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Volume 3

CROP PRODUCTION

AGRONOMY

ALL INDIA CO-ORDINATED RICE IMPROVEMENT PROGRAMME (AICRIP)

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AGRONOMY

4. AGRONOMY

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4. AGRONOMY

SUMMARY

AICRP experiments conducted by Agronomists, Soil scientists and Physiologists at different locations during *rabi* 2018-19 and *kharif* 2019 for understanding the response of rice crop to management practices, resource conservation and climatic variations for developing efficient crop and resource management technologies that maximize the productivity and ensure high profitability to double the farmers income on sustainable basis are compiled in this report. Agronomists conducted 236 experiments at 49 locations consisting of evaluation of promising cultivars (94 cultures) belonging to 16 groups *viz.*, early hill (irrigated), medium hill (irrigated), early (TP), irrigated mid early, irrigated medium, late, medium slender, alkaline & inland saline, rain fed shallow lowland, basmati, bio-fortified, NIL (BL & BLB), herbicide resistant mutant, Nitrogen and Phosphorous use efficiency trials in transplanted situation, for their response to integrated nutrient management at 50,100 and 150% Recommended dose of fertilizer(RDF). In addition, six trials on cultural management, four trials each on weed management, four trials on rice based cropping systems and climate resilient agriculture and five collaborative trials (Soil science, Entomology, and Plant Breeding) were also conducted to develop cost effective technologies in rice and rice based cropping systems.

4.1. NUTRIENT MANAGEMENT TRAILS (NMT)

Development of high yielding and improved varieties and hybrids is one of the major components of rice production technology. In rice growing regions, nutrient management is also most important yield limiting factor for production. Adaptation of cultivars with high Nutrient use efficiency in two different planting situations and nutrient management is a potential strategy in optimizing nutrient requirement, lowering cost of cultivation and reducing environmental pollution. Optimization of nutrient use not only enhances grain yield through better nutrient use efficiency but also reduces the cost of cultivation. In order to find out the production potential of promising cultivars and their response to varying levels of nutrients and to identify the optimum dose, the effect on late planted rice situations and efficient N and P cultivars, Nutrient management trials (NMTs) were constituted and conducted during *kharif* 2019. A total of 94 AVT-2 entries belonging to 16 categories were evaluated at different locations under different levels of nutrients, i.e., 50 or 100 and 150 % of recommended dose of nutrients along with standard and local cultivars to identify stable and efficient genotypes.

4.1 Nutrient response trials on selected AVT-2 rice cultures under high and low input management

4.1(a) AVT-2 EH (Irrigated)

IET 26562 was evaluated at four locations **(Almora, Khudwani, Malan and Upper Shillong)** under two recommended doses of fertiliser (50% and 100% RFD).Application of 100% RFD recorded higher yield at **Almora**, **Khudwani** and **Malan** (3.51, 5.78 and 4.61 t/ha) with higher nutrient response. Average yield of the locations popular varieties like VL Dhan 86, Vivek Dhan-86 were found promising except. IER 26565 at **Almora**

4.1(b) AVT-2 MH (Irrigated)

Different cultivars three cultures viz., IET 26579, IET 26594, IET 25838 were evaluated at five locations **(Almora, Khudwani, Malan, Upper Shillong and Wangbal)** under two recommended fertilizer dose (50 and 100% RFD) under medium hill conditions. Application of 100% RFD recorded significantly higher yield at **Khudwani** (5.55 t/ha), **Malan** (4.57 t/ha) and **Upper Shilong** (2.07 t/ha). Nutrient response (kg grain / kg N) was higher at 100% RDF. IET 25838 and IET 26579 were found to be promising at **Almora** and **Malan** respectively.

4.1(c) NMT Early (Transplanted)

The trial conducted at thirteen locations (**Chiplima, Faizabad, Ghagraghat, Jagdalpur, Mandya, Nagina, Puducherry, Ranchi, Rewa, Sabour, Vadgaon, Varanasi** and **Maruteru** under two recommended doses of fertiliser (50% and 100% RDF) with 5 AVT-2 entries compared with standard, popular and local varieties. Mean over the locations, the performance of IET 25713 (5.13 t/ha) followed by IET 26477 (5.05 t/ha) were better over other entries, popular varieties local check. The application of 100% NPK recorded higher grain yield and also exhibited higher nutrient recovery.

4.1(d) NMT IME (Transplanted)

Promising AVT-2 cultures of medium duration were evaluated (IET 24952 and IET 25745) for their response to nutrients on grain yield at seventeen different locations viz., **Aduthurai, Chinsura, Chiplima, Dhangain, Faizabad, Gangavathi, Karjat, Kanpur, Kota, Mandya, Nagina, Navsari, Nawagam, Pantnagar, Pattambi, Puducherry and Varanasi** under two different doses of fertiliser (100% and 150% RDF). IET cultures viz., IET 24950 (5.50 t/ha) followed by IET 25745 (5.22 t/ha) were performed better and recorded higher mean grain yield over the locations compared to other cultures.

4.1(e) NMT IM (Transplanted)

AVT-2 entries (IET 27263, IET 26418 and IET 26420) of medium duration were evaluated for their response to nutrients and grain yield at thirteen different locations viz., **Chinsurah, Chiplima, Coimbatore, Dhangain, Faizabad, Jagdalpur, Karjat, Kaul,**

Kota, Nagina, Pantnagar, Titabar and **Maruteru** under two different levels of nutrient input (100% and 150% RDF). Application of 150% RDF recorded higher grain yields and also exhibited higher nutrient recovery at all the locations. IET 27263 and IET 26420 were found to be promising and recorded higher mean grain yield and nutrient response.

