233
T5	Monceren (Pencycuron 22.9 %)	4730	6219	4795	3863	7433	4671	5944	7808	4080	3916	5346
T6	Folicur (Tebuconazole 250 EC)	5033	6257	4503	3287	6700	4848	5873	7793	4220	4067	5258
T7	Pulsor (Thiafluzamide 24 % SC)	4313	6173	4232	2977	6667	4538	5411	7753	4050	3940	5005
T8	Lustre 37.5 SE (Flusilazole 25%+ Carbendazim 12.5%)	4907	6223	4046	3307	7267	4437	5886	7979	3890	3740	5168
T9	Tilt (Propiconazole 25 EC)	5263	6233	5200	3133	7567	5285	5376	7855	4460	3800	5417
T10	Untreated control	5957	6257	3933	3253	6367	4176	4963	7260	3380	3650	4920
	LSD (P= 0.05)	**656**	**270**	**568**	**667**	**524**	**302**	**1322**	**161**	**233**	**2733**	
	CV (%)	**4.32**	**2.53**	**7.04**	**11.04**	**4.34**	**3.67**	**13.55**	**1.21**	**3.39**	**40.95**	

Annexure - I

Weather conditions at test locations where Plant Pathology coordinated trials were conducted, *Kharif* 2016

S. No	Location/ Details		Weather data from May-2016 to January-2017								
1	**Aduthurai**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		4	2	3	5	2	2	5	4	-
	Rainfall (mm)		113.8	51.2	12.9	118.4	38.8	30.8	86.8	77.4	-
	Temp. (^{0}C)	Maximum	36.4	34.6	34.8	35.4	34.7	34.5	31	29.6	-
		Minimum	26.0	25.2	25.3	25.3	25.1	24.3	22.1	20.5	-
	RH (%)	Morning	87.0	87.0	80.0	78.0	81.4	86.0	92.0	93.0	-
		Evening	58.0	63.0	54.0	48.0	54.2	54.0	66.0	69.0	-
2	**Almora**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		9	10	17	18	6	1	-	-	-
	Rainfall (mm)		80.5	113.1	383.5	212	47.9	3.5	-	-	-
	Temp. (^{0}C)	Maximum	9	10	17	18	6	1	-	-	-
		Minimum	80.5	113.1	383.5	212	47.9	3.5	-	-	-
	RH (%)	Morning	78.4	79.5	89.9	91.1	86.1	84.1	-	-	-
		Evening	51.3	62.1	78.4	68.9	64	50.6	-	-	-
3	**Arundhutinagar**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		4	2	3	5	2	2	5	-	-
	Rainfall (mm)		113.8	51.2	12.9	118.4	38.8	30.8	86.8	-	-
	Temp. (^{0}C)	Maximum	36.4	34.6	34.8	35.4	34.7	34.5	31	-	-
		Minimum	26.0	25.2	25.3	25.3	25.1	24.3	22.1	-	-
	RH (%)	Morning	87.0	87.0	80.0	78.0	81.4	86.0	92.0	-	-
		Evening	58.0	63.0	54.0	48.0	54.2	54.0	66.0	-	-
4	**Bankura**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		9	13	14	17	14	2	0	0	9
	Rainfall (mm)		142.2	190.2	271.8	470	397.9	12.8	NIL	NIL	142.2
	Temp. (^{0}C)	Maximum	37.85	36.08	32.08	33.61	31.86	32.27	32.18	22.98	37.85
		Minimum	26.06	25.71	26.01	25.79	27.58	23.85	18.08	14.45	26.06
	RH (%)	Morning	-	-	-	-	-	-	-	-	-
		Evening	-	-		-	-	-	-	-	-
5	**Chakdha**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		12	9	18	25	10	6	4	0	12
	Rainfall (mm)		253.8	131.3	350.7	477.4	189.5	87.2	19.6	0	253.8
	Temp. (^{0}C)	Maximum	35.5	34.1	31.1	31.2	33.1	33.5	29.8	26.5	35.5
		Minimum	24.9	26.7	26.3	26.3	26.2	23.9	18.1	12.2	24.9
	RH (%)	Morning	74.2	94.2	95.5	94.8	96.2	96	93.5	94	74.2
		Evening	60.8	76.2	76	79.4	78.7	68.5	55	56	60.8
6	**Chatha**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	7	11	9	6	0	0	-	-
	Rainfall (mm)		-	93.6	378.4	227.5	103.7	1.2	0	-	-
	Temp. (^{0}C)	Maximum	-	38.3	34.1	33.3	34	32.4	26.3	-	-

S. No	Location/ Details		Weather data from May-2016 to January-2017								
		Minimum	-	25.1	25	24.2	24	17.5	9.5	-	-
	RH (%)	Morning	-	60.0	81.0	81.0	79.0	77.0	86.0	-	-
		Evening	-	41.0	64.0	65.0	59.0	51.0	43.0	-	-
7	**Chinsurah**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		10	11	17	17	14	5	3	-	-
	Rainfall (mm)		197.4	249.7	282.7	376.8	215.4	161.8	23.8	-	-
	Temp. (^{0}C)	Maximum	35.3	34.63	32.48	32.81	28.58	31.19	29.53	-	-
		Minimum	25.03	26.5	26.35	26.26	22.51	22.54	16.49	-	-
	RH (%)	Morning	84.35	91.8	92.7	94.22	81.01	92.7	93.63	-	-
		Evening	59.83	64.6	75.19	77.51	63.1	63.3	49.9	-	-
8	**Chiplima**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	9	18	26	17	3	1	0	-
	Rainfall (mm)		-	144.7	291	645.8	736.5	20.8	3.2	0	-
	Temp. (^{0}C)	Maximum	-	34.7	32	32.5	32.3	32.2	28.5	27.5	-
		Minimum	-	26.8	22.7	21.8	21.8	20.5	14.5	10.1	-
	RH (%)	Morning	-	90.6	87.8	93.6	89.7	88.7	90.5	89.1	-
		Evening	-	80.4	67.9	76.3	75	62	70.1	77.2	-
9	**Coimbatore**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	1	-	-	-	3	-	2	-
	Rainfall (mm)		-	9	-	-	-	139.1	-	26.5	-
	Temp. (^{0}C)	Maximum	-	31.6	30.3	30.6	31	30.9	29.7	29.3	-
		Minimum	-	23.3	22.9	23.2	21.9	21.3	19.6	17.6	-
	RH (%)	Morning	-	91.9	91.6	90.8	90.2	90.5	82.6	89	-
		Evening	-	-	-	-	-	-	-	-	-
10	**Cuttack**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		5	10	14	14	18	4	1	0	-
	Rainfall (mm)		110.8	256.2	278.5	294.5	300.6	33.4	12.7	0	-
	Temp. (^{0}C)	Maximum	36.8	32.7	31.1	30.5	30.1	31.1	29.5	27.9	-
		Minimum	26.9	26.8	25.8	26	25.7	23.7	17.3	13.5	-
	RH (%)	Morning	92.4	93.2	95.5	94.5	95.2	92.2	93.3	94.2	-
		Evening	50.9	71.2	79.2	77.2	80.4	70.4	44.8	45.4	-
11	**Faizabad** (Masodha)		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	5	13	14	9	3	-	-	-
	Rainfall (mm)		-	105.1	348.9	330.8	204.8	62.9	-	-	-
	Temp. (^{0}C)	Maximum	-	37.8	33.4	32.7	33	32.7	29.5	-	-
		Minimum	-	26.5	25.8	25.5	24.3	20.0	13.3	-	-
	RH (%)	Morning	-	-	-	-	-	-	-	-	-
		Evening	-	-	-	-	-	-	-	-	-