4.1(f) NMT Late

AVT- 2 entries IET 26927, IET 26974, IET 25948 and IET 26948 were evaluated for its response to nutrients on grain yield at nine different locations i.e., **Aduthurai, Chinsurah, Chiplima, Dhangain, Karjat, Mandya, Maruteru, Nagina** and **Pusa** under two different fertiliser levels (100% and 150% RDF). The application of 150% RDF had higher grain yields and also exhibited higher nutrient recovery at most of the locations. IET 26974, IET 26948 and IET 25948 found to be promising in terms of grain yield at most of the locations.

4.1(g) NMT MS

Five entries (IET 26549, IET 27136, IET 25802, IET 25798 and IET 24990) of medium slender group were evaluated for their response to levels of nutrients on grain yield at seven different locations i.e., **Dhangain, Karjat, Kaul, Mandya, Nagina, Raipur and Maruteru** under two levels of RDF (100% and 150% RDF). Application of 150% RDF recorded higher grain yields at **Dhangain** (6.48 t/ha), **Karjat** (3.91 t/ha), **Mandya** (7.37 t/ha), and **Raipur** (6.40 t/ha). Higher nutrient response was also recorded with 150% RDF application. Average over the locations, higher mean grain yield of 5.98 t/ha was recorded with 150% RDF and was 8.5% higher than yield obtained with 100% RDF. Grain yield differences among the tested varieties were found significant at all the locations. Entries like IET 25802, IET 25798 and IET 26549 were found to be promising with higher mean grain yield.

4.1(i) NMT AL and ISTVT

Saline tolerant culture (IET 27077) was evaluated for its response to different levels of nutrients on grain yield at four different locations i.e. **Kanpur, Lucknow, Navsari** and **Rajendranagar** under two recommended doses of fertiliser (100% and 150% RDF). Application of 150% RDF recorded higher grain yields at **Kanpur** (2.77 t/ha), **Lucknow** (5.25 t/ha) and nutrient response. Application of 150% RDF with IET 27077 was found to exhibit significant interaction and found to be promising entry and recorded higher grain yield.

4.1(j) NMT RSL

AVT-2 entry (IET 26692) was evaluated for its response to levels nutrients on grain yield at five locations i.e. **Faizabad, Chinsurah, Dhangain, Ghaghraghat and Pusa** under two levels of RDF (100% and 150% RDF). In this trial, Application of 150% RDF recorded higher grain yields at **Chinsurah** (4.73 t/ha) and **Ghaghraghat** (3.44 t/ha) and also exhibited higher nutrient recovery. Significantly higher mean maximum grain yield was recorded by IET 26692 at most of the locations.

4.1(k) NMT BT

Basmati cultures (IET 26995 and IET 26999 at twelve different locations i.e., **Chatha, Dhangain, Faizabad, Kanpur, Kaul, Kota, Ludhiana, Nagina, Navsari, Pantnagar, Raipur** and **Rewa** under two different doses of RFD (100 and 150%). The application of 150% RFD was found to be promising and also exhibited higher nutrient recovery. IET cultures IET 26999 and IET 26995 were found to be promising over rest of the entries at most of locations.

4.1 (l) NMT Biofortified

AVT-2 entry (IET 27179) was evaluated for their response to different levels of nutrients (100% and 150% RDF) on grain yield from thirteen different locations viz., **Chinsurah**, **Coimbatore, IIRR, Kaul, Mandya, Maruteru**, **Nagina, Nawagam, Pantnagar, Raipur, Rajendranagar Rewa and Varanasi.** Application of 150% RDF recorded significantly higher grain yields at **Chinsurah, Mandya, Nawagam, Raipur, Rajendrnagara** and **Rewa** with higher nutrient response. Mean over the locations, IET 27179 (4.70 t/ha) performed better check (Kalanamak) and found to be promising and recorded higher mean grain.

4.1(m-i) NMT NIL (Bl & BLB)

AVT-2 NIL lines (IET 27285, IET 27294, IET 7280, IET 27286 and IET 28014) were evaluated at two different nutrient management (100 and 150% RDF) at four locations (**IIRR, Jagdalpur, Pantnagar** and **Nellore**). Application of 150% of RDF was promising at most of the location and IET 27280 (5.88 t/ha) followed by IET 27285 (4.97 t/ha) were found promising over rest of the cultures.

4.1(m-ii) NMT Herbicide tolerant genotypes

The present investigation to study the herbicide tolerance in elite genotypes for their efficacy in Basmati growing areas of the country was taken up at six locations viz., **ICAR-IARI, ICAR-IIRR, Kaul, Ludhiana, Nagina** and **Pantnagar** during kharif 2019. The trial was conducted in replicated split plot design with weed control treatments (T1–Imazethapyr 10%SL post-emergence application; T2–Pendimethelin 30% EC pre-emergence application followed by Bispyribacsodium 10% SC post-emergence application; T3–Weed free check)in main plots and genotypes (G1–IET 28812, G2–IET 28813, G3–IET 28814, G4-IET 28815, G5–Pusa Basmati 1121, G6– Pusa Basmatia1509) in sub plots. The data on cop growth parameters, yield attributes, yield and weed parameters were recorded in the crop season and results are presented.

The results of one season study of HT genotypes showed that at all the locations, irrespective of genotypes tested, weed free check has resulted is significantly high crop growth, yield attributes and grain yield. The herbicide treatment of standard pre and post-emergence application of Pendimethalin and Bispyribacsodium resulted in higher yield, yield attributes and growth parameters. Till 60 days after herbicide application, application of

Imazethapyr resulted in lower weed parameters at five out of six locations. At these locations, after 60 DAHA also, another weed flush might had appeared and resulted in lower crop growth, and grain yield etc. in the treatment of Imazethaypr application. Among the test genotypes, IET 28812 and 28813 were superior at three locations; IET 28814 and 28815 at two locations; IET 28812, 28813, 28814 and 28815 were comparable at one location. At majority of the test locations, weed population and biomass at 30, 45 & 60 days after herbicide application were lower with IET 28812 and 28813. The genotypes IET 28812 and IET28813 with no or low phytotoxicity to Imazethapyr have contributed to higher crop growth and grain yield with standard pre and post-emergence application of Pendimethalin, Bispyribacsodium.

4.1(m-iii) NMT Nitrogen use efficiency

The trial is constituted to evaluate the identified cultures and cultivars with the following objective: 1) To study the comparative performance of elite lines and cultivars under different levels of nitrogen. The trial was conducted at 4 locations (**ICAR-IIRR, Ludhiana, Ranchi and Maruteru**). Split plot design was adopted with 3 main plots of nitrogen levels (N_1- No nitrogen, N_2: 50 %of recommended N dose (P and K is constant) and M_3: 100 % of recommended dose of N (P and K constant).

Trials conducted at 4 locations revealed that the following cultivars/entries to be high grain yielding and nitrogen use efficient.

High grain yielding entries/cultivars under without application of nitrogen (0 kg/ha)	**High grain yielding entries/cultivars under 50% of recommended nitrogen dose**
IET 27730 (3.32 t/ha), IET 28081 (3.07 t/ha), IET 28830 (2.95 t/ha), IET 28080 (2.94 t/ha), IET 28084 (2.93 t/ha) IET 28828 (2.33 t/ha), IET 28832 (2.24 t/ha), IET 28831 (3.0 t/ha) IET 28832 (2.71 t/ha), IET 28079 (2.68 t/ha), IET 28086 (2.58 t/ha)	IET 28087 (5.81 t/ha), IET 27730 (5.26 t/ha), IET 28080 (5.03 t/ha), IET 28831 (4.47 t/ha), IET 28081 (4.38 t/ha), IET 28830 (4.37 t/ha) IET 28827 (4.98 t/ha), IET 28084 (4.98 t/ha), IET 28088 (4.84 t/ha), IET 28828 (4.81 t/ha), IET 28086 (4.78 t/ha) IET 28079 (5.52 t/ha)
High grain yielding entries/cultivars under 100% of recommended nitrogen dose	**High grain yielding entries/cultivars under 150% of recommended nitrogen dose**
IET 28080 (7.31 t/ha), IET 28084 (7.29 t/ha), IET 27730 (7.29 t/ha), IET 28088 (7.24 t/ha) IET 28087 (5.93 t/ha), IET 28827 (5.51 t/ha), IET 27730 (4.82 t/ha), IET 28831 (4.62 t/ha), IET 27730 (6.96 t/ha), IET 28831 (6.52 t/ha)	IET 28827 (8.75 t/ha), IET 28084 (8.03 t/ha), IET 28088 (7.99 t/ha), IET 28080 (7.55 t/ha), IET 27730 (7.49 t/ha)

4.1(m-iii) NMT Phosphorus tolerance Cultures

The trial is constituted to evaluate the identified cultures and cultivars with the following objectives: 1) To study the comparative performance of elite lines and cultivars in different levels of Phosphorus and 2) To identify the elite lines for tolerance to low P soil conditions. The trial was conducted at 3 locations (**ICAR-IIRR, Ludhiana and Nellore**). Split plot design was adopted with 3 main plots of phosphorus levels (P_1- No Phosphorus (Control) (N and K Constant), P_2: 50 %of recommended P dose (N and K is constant) and P_3: 100 % of recommended dose of P (N and K constant). Subplots consist of 36 advanced cultures.

Trials conducted at 3 locations revealed that the following cultivars/entries to be high grain yielding and phosphorus use efficient.

Location	High grain yielding entries/cultivars under low phosphorus condition	High grain yielding entries/cultivars under recommended phosphorus dose
ICAR-IIRR	IET 28061 (3.73 t/ha), IET 28065 (3.49 t/ha), IET 28076 (3.44 t/ha), IET 28776 (3.34 t/ha), IET 27641 (3.32 t/ha) IET 28075 (3.32 t/ha)	IET 28061 (5.41 t/ha), IET 28816 (5.15 t/ha), IET 28066 (5.0 t/ha)
PAU, Ludhiana	IET 28816 (3.84 t/ha), IET 28066 (3.77 t/ha)	IET 28066 (4.2 t/ha), IET 28816 (3.9 t/ha), IET 28075 (3.88 t/ha) IET 28061 (3.7 t/ha)
Nellore, AP	IET 28070 (5.9 t/ha), IET 28818 (5.57 t/ha),	IET 28070 (6.4 t/ha) IET 28816 (5.77 t/ha)

4.2 CULTURAL MANAGEMENT TRIAL (CMT)

4.2.1. Development of package of practices for mechanized transplanting

The trial was conducted at 7 locations (**Aduthurai, Chiplima,Gangavathi, Puducherry, ARI Rajendranagar, Ranchi and Warangal**). Split plot design was adopted with 3 main plots of crop establishments {M_1: Normal Planting time Mechanical Transplanting (15 days seedlings and recommended spacing); M_2: Normal Planting time Mechanical Transplanting (21 days seedling and recommended spacing); M_3: Delayed Planting time (15 days late) Mechanical Transplanting (15 days seedlings and recommended spacing); M_4: Manual transplanting – Normal time (25 days old seedlings) and M_5: Manual transplanting – Delayed sowing time (25 days old seedlings) and 3 subplots consists of local latest released rice varieties.