S. No	Location/ Details		Weather data from May-2016 to January-2017								
12	**Gangavati**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		3	13	8	8	9	0	0	0	-
	Rainfall (mm)		46.2	134.9	68.3	48	72.4	0.1	0	2.3	-
	Temp. (^{0}C)	Maximum	37.84	32.33	30.41	30.74	29.53	31.97	31.13	30.5	-
		Minimum	26.06	23.53	23.32	22.96	22.53	20.16	15.79	16.35	-
	RH (%)	Morning	55.75	67	67.52	67.25	71.33	53.62	52.14	54.89	-
		Evening	25.6	46.23	54.54	51.09	59.88	38.54	32.88	32.7	-
13	**Gerua**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		13	11	16	5	12	2	0	0	
	Rainfall (mm)		230.7	203.3	222.1	67.5	180.3	8.5	0	2.3	
	Temp. (^{0}C)	Maximum	32.5	34	32.8	35.9	34.6	33.9	30.1	27.4	
		Minimum	12.4	15.3	13.1	19.4	18	18	12.5	10.5	
	RH (%)	Morning	88.6	88.6	94.7	88.2	91.2	87.2	88.7	91.3	-
		Evening	73.3	64.1	70.2	58.2	66.4	63.3	66.7	64.6	-
14	**Ghaghraghat**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		07	10	14	10	10	01	-	-	-
	Rainfall (mm)		116.9	242	238.8	221.6	182.2	22.4	-	-	-
	Temp. (^{0}C)	Maximum	39.18	36.60	31.00	30.81	31.10	30.20	27.78	20.93	-
		Minimum	20.08	19.65	19.24	20.00	21.42	19.12	13.71	6.95	-
	RH (%)	Morning	-	-	-	-	-	-	-	-	-
		Evening	-	-	-	-	-	-	-	-	-
15	**Gudalur**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		9	20	29	23	14	4	1	4	-
	Rainfall (mm)		120.4	449.8	428.8	165	140.2	109	12.8	38.4	-
	Temp. (^{0}C)	Maximum	29.6	24.4	23.5	24.58	25.56	26.83	27.5	26.73	-
		Minimum	18.6	16.4	16.2	16.04	16	15.13	13.73	11.31	-
	RH (%)	Morning	89.1	95.1	90	95.85	91.16	91.17	87.42	88.96	-
		Evening	68.6	87	88.2	86.85	80.38	72.21	62.91	63	-
16	**IIRR**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		6	8	11	6	17	4	0	0	-
	Rainfall (mm)		157.4	90	144.7	180.6	391.6	32.2	0	2	-
	Temp. (^{0}C)	Maximum	38	32.9	30.2	30.6	28.5	30.2	30.3	29	-
		Minimum	24.2	23.2	22.8	22.8	22	18.5	12.8	11.3	-
	RH (%)	Morning	71	84.2	88.6	86.2	94	91.4	88.3	90.1	-
		Evening	35.6	59.6	67.3	64.6	76	48.2	33.5	37.4	-
17	**Imphal**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		19	22	28	16	23	15	6	1	-

S. No	Location/ Details		Weather data from May-2016 to January-2017								
	Rainfall (mm)		377.3	205.3	328.6	119.8	221.5	198.3	66.2	5.8	-
	Temp. (^{0}C)	Maximum	29.5	31.4	30.4	31.1	29.4	28.6	24.9	23.7	-
		Minimum	21.3	22.1	22.3	22.4	21.9	19.5	12.3	8.3	-
	RH (%)	Morning	89.9	89.9	90	88.7	92.2	92.6	92.6	92.4	-
		Evening	70.2	78.2	79	73.3	74.3	71.2	59.9	51.5	-
18	**Jagadalpur**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		5.0	14.0	17.0	19.0	10.0	8.0	0.0	0.0	-
	Rainfall (mm)		47.0	296.2	481.2	335.9	308.6	182.0	0.0	0.0	-
	Temp. (^{0}C)	Maximum	37.5	33.4	29.1	29.3	29.6	30.0	29.6	28.9	-
		Minimum	25.7	24.4	23.2	23.8	23.4	19.4	13.5	10.0	-
	RH (%)	Morning	67.2	85.7	91.9	90.0	93.3	95.6	96.5	94.2	-
		Evening	33.2	60.9	77.0	70.6	75.4	52.4	32.2	30.8	-
19	**Karjat**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		2	16	31	31	23	10	0	0	-
	Rainfall (mm)		4.1	324.3	1249.1	1201.4	569.7	76.9	0	0	-
	Temp. (^{0}C)	Maximum	39.4	34.7	28.4	28.8	29.1	31.9	34.8	35.1	-
		Minimum	25.1	24.9	24.3	24.4	23.7	21.5	14.5	14.1	-
	RH (%)	Morning	78.5	81.1	94.1	92.4	93.7	90.8	87.6	87.5	-
		Evening	38.3	59.5	87.2	82.1	83.1	55.7	27.9	27.3	-
20	**Kaul**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		4	4	9	9	0	0	0	-	-
	Rainfall (mm)		49.2	107.9	201.6	251.8	0	0	0	-	-
	Temp. (^{0}C)	Maximum	39.8	38.7	33.3	32.4	33.2	33.3	28.8	-	-
		Minimum	22.7	25.7	25.2	24.3	22.5	17.2	9.5	-	-
	RH (%)	Morning	60.0	76.0	91.0	94.0	93.0	92.0	89.0	-	-
		Evening	31.0	46.0	74.0	79.0	69.0	45.0	34.0	-	-
21	**Khudwani**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		9	2	7	8	2	1	0	-	-
	Rainfall (mm)		53.8	4	107.4	98.2	12.1	6.4	0	-	-
	Temp. (^{0}C)	Maximum	26.29	30.43	30.29	27.31	28.93	24.82	16.03	-	-
		Minimum	9.75	14.21	16.6	15.56	11.08	3.54	-1.48	-	-
	RH (%)	Morning	79.25	73.26	80.61	86.38	85.23	82.35	89.36	-	-
		Evening	52.64	47.16	49.22	57.77	46.56	38.41	47	-	-
22	**Lonavala**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		1	16	30	30	17	4	0	0	-
	Rainfall (mm)		15	251	1696	1598	730	69	0	0	-
	Temp. (^{0}C)	Maximum	34.6	29.6	25.3	24.8	24.8	27.7	29.8	29.9	-
		Minimum	22.0	21.4	21.1	20.7	20.2	19.1	13.5	15.2	-