<u>Mechanical transplanting of 15 days seedlings at normal sowing time</u> resulted the highest grain yield (5.87 t/ha) at five locations out of seven locations. Among cultivars ADT-

53, Arize Gold, GGV-0501, TKM-13 and Naveen found promising with higher grain yield at **Aduthurai, Chiplima, Gangavathi, Puducherry** and **Ranchi** respectively

4.2.2. Developing suitable package of practices for dry DSR

The trial was conducted at 14 locations (**Arundhatinagar, Chatha, Gangavathi, Jagdalpur, Kota, Mandya, Nagina, Nawagam, Pantnagar, Ragolu, Tuljapur, Ranchi, Ludhiana and Pusa**). Split plot design was adopted with 2 main plots of sowing time (M_1: Normal sowing time and M_2: Delayed sowing by 30 days). Four subplots consist of S_1: Broadcasting of seeds; S_2: Manual line sowing of seed (20-25 cm row spacing sown) in solid row); S_3: Mechanized line sowing of seeds (Dribbler, Happy Seeder or any Drum Seeder) and S_4: Any improved system in that particular location.

Multi-location trial revealed that normal date of sowing at most of the locations and resulted in higher grain yield. However, average reduction of 14% in grain yield recorded due to 13 day in sowing. Similarly, mechanized line sowing (4.11 t/ha) found to be the best among all establishment methods. Local practices such as at **Chatha** (dibbling SRI)**, Ragolu** (semi dry rice, 20 x 15 cm) **and Ranchi**(Rice + Sesbania was broadcasted, Sesbania was broadcasted at the rate of 40 kg/ha and then rice was sown in lines 20 cm apart , at 25th DAS *sesbania* was uprooted and placed in between rice rows) also showing better results.

4.2.2(R). Nutrient and Weed management for higher productivity in different rice establishment methods

The experiment was conducted during *rabi*2018-19 in split-split design with four replications. Treatments consisting of five crop establishment methods {Mechanical Transplanting method (All the principles as per the SRI); M_2: Direct seeding (Use of Drum seeder/ dibbling of sprouted seed at 25 x25 cm) *fb*. SRI principles (saturation method of water management, weeding with cono-weeder and fertilizer management); M_3: Normal Transplanting (20 x15 cm with flooding water management,3-4 seedlings transplanted at 25-30 days old seedlings); M_4: SRI; M_5: Aerobic rice and M_6: Semi dry rice} were assessed for their system productivity performance at 2 locations (**Mandya and Puducherry**).

At red sandy loam soils of **Mandya**, cowpea was grown in 2018-19 *rabi*season. Main plots and sub plots effect on grain yield was non-significant. Rice equivalent yield of rice-cowpea system was highest (11.66 t/ha) under direct seeding followed by SRI principles. Similarly, application of 150% RDF in this system produced highest system productivity (12.0 t/ha). In clay loam soils of **Puducherry**, rice was grown in *rabi* season. In *rabi* season, mechanical transplanting resulted the highest rice grain yield (6.89 t/ha). Among nutrient managements practices LCC based nitrogen application resulted the highest yield (7.07 t/ha). The highest rice-rice system productivity was recorded under mechanical transplanting with LCC based N management (13.64 t/ha). Lower weed population at active tillering stage was also recorded under mechanical transplanting and LCC based N management.

4.2.3. Developing suitable package of practices for wet DSR

The trial was conducted at 16 locations (**Aduthurai, Chatha, Chiplima, Coimbatore, Karjat, Kota, Mandya, Navsari, Nawagam, Puducherry, Rajendranagar, Ranchi, Rewa, Titabar, Warangal and Pusa**). Split plot design was adopted with 2 main plots of sowing time (M_1: Normal sowing time and M_2: Delayed sowing by 30 days). Four subplots consist of S_1: Broadcasting of seeds; S_2: Manual line sowing of seed (20-25 cm row spacing sown in solid row); S_3: Mechanized line sowing of seeds (Dribbler, Happy Seeder or any Drum Seeder), S_4: Any improved system in that particular location and S_5: Normal Transplanting.

Delay of sowing time significantly reduced grain yield of wet DSR at most of the locations and average yield reduction was 16% across the locations. Among crop establishment methods transplanting method resulted in the highest grain yield at **Chiplima** (4.78 t/ha), **Coimbatore** (6.13 t/ha), **Puducherry** (6.26 t/ha), **Ranchi** (5.01 t/ha), **Titabar** (3.98 t/ha), **Warangal** (6.27 t/ha) and **Pusa** (4.32 t/ha). Multi-location trials revealed that locally practiced establishment methods sown at normal time were found to be superior in resulting higher grain yield.

4.2.4. Evaluation of IRON coated seed for direct seeded rice for enhancing the crop establishment as well as productivity

In order to enhance the productivity of DSR, iron coating of seeds was done and evaluated at 5 locations consequently viz., IIRR, Coimbatore, Karjat and Raipur with 4 date of sowings with one week interval as main plots and five establishment methods(T1- Iron coated seed, seed rate 25 kg/ha, broadcasting in 1-2mm water level condition (Direct sowing) T2- Iron coated seed, seed rate 25 kg/ha, broadcasting in wet Condition (Direct sowing) T3 – Un-coated seed, seed rate 25 kg/ha, broadcasting in 1-2mm water level condition (Direct sowing) T4 – Un-coated seed, seed rate 25 kg/ha, broadcasting in wet condition (Direct sowing) T5 – Normal transplanting 21-25 days after sowing as subplots in 3 replications. Among the date of the sowing, 1st date of sowing (6.21 t/ha at Chiplima, 5.67 t/ha at IIRR , 3.81 t/ha at Karjat) gave significantly higher grain yield and over 15 days delay reduced mean grain yield reduced yield by 8.1%, 21% and 30% respectively. There is an significant increase of grain yield to the tune of 5.72 to 9.85% due to iron coating of seeds which felicitated better system of establishment and growth. The results are inconformity with previous year. Effect of iron seed coating on insect pest incidence (ESCP indicated low pest incidence across the locations in different treatments. Stem borer incidence was at par in different seed coated treatments (0.5 – 10.6% DH & 3.9 – 16.6% WE) and also in different sowings (0.1 – 10.8% DH & 4.1 - 16.4% WE). However, gall midge (9.2 – 13.9% SS) and BPH incidence (11-19/hoppers hill) was found low in seed coated treatments compared to normal transplanting (24.6% SS & 33/hill) and T3 treatment with uncoated seed (22.6%SS & 32/hill).