S. No	Location/ Details		Weather data from May-2016 to January-2017								
	RH (%)	Morning	81.5	92.5	99.0	99.9	98.3	78.6	57.4	57.8	-
		Evening	46.4	68.0	97.8	93.5	91.1	73.4	47.5	42.0	-
23	**Ludhiana**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		4	4	10	6	1	0	0	-	-
	Rainfall (mm)		25.2	86	305.5	84.6	15	0	0	-	-
	Temp. (^{0}C)	Maximum	39.6	38.8	33.6	33.3	34	32.7	27.7	-	-
		Minimum	24.6	28.5	27.3	26.1	25.4	19	12	-	-
	RH (%)	Morning	57.3	64.2	85	84.5	86	88.5	88.8	-	-
		Evening	28.6	42.2	64.7	65.6	55	37.8	31.7	-	-
24	**Malan**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		9	15	22	12	13	3	-	-	-
	Rainfall (mm)		70.5	146.7	930	505.4	113.7	21	-	-	-
	Temp. (^{0}C)	Maximum	33	33	32.4	32.1	31.5	30.1	-	-	-
		Minimum	12.9	13	13.1	11.5	11.1	9.7	-	-	-
	RH (%)	Morning	65.2	70	80.9	80.5	74.1	66.4	-	-	-
		Evening	61.2	66.2	78	76.9	70.1	62.7	-	-	-
25	**Mandya**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		2	8	6	3	4	2	1	4	-
	Rainfall (mm)		34.4	102	65.6	104.1	68.2	65	4.4	41.9	-
	Temp. (^{0}C)	Maximum	36.85	32.70	30.91	32.19	33.27	34.55	31.93	30.52	-
		Minimum	16.55	19.98	20.65	20.25	19.08	17.27	15.83	12.18	-
	RH (%)	Morning	83.17	85.49	87.12	92.31	91.90	86.25	88.98	92.35	-
		Evening	66.20	77.79	62.99	55.62	60.50	54.61	42.79	39.54	-
26	**Maruteru**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		5	12	10	7	10	5	1	-	-
	Rainfall (mm)		146.2	310.4	168.2	136	236.6	41.4	4	-	-
	Temp. (^{0}C)	Maximum	35.77	31.93	31.37	31.19	30	30.51	30.11	-	-
		Minimum	27.48	26.73	27.51	27.19	26.6	24.64	20.83	-	-
	RH (%)	Morning	83.38	84.9	81.35	83.41	86.5	84.9	86.66	-	-
		Evening	72.74	77.2	76.48	72.06	75.16	74.54	72.5	-	-
27	**Moncompu**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		17	28	22	20	8	7	7	2	-
	Rainfall (mm)		337.5	520	400.4	165.4	20.62	144.8	13.5	34	-
	Temp. (^{0}C)	Maximum	27.37	24.6	24.32	24.53	24.14	25.14	24.09	23.6	-
		Minimum	33.38	30.5	30.33	31.29	29.82	29.81	31.48	31.76	-
	RH (%)	Morning	89.81	91.4	91.54	88.41	88.41	91.48	85.01	93.19	-
		Evening	71.35	77.4	73.83	71.35	76.9	78.61	70	71.35	-
28	**Mugad**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		4	10	26	20	8	3	-	-	-
	Rainfall (mm)		110.8	124.8	234.6	140.4	98	41	-	-	-

S. No	Location/ Details		Weather data from May-2016 to January-2017								
	Temp. (^{0}C)	Maximum	34.7	28.8	28,7	28.7	29.9	31.2	30	30.6	-
		Minimum	22	22.1	21. 0	22	20.6	19.6	18	15.7	-
	RH (%)	Morning	63	80	80	80	78	68	68	56	-
		Evening	-	-	-	-	-	-	-	-	-
29	**Navsari**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		0	3	26	23	14	3	0	0	-
	Rainfall (mm)		0	34	868	1061	395	11	0	0	-
	Temp. (^{0}C)	Maximum	37.3	36.5	28.9	29.1	29.7	31.8	33.3	31.5	-
		Minimum	29.7	27.3	24.6	24.2	23.2	18.9	11.8	10.9	-
	RH (%)	Morning	80.8	85.5	95.4	92.5	96.2	90.1	73.5	71.6	-
		Evening	60.3	71.7	84.6	78.6	75.7	59.7	29.8	27.5	-
30	**Nawagam**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		0	0	15	14	3	3	3	0	-
	Rainfall (mm)		0	0	174.4	190.2	76.2	63.4	0	0	-
	Temp. (^{0}C)	Maximum	42.5	39.0	33.1	30.7	32.4	32.5	32.6	0	-
		Minimum	27.0	27.9	26.1	25.4	24.4	21.2	14.2	0	-
	RH (%)	Morning	62.0	69.0	85.0	89.0	90.0	85.0	69.0	0	-
		Evening	27.0	42.0	69.0	78.0	66.0	5.0	30.0	0	-
31	**Nellore**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	-	-	-	1	3	3	4	-
	Rainfall (mm)		-	-	-	-	9.8	53	9.3	157	-
	Temp. (^{0}C)	Maximum	-	-	-	-	35	34	30.6	27.8	28.2
		Minimum	-	-	-	-	26.3	23.4	22	21.2	20.8
	RH (%)	Morning	-	-	-	-	67	65	77	87	86
		Evening	-	-	-	-	57	46	67	70	68
32	**New Delhi**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		3	6	20	15	2	1	0	-	-
	Rainfall (mm)		30.4	16.6	540.9	388.2	56.45	37.8	0	-	-
	Temp. (^{0}C)	Maximum	40.1	39.2	38.8	32.5	-	33.3	30	-	-
		Minimum	23	25	29.9	24.2	-	-	10.4	-	-
	RH (%)	Morning	66.8	72.5	90.3	89.4	-	-	96.0	-	-
		Evening	52.0	49.0	74.0	73.0	-	-	37.0	-	-
33	**Pantnagar**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		8	13	19	14	4	0	0	-	-
	Rainfall (mm)		4.04	8.4	76.82	42.45	35.45	0	0	-	-
	Temp. (^{0}C)	Maximum	35.33	33.98	31.97	33.17	32.54	31.57	27.31	-	-
		Minimum	23.16	23.03	25.77	25.98	24.35	17.49	10.66	-	-
	RH (%)	Morning	69.05	80.08	88.05	89.57	88.89	86.2	92.07	-	-
		Evening	42.12	60.93	89.57	88.89	67.07	49.31	41.43	-	-

S. No	Location/ Details		Weather data from May-2016 to January-2017								
34	**Patna**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		3	4	19	14	10	2	0	-	-
	Rainfall (mm)		16.8	85.2	423.8	214.0	267.6	99.6	0	-	-
	Temp. (^{0}C)	Maximum	33.8	39.3	33.2	33.1	31.9	32.9	29	-	-
		Minimum	17.9	24.7	22.5	22.7	21.8	17.8	14.1	-	-
	RH (%)	Morning	-	-	-	-	-	-	-	-	-
		Evening	-	-	-	-	-	-	-	-	-
35	**Pattambi**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	28	26	21	14	5	2	-	-
	Rainfall (mm)		-	480.6	344.6	120.2	92.8	59.6	4.1	-	-
	Temp. (^{0}C)	Maximum	-	30.14	29.78	30.51	30.26	31.46	33.04	-	-
		Minimum	-	23.88	23.83	23.88	23.56	23.14	22.58	-	-
	RH (%)	Morning	-	93.6	93.4	93.3	92.3	92.4	88	-	-
		Evening	-	84.37	71.3	68.3	66.6	62.5	48.07	-	-
36	**Ponnampet**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		6	20	27	25	10	1	1	4	-
	Rainfall (mm)		77.53	401.3	446.31	290.36	104.9	6	9	84	-
	Temp. (^{0}C)	Maximum	-	-	-	-	-	-	-	-	-
		Minimum	-	-	-	-	-	-	-	-	-
	RH (%)	Morning	-	-	-	-	-	-	-	-	-
		Evening	-	-	-	-	-	-	-	-	-
37	**Pusa**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		8	5	16	5	17	4	0	0	-
	Rainfall (mm)		132.8	105.1	304.1	110.8	319.2	34.6	0	0.0	-
	Temp. (^{0}C)	Maximum	34.6	35.2	32	33.7	31.4	32.8	29	-	-
		Minimum	23.1	26.3	26	26.2	25	23	22	-	-
	RH (%)	Morning	83.0	81.0	91.0	86.0	93.0	88.0	86.0	-	-
		Evening	53.0	61.0	79.0	67.0	79.0	58.0	44.0	-	-
38	**Raipur**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	8	18	9	16	6	0	-	-
	Rainfall (mm)		-	115.8	434.2	173.2	421.8	57.4	0	-	-
	Temp. (^{0}C)	Maximum	-	38.5	30.9	30.2	31	31.2	27	-	-
		Minimum	-	27.7	25	23.9	24.8	21.1	17.3	-	-
	RH (%)	Morning	-	97.0	93.0	90.0	93.0	91.0	88.0	-	-
		Evening	-	73.0	77.0	75.0	76.0	48.0	31.0	-	-
39	**Rajendranagar**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		6	8	11	6	17	4	0	0	-
	Rainfall (mm)		157.4	90	144.7	180.6	391.6	32.2	0	2	-