4.2.5. Yield maximization in farmers' field using Nutrient Expert

To validate NE® tool, this collaborative trial was constituted along with IPNI during *kharif* 2014 and continued in *kharif* 2019 at 2 locations viz. **Chinsurah, and Titabar**. This year the trial was conducted in farmers' field. The treatments were as follows: T_1 – Recommended fertilizer recommendation of that region, T_2 – SSNM based on Nutrient Expert (Varies for each location), T_3 – Farmers fertilizer practice and T_4: Absolute control (Without NPK). SSNM based on Nutrient Expert treatment resulted in highest yield at **Chinsurah** (5.28 t/ha) and **Titabar** (5.76 t/ha).

4.2.5(R). Management practices for enhancing grain yield with green manure and nutrient management in rain fed upland rice

The present investigation was taken up to study the effect of phosphorus and greenmanure on productivity of rice at one location (**Pattambi**). Experiment was laid out in factorial RBD design {M_1: Rice alone, M_2: Rice + GM (Sunhemp/Dhaincha/Green leafmanuring) and 5 subplots of phosphorus treatment (S_1: 0 kg P_2O_5/ha, S_2: 20 kg P_2O_5/ha, S_3: 40 kg P_2O_5/ha, S_4: Optional and S_5: Farmers practice.

In red lateritic soils of **Pattambi** the highest grain yield (5.08 t/ha) was observed under rice + green manure crop without phosphorus application to soil as compared to other treatments.

4.2.6. Water management for enhancing water use efficiency and weed control efficiency in different rice establishment methods

The trial was conducted at 5 locations (**Chatha, Faizabad, Mandya, Pusa, and Varanasi**). Split plot design was adopted with 3 main plots of irrigation management {I_1: Flooding throughout crop growth (3 + / - 2 cm), I_2: Saturation maintenance upto PI and (3 + / - 2 cm) after PI and I_3: Alternate wetting and drying (irrigation at 5 -7 days interval with 5 cm/ha of water (5 cm irrigation at 3 DADPW) up to PI and (3 + / - 2 cm) after PI} and 6 subplots of crop establishment methods {T_1: Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice), T_2: Direct wet seeding on puddled soil (Use of Drum seeder/ dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice, T_3: Normal hand transplanting (20 x15 cm with flooding water management, 3-4 seedlings transplanted at 25-30 days old seedlings), T_4: Aerobic rice T_5: Direct broadcast dry seeding on well prepared unpuddled soil fb crop management practices for direct dry drill seeded rice and T_6: Optional- Location specific} and replicated thrice.

Grain yield across all the centers revealed that **alternate wetting and drying** resulted the highest grain yield among irrigation management treatments. Higher cost of cultivation was recorded under flooding throughout crop growth at **Mandya** (Rs. 56717/-) and **Varanasi** (Rs. 32943/-). Similarly, water input was saved due to adoption of alternate wetting and drying was 49.0 cm at Varanasi and 66.9 cm at **Mandya**. Among the crop establishment methods during *rabi* season, mechanical transplanting recorded as significant. Water input was significantly reduced in AWD method 1593 mm/ha as compared to saturation and flooding throughout crop growth 1603 and 1613 mm/ha respectively. Lower weed population and dry weight were observed in alternate wetting and drying treated plots in **Puduchery**.

4.3. WEED MANAGEMENT TRIAL

4.3.1 Evaluation of Bio efficiency of Thiobencarb in wet direct sown rice :

With the objective of evaluating the bio efficiency of thiobencarb at different doses in wet direct sown rice in comparison to the promising pre and post emergence herbicides at different locations viz**., ICAR-Indian Institute of Rice Research Hyderabad, Malan, Puducherry** and **Raipur**, the experiments conducted during kharif 2019, revealed that, the systemic post emergence herbicide thiobencarb @5 l /ha appliced at 20 days after sowing was found superior, resulting in higher weed control efficiency; higher grain yields; and the performance was comparable to hand weeding twice, standard post emergence herbicide bispyribacsodium @ 300 ml/ha.

The multi-locational two consecutive seasons study (kharif 2018 and kharif 2019) results showed that, the systemic post emergence herbicide thiobencarb @5 l/ha has contributed to higher weed control efficiency; higher grain yields; and the performance was comparable to hand weeding twice and standard post emergence herbicide bispyribacsodium@ 300 ml/ha.