S. No	Location/ Details		Weather data from May-2016 to January-2017								
	Temp. (^{0}C)	Maximum	38	32.9	30.2	30.6	28.5	30.2	30.3	29	-
		Minimum	24.2	23.2	22.8	22.8	22	18.5	12.8	11.3	-
	RH (%)	Morning	71.0	84.2	88.6	86.2	94.0	91.4	88.3	90.1	-
		Evening	35.6	59.6	67.3	64.6	76.0	48.2	33.5	37.4	-
40	**Rewa**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	3	17	15	13	1	1	-	-
	Rainfall (mm)		-	61.6	324.8	752.6	375.4	20.2	Nil	-	-
	Temp. (^{0}C)	Maximum	-	40.4	33.8	32.2	32.9	33.3	38.5	-	-
		Minimum	-	27.4	22.9	22.1	23.5	19.9	11.9	-	-
	RH (%)	Morning	-	81.3	87.7	90.3	91.8	90.2	90.2	-	-
		Evening	-	44.1	47.3	52.2	63.5	59.4	61.9	-	-
41	**Titabar**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		17	17	27	11	14	2	3	2	-
	Rainfall (mm)		228.9	347.2	395.8	201	178	15.9	30.6	5.6	-
	Temp. (^{0}C)	Maximum	29.9	30.8	31.9	34.65	32	32	28	26.8	-
		Minimum	21.3	24.4	23.9	24.6	22	21	15	10.3	-
	RH (%)	Morning	91.0	90.0	91.0	93.0	92.0	93.0	91.0	93.0	-
		Evening	68.0	72.0	74.0	65.0	70.0	63.0	61.0	53.0	-
42	**Umiam (Barapani)**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	19	24	13	-	-	-	-	-
	Rainfall (mm)		-	422.3	457.4	219.2	-	-	-	-	-
	Temp. (^{0}C)	Maximum	-	28.6	27.6	27.6	-	-	-	-	-
		Minimum	-	18.6	19.4	19	-	-	-	-	-
	RH (%)	Morning	-	85.9	89.3	85.5	-	-	-	-	-
		Evening	-	76.8	77.8	70.5	-	-	-	-	-
43	**Upper Shillong**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	18	20	18	23	8	2	0	-
	Rainfall (mm)		-	1128.5	214.5	112.5	198.0	96.0	17.2	-	-
	Temp. (^{0}C)	Maximum	-	27.40	27.9	29.20	26.4	26.9	24.4	-	-
		Minimum	-	25.80	21.2	22.5	21.3	19.6	16.2	-	-
	RH (%)	Morning	-	86.0	91.0	85.0	92.0	88.0	88.1	-	-
		Evening	-	80.0	81.0	73.0	87.20	88.0	63.10	-	-
44	**Varanasi**		**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
	Rainy days (No.)		-	-	-	-	-	-	-	0	-
	Rainfall (mm)		10.6	97.4	490.8	385.6	214.3	4.1	0	-	-
	Temp. (^{0}C)	Maximum	41.3	41	33.4	34	31.6	32.4	29.2	-	-
		Minimum	25.1	25.6	26	24.7	24	16.6	13.8	-	-
	RH (%)	Morning	68.0	78.0	95.0	93.0	95.0	88.0	80.0	-	-
		Evening	28.0	36.0	69.0	69.0	74.0	43.0	42.0	-	-