4.3.2 Long term trial on weed dynamics in mono or double cropped rice system under different establishment methods

With the objective of assessing the weed dynamics in different establishment methods on a long term basis of minimum five years, the trial was initiated during *kharif* 2019. The trial was conducted at 12 locations viz., **Aduthurai, Chiplima, Gangavathi, Ghaghraghat, Jadgalpur, Malan, Moncompu, Nawagam, Pantnagar, Puducheery, Varanasi** and **Titabar** in replicated split plot design. Though allotted, the trial was not conducted by **Chinsurah, Cuttack, Karaikal, Kota, Nagina, Prabhani, Pattambi, Pusa, Ranchi, Rewa, Tuljapur** . The treatments consisted of 3 main plots M1 – Mechanised planting/transplanting, M2 – Puddled direct seeding, M3 – Unpuddled dry direct seeding and four sub plots T1 – Weed free, T2 – Weedy check, T3 – Mechanical weeding using weeder and T4 – Chemical weed control of pre and post emergence herbicide application. The results of data on growth parameters, yield attributes, grain yield, weed parameters reveal that at ten out of twelve locations, mechanical transplanting recorded lower weed population, dry weed biomass at maximum tillering stage, panicle initiation and heading stages of rice crop which in turn reflected in increased crop growth parameters, yield attributes and yield of rice. At two locations, puddle/un-puddled direct seeding has contributed to lower weed population and biomass,. Among the weed control treatments, six out of twelve locations reported superiority of chemical weed control by pre and post emergence herbicide application and effective in controlling weeds and more resources were made available for improved crop growth and yield. At four locations, the performance of mechanical weeding using weeder and chemical weed control were comparable. At two locations, mechanical weeding using weeder resulted in significantly higher crop growth, yield attributes and grain yield. The results clearly indicate the necessity of adopting improved agronomic management technologies for reducing weed problems and for improving production potential of puddled and un-puddled direct seeding systems. The performance of mechanical weeding in different establishment methods is indicating the scope and potential of mechanical weeding methods and can be further exploited in view of scarce resources and changing climate.

4.3.3 Evaluation of cultivars for weed competitiveness under direct seeded rice system

With the objective of evaluating the performance of recently released high yielding varieties for weed competitive ability and yield performance, multilocational trial was conducted at five locations viz., **Chinsurah, Ghaghraghat, Malan, Nellore** and **Tuljapur** during kharif 2019. At **Monompu, Pantnagar, Pattambi** and **Parbhani**, the trail was conduted with different technical programme cannot fit in this trial report. The treatments consisted of four weed control treatments (T1-Weed free, T2-Weedy check, T3-Mechanical weeding using weeder and T4-Chemical weed control (pre & post emergence herbicide application)) as main plots and three varieties (V1 – DRR Dhan 50, V2 – DRR Dhan 52 and V3 - Latest released state variety) as sub plot treatments in replicated split plot design. The results of the data recorded on crop growth, yield attributes, yield and weed parameters indicated that, the trend in usual relative dominance of weed groups varied from the earlier order of grasses-BLW-sedges to sedges-BLW-grasses and/or BLW-grasses-sedges. At majority of the locations, in clay loam and clay soils, chemical weed control using pre and post emergence herbicides was found superior and in sandy loam soils, mechanical weeding using weeder showed superior performance. Varietal performance varied among the test locations. DRR Dhan 50 at two locations, DRR Dhan 52 at two locations, local high yielding varieties at two locations showed superior performance with lower weed population, weed biomass, higher crop growth parameters, yield attributes and grain yield.

4.3.4 Integrated Pest Management–(Collaborative trial with Entomology and Pathology)

IPM special trial was conducted with an aim to manage pests (including insects, diseases and weeds) in a holistic way in farmers' fields involving them in a participatory way and allowing them to select IPM practices from a basket of options available. During *Kharif* 2019, the trial was conducted at 11 locations viz. **Chatha, Chinsurah, Gangavathi, Malan, Mandya, Nagina, Navsari, Puducherry, Raipur, Titabar and Vadagaon.** The data and results of weed parameters during critical period of crop weed competition and grain yields showed that across the locations, weeds, insect pests, and disease incidence was low in IPM plots. The mean weed population was considerably reduced by 9 to 71% at 30 DAT, 4 to 79% at 60 DAT; resulting in reduction of the mean weed biomass by 5 to 70% at 30 DAT, 5 to 81% at 60 DAT respectively. The mean grain yield advantage in IPM implemented plots compared to farmers practice is 2 to 52% among the test locations.

4.4. RESOURCE CONSERVATION TECHNOLOGIES (RCTs) IN RBCS

4.4.1 Conversation Agriculture/system base management practices in rice and rice based cropping systems (crop diversification) to utilise the resources and enhancing the profitability and productivity

Conservation Agriculture (CA) systems are developed for the intensive rice-based cropping systems that one be evaluated in different rice-based cropping systems. In general, Rice-based cropping systems are characterised by key edaphic influence of puddling soil for transplanting which destroys the soil structure through intensive tillage and removal or burning of crop residue before sowing of next crop that limits the recycling of organic matter of soils. To address this issue the trial on conservation agriculture system management practices in rice and rice based cropping system are conducted at 5 location viz. **Vadagaon, Ghaghraghat, Karjat, Rajendranagar**and**Titabar**. Main plot treatments comprises of three crop establishment methods (M1 – Transplanting, M2 – Wet seeding (line sowing under puddle condition) and M3: Aerobic rice – Dry rice cultivation). The sub plot treatment consists of 3 different residue/straw management (S1 – No residue, S2 – 15 cm height of rice straw retention and S3 – 30 cm height of rice straw retention). Among the crop establishment methods, transplanting method gave better yields at most of the locations viz., **Rajendranagar** (5.62 t/ha), **Karjat** (8.68 t/ha) due to reduced weed competition. The REY of system productivity was higher at three locations due to rice- residue incorporation in **Vadagaon**, **Rajendranagar** and **Karjat**.

At **Karjat**, the incidence crossed ETL in M3 - aerobic rice (10.2% DH) and S1- No residue sub-plot (10.9% DH), at 60 DAT. There were no significant differences among the treatments in pest incidence at both vegetative and reproductive stages. At **Jagdalpur**, due to low pest incidence all the treatments were on par and no trends were discernible.

4.4.2 (Rabi) Enhancing productivity of rice-pulse system under different crop establishment methods

This trial was initiated with a view to evaluate pulses in different rice establishment methods to realize the production potential of alternate systems of crop establishment was conducted at **Mandya** during *kharif* 2018 and *rabi* 2018-19. The results revealed that higher average higher system productivity (10.65 t/ha) was recorded under rice-cowpea system as compared to rice-rice system (7.65 t/ha). Rice fallow pulse increases grain yield significantly over rice-rice system for the past two years of study.