Annexure - II

Details on the locations where Coordinated Pathology Screening trials were conducted during, *Kharif* 2016

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2016)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
1	**Aduthurai**	10° N	79 °E	19.5 m	Irrigated	01-09-16	37.5:50:25	112.5:0:25 (NPK)
2	**Almora**	29°36'N	79°40'E	1250 m	Upland	21-07-16	20:60:40	40 N
3	**Arundatinagar**	22°56'N	91°10'E	12.6 m	Upland	08-09-16	50:100:100	50 N
4	**Barapani**	25°30'N	91°51'E	1000 m	Upland	23-06-16	60:60:0	60 N
5	**Bankura**	23°24' N	87°05'E	84 m	Upland (Rainfed)	08-07-16	40:50:30	40 N
6	**Chakdha**	23°08' N	88°52' E	13 m	Irrigated	13-07-16	120:30:30 60:30:30	60 N
7	**Chatha**	32°40'N	74°18'E	293 m	Irrigated	17-06-16	120:60:30	40N, 40+40 N (1st and 2nd top dressing)
8	**Chinsurah**	22°52'N	88°24'E	8.62 m	Irrigated	23-06-16	60:50:30	60 N
9	**Chiplima**	20°21'N	80°55'E	178.8 m	Irrigated	14-07-16	100:50:50 50:50:25	25:0:25 (30 DAP) 25:25 (30 DAP) +30:0:0 (70 DAP) 25:0:0 (70 DAP)
10	**Coimbatore**	11° N	77°E	409 m	Irrigated	10-6-16	25:20:4	45 N and 4P
11	**Cuttack**	20°23'N	85° 17'E	36 m	Irrigated Shallow lowland	12-07-16	40:0:0	20 N
12	**Faizabad (Masodha)**	26°47'N	82°12'E	113 m	Irrigated	23-06-16	135:120:120	135 N
13	**Gangavati**	15°47'N	76°53'E	419 m	Rainfed	16-10-16 LB 13-9-16 BS 19-7-16 ShB	300:150:150	75N
14	**Gerua**	26°14'N	91°33'E	49 m	Rainfed lowland	23-07-16	20:20:20	20 N
15	**Ghaghraghat**	27°50'N	81°20'E	112 m	Rainfed lowland	-	60:60:0	60N
16	**Gudalur**	11°30'N	76°30'E	950 m	Irrigated	27-07-16	-	-
17	**IIRR**	17°19' N	78°23'E	542 m	Irrigated	12-06-16	45:60:40	135N

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2016)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
18	**Imphal**	24°45' N	93°54' E	774 m	Rainfed lowland	17-08-16	120:60:40	80:60:40 NPK 40 N
19	**Jagadalpur**	19°05' N	81°57'E	556 m	Upland,/ Irrigated	07-10-16	60:60:60	30:30:0 (NPK)
20	**Karjat**	18°55' N	73°15'E	51.7 m	Rainfed lowland	BLB & ShR: 08-07-16 BL:10-08-16	-	70N
21	**Kaul**	29°51'N	76°39'E	230.7 m	Irrigated	15-06-16	22.5 N + 57.5 P2O5 + 25 Zinc sulphate/ha	57.5+57.5 N in two splits
22	**Khudwani**	34°N	73°E	1560 m	Irrigated	28-06-16	120:60:30	60: 60: 30 (NPK) /60 N
23	**Lonavala**	18.9°N	73.5°E	622m	Rainfed lowland	22-08-16	120:50:50 60:50:50	60N
24	**Ludhiana**	30°90'N	75° 85'E	262 m	Irrigated	17-06-16	Urea 37kg/Acre	Urea 74kg/acre
25	**Malan**	32°1'N	76.2°E	950 m	Irrigated/ Upland	NB:21-06-16 LB:01-08-16	60:40:40	60N
26	**Mandya**	12°36'N	76°15'E	694.65 m	Irrigated	20-09-16	60:50:50	30:0:0
27	**Maruteru**	16°38'N	81°44'E	5m	Irrigated	23-06-16	150:40:40 50:40:20	50:0:0 (NPK) 50:0:20
28	**Moncompu**	9°51'N	76 °5'E	-10 m	Irrigated	28-06-16	120:45:45 Kg/ha 1/2N,1/2P&K	15DAP-1/4N, 1/4P&K, 40DAP-1/4N, 1/4P&K
29	**Mugad**	15°15' N	74°40' E	697m	Rainfed lowland	16-06-16	100:50:50	50:0:0N at 45DAS
30	**Nawagam**	22°48'N	71°38'E	32.4 m	Irrigated	07-12-16	60 N + 30 P_2O_5.	60 N + 20 ZnSO4
31	**Navsari**	20 °29'N	73°29'E	105 m	Rainfed	04-07-16	75:50:0	75N
32	**Nellore**	14°27'N	79°59'E	20 m	Irrigated	BLB :06-10-16 LB :17-12-16	50:40:40	BLB : 100 N LB : 150N
33	**New Delhi**	28°08'N	77 °12'E	216 m	Irrigated	BLB : 20-06-16 LB : 06-09-16 ShBl : 28-06-16	20:60:40	20 N
34	**Pantnagar**	29°N	79°30'E	243.84 m	Irrigated	29-06-16	60:40:40-15Kg (ZnSO4)	60N +5.0 (ZnSO4)

S. No.	Location	Latitude (North)	Longitude (East)	Elevation (m. from MSL)	Ecosystem	Sowing (Year, 2016)	Fertilizer Basal - NPK (Kg/ha)	Fertilizer top dressing (Kg/ha)
35	**Patna**	25 °30'N	85°15'E	77 m	Upland/Irrigated	24-06-16	120:60:40	60N
36	**Pattambi**	10°48'N	76°12'E	25.35 m	LB:Upland BLB, Shb: Rainfed Lowland	20-06-16	80:30:15	40:0:15 (NPK)
37	**Ponnampet**	12°29'N	75°56'E	856 m	Rainfed Lowland	05-08-16	37.5:75:45	37.5 N:0:45
38	**Portblair**	6°14'N	92°94'E	5 m	Rainfed lowland	-	-	-
39	**Pusa**	25.9°N	85.40'E	51.84 m	Irrigated	15-06-16 & 16-06-16	40:40	80N: $40P_2O_5$: $20K_2O$
40	**Raipur**	21° 16'N	81°36'E	681 m	Irrigated	27-06-16	40N	80N
41	**Rajendranagar**	17° 19'N	78°23'E	542 m	Irrigated	LB : 17-10-16, NB: 26-06-16, ShR: 26-6-16	45:60:40	135N
42	**Rewa**	24°30'N	81°15'E	360 m	Upland Irrigated	25-07-16	20:60:40	80N
43	**Titabar**	26°N	93°E	99 m	Lowland	23-07-16 25-06-16	60:20:40	20N
44	**Upper Shillong**	25° 32'6"N	91° 03' 06" E	869 m	Rainfed lowland	29-07-16	60:40:40	30N:30N
45	**Varanasi**	25°20'N	23°03'E	75.7 m	Irrigated	20-06-16	120:60:60	30N

Note: (-) data is 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
Chakdha (Mohanpur)	CKD	BLB	Bacterial leaf 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
Gangavati	GNV	GSN	Germplasm Screening Nursery
Gerua	GER	IC No.	Indigenous collection Number
Ghagraghat	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	JGL	N	Natural Infection
Karaikal	KRK	NB	Neck blast
Karjat	KJT	NdB	Node blast
Kaul	KUL	NHSN	National Hybrid Screening Nursery
Kudhwani	KHD	NSN-1	National Screening Nursery 1
Kurumbapet (Puducherry)	KBP	NSN -2	National Screening Nursery 2
Lonavala	LNV	NSN-H	National Screening Nursery- Hills
Ludhiana	LDN	PI	Promising index
Malan	MLN	RTD	Rice Tungro Disease
Mandya	MND	RTV	Rice Tungro Virus
Maruteru	MTU	SE	Standard error
Masodha (Faizabad)	MSD	ShB	Sheath blight
Moncompu	MNC	ShR	Sheath rot
Mugad	MGD	SI	Susceptibility Index
Navsari	NVS	StR	Stem rot
Nawagam	NWG		
Nellore	NLR		
New Delhi (IARI)	NDL		
Pantnagar	PNT		
Patna	PTN		
Pattambi	PTB		
Ponnampet	PNP		
Portblair	POB		
Pusa	PSA		
Raipur	RPR		
Rajendranagar	RNR		
Ranchi	RCI		
Rewa	REW		
Sabour	SBR		
Tirur	TRR		
Titabar	TTB		
Umiam (Barapani)	UMM		
Upper Shillong	USG		
Varanasi	VRN		
Wangbal	WBL		

Progress Report-2016 report was compiled by the following scientists of Department of Plant Pathology, ICAR-IIRR, Hyderabad.

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