4.4.3 Evaluation of promising cultivars for late planting and management for higher productivity and mitigate the effect climate change

The trial to evaluate promising cultivars for late transplanting was conducted at **Aduthurai** with five cultivars, **Mandya** with fifteen cultivars at different dates of planting while at **Gangavathi** two fertilizer doses were tested with eleven cultivars planted very late situation (4th September, 2019).

The results indicated that, there is no difference in grain yield due to delay in planting. However, the yield reduction was 16 and 53% due to 15 and 30 days delay in planting at **Mandya**. The results indicate that AD 17037, ADT 53 at **Aduthurai**, Indiraero-1, MTU 1010, Co-51, IR 64, GNV-1089 at **Gangavathi** and KMP 175, Samleshwari, CR Dhan 201, Co-51 and CTH-3 at **Mandya** were found promising with better yields.

4.4.4. Assessing the performance and yielding ability of *kharif* sorghum hybrids in Rice-Sorghum sequence cropping system

In rice fallows, sorghum cultivation was found to be high yield potential with reduced inputs and labour. New promising Sorghum hybrids having high yield potential were tested in rice fallows where in rice cultivated as Transplanted, Wet DSR and Dry DSR method. The trial conducted at **Chinsurah**, **Mandya** and **Ragolu** during 2019. Mean over the locations, transplanting method gave comparable yields with wet DSR methods (2.50 t/ha to 6.80 t/ha) at **Chinsurah** and **Mandya**. The data of Sorghum hybrids (9) are yet to be received and analysed to know the performance in rice fallows. .

NUTRIENT MANAGEMENT TRIALS

NUTRIENT MANAGEMENT TRIALS (NMT)

Agronomists conducted 236 experiments at 49 locations consisting of evaluation of promising cultivars were (94 cultures) belonging to 16 groups *viz.,* early hill (irrigated), medium hill (irrigated), early (TP), irrigated mid early, irrigated medium, late, medium slender, alkaline & inland saline, rainfed shallow lowland, basmati, biofortified, NIL (BL & BLB), herbicide resistant mutant, Nitrogen and Phosphorous use efficiency in transplanted situation, for their response to integrated nutrient management at 50,100 and 150% Recommended dose of fertilizer(RDF). In addition, six trials on cultural management, four trials on weed management, four trials on rice based cropping systems and five collaborative trials (Soil science, Entomology and Plant Breeding) were also conducted to develop cost effective technologies in different rice and rice based cropping systems.

NMT 1 (a) Early hill EH (Irrigated)

Cultivar IET 26565 was evaluated with Shalimar Rice 3, Vivekdhan 86, VL Dhan 86 and local check at four locations **(Almora, Khudwani, Malan and Upper Shillong)** under two different recommended doses of fertilizer (50% and 100% RFD). The data received from four locations are summarized and presented in **Table 4.1(a)**.

Different doses of fertilizer exhibited varying differences in grain yield and yield attributes at all the four locations. Application of 100% RFD recorded higher yield at **Almora**, **Khudwani** and **Malan** (3.51, 5.78 and 4.61 t/ha) and was found significantly superior to 50% RFD at **Khudwani** and **Malan** however at **Almora** the yield difference was not significant. Interaction effects of N doses and varieties was non-significant at all locations. Averaged across the locations, Nutrient response (kg grain / kg N) was higher at 100% RFD compared to 50% RFD.

Average yield of the locations with different varieties ranged from 3.21 to 3.62 t/ha in **Almora**, 3.52 to 7.13 t/ha in **Khudwani**, 2.70 to 5.25 t/ha in **Malan**, IET entries did not mature and no grain formation at **Upper Shillong**. Grain yield of varieties differed significantly at all locations with different doses of RFD. Among the varieties tested, local check Shalimar Rice-3 (7.13 t/ha) at **Khudwani** and Shalimar Rice-3 (5.25 t/ha) at **Malan** was found promising over other varieties. Among the cultures, IET 26565 (3.62 t/ha) at **Almora** was found promising. Mean over the four locations, Vivek dhan 86 was found promising over other tested varieties.

In this trial, nutrient management with 100% RFD was found to be promising and also exhibited higher nutrient recovery at all the locations. Popular variety like VL Dhan 86, Vivek Dhan-86, were found to be promising except IET 26565 at **Almora**.

NMT 1 (b) Medium hill MH (Irrigated)

Different cultivars (IET 26579, IET 26594 and IET 25838) were evaluated in comparison with local checks at five locations **(Almora, Khudwani, Malan, Upper Shillong and Wangbal)** under two recommended fertilizer dose (50 and 100% RFD) under medium hill conditions. The data received from four locations are summarized and presented in **Table 4.1(b)**.

Application of 100% RFD gave significantly higher grain **Khudwani, Malan** and **Upper Shillong** indicating better response of cultivars to higher nitrogen application. Application of 100% RFD recorded significantly higher yield at **Khudwani** (5.55 t/ha), **Malan** (4.57 t/ha) and **Upper Shillong** (2.07 t/ha). Interaction effects of varieties and N levels were not significant at all the locations except **Almora** and **Khudwani**. Nutrient response (kg grain / kg N) was higher at 100 % RDF as compared to 50% RFD at all the locations.

Grain yield differences among cultivars were significant at all the locations Average yield of the locations ranged from 3.56 to 3.95 t/ha at **Almora**, 1.67 to 6.92 t/ha in **Khudwani**, 3.72 to 5.31 t/ha at **Malan** and 1.25 to 2.28 t/ha at **Upper Shillong** and 2.55 to 3.53 t/ha. Mean grain yield was provided from **Wangbal**. Among the varieties tested, IET 25838 at **Almora** (3.95 t/ha), IET 26579 (5.31 t/ha) at **Malan** found promising over other varieties. At **Khudwani**, Shalimar rice 1 (6.92 t/ha) recorded higher yield. Vivek Dhan 62 was found to be promising at **Malan** (4.53 t/ha) and **Upper Shillong** (2.73 t/ha), whereas MEG-1 (2.28 t/ha) was superior to other entry at **Upper Shillong**.

In this trial, integrated agronomic management with 100% RFD was found to be promising and also exhibited higher nutrient recovery. Popular varieties like VL Dhan 65, Vivek Dhan 62, and Shalimar rice 1 were found to be promising. Among the cultures, IET 25838 at **Almora**, IET 26579 at Malan were found promising in recording higher grain yield.

Table-4.1(a): Summary of data on grain yield and ancillary character of selected NMT- early hill (irrigated) cultures grown under transplanted conditions at graded levels of recommended nutrient(NPK) doses, kharif 2019.

		ALMORA							KHUDWANI						
Fertilizer-levels	**Varieties**	**Grain Yield (t/ha)**	***Rank***	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Test Wt(g)**	**Days for 50% flowering**	**Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)**	**Grain Yield (t/ha)**	***Rank***	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Test Wt(g)**	**Days for 50% flowering**	**Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)**
F1 - 50% RFD	V1	3.59	*2*	255	3.24	25.53	93		3.4	*7*	298	2.16	26.43	114	
	V2								5.31	*4*	331	2.5	28.62	94	
	V3	3.46	*4*	245	2.62	25.60	84								
	V4	3.06	*6*	271	2.92	25.67	82		3.3	*8*	302	2.18	26.14	114	
	V5								5.93	*3*	347	2.66	30.26	98	
F2 - 100% RFD	V1	3.64	*1*	275	3.84	26.37	84	0.50	4.08	*5*	326	2.3	26.02	115	6.48
	V2								6.97	*2*	386	3.06	28.3	95	15.81
	V3	3.55	*3*	267	2.81	25.89	83	0.90							
	V4	3.35	*5*	299	2.57	25.30	85	2.90	3.73	*6*	338	2.44	27.01	107	4.10
	V5								8.32	*1*	410	3.23	30.36	99	22.76
Interaction															
N at same V		NS		NS	0.19	NS	2.94		NS		NS	NS	NS	2.78	
V at same N		NS		NS	0.33	NS	3.81		NS		NS	NS	NS	3.69	
Means of N levels:															
F1		3.37	*2*	257	2.93	25.60	86		4.49	*2*	319	2.38	27.86	105	
F2		3.51	*1*	280	3.07	25.85	84	1.43	5.78	*1*	365	2.76	27.92	104	12.29
C.D.(0.05)		NS		20.46	NS	NS	NS		0.84		NS	NS	NS	NS	
C.V.(%)		5.76		3.76	6.28	1.67	2.20		9.37		10.25	9.45	5.31	1.95	
Mean of varieties:															
V1		3.62	*1*	265	3.54	25.95	89	0.50	3.74	*3*	312	2.23	26.23	114	6.48
V2									6.14	*2*	358	2.78	28.46	95	15.81
V3		3.51	*2*	256	2.72	25.75	83	0.90							
V4		3.21	*3*	285	2.75	25.49	84	2.90	3.52	*4*	320	2.31	26.58	111	4.10
V5									7.13	*1*	378	2.95	30.31	99	22.76
C.D.(0.05)		0.31		5.19	0.13	NS	2.08		0.8		36.89	0.27	1.13	1.97	
C.V.(%)		6.78		1.45	3.35	3.67	1.84		12.41		8.57	8.37	3.22	1.50	
Expt. Mean		**3.44**		**269**	**3.00**	**25.73**	**85**		**5.13**		**342**	**2.57**	**27.89**	**104**	
Soil type		-							Sandy clay loam						
pH		7.30							6.80						

Table 4.1(a): Contd.

Fertilizer-levels	Varieties	ALMORA							KHUDWANI						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
Fertilizer levels (kg/ha)															
F1		50:30:20							60:30:15						
F2		100:60:40							120:60:30						
Varieties															
V1		IET 26565							IET 26565						
V2		-							Shalimar Rice-3						
V3		Vivekdhan-86							-						
V4		VL Dhan-86							VL Dhan-86						
V5		-							Local Check (Shalimar Rice-4)						
Available NPK in Soil		278:11.47:214							212:12.5:216						

Table 4.1(a) (Contd…)

Fertilizer-levels	Varieties	MALAN Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	UPPER SHILLONG Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Test Wt(g)	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	Over All Mean	*Rank*
F1 - 50% RFD	V1	4.23	*6*	228	2.84	28.59	88		**No grain formation found in IET entry**					3.74	*8*
	V2	2.56	*8*	161	2.71	26.73	76							3.94	*7*
	V3	4.71	*3*	240	2.73	29.15	87							4.09	*6*
	V4													3.18	*10*
	V5	4.38	*5*	214	2.35	29.23	91							5.16	*2*
F2 - 100% RFD	V1	5.18	*2*	238	3.64	28.88	90	11.18						4.30	*5*
	V2	2.83	*7*	170	2.95	26.58	75	3.18						4.90	*3*
	V3	5.78	*1*	251	3.10	28.72	88	12.59						4.67	*4*
	V4													3.54	*9*
	V5	4.65	*4*	226	2.62	29.18	91	3.18						6.49	*1*
N at same V		NS		NS	NS	NS	NS								
V at same N		NS		NS	NS	NS	NS								
Means of N levels:															
F1		3.97	*2*	211	2.66	28.43	85							3.94	*2*
F2		4.61	*1*	221	3.08	28.34	86	7.53						4.63	*1*
C.D.(0.05)		0.24		8.43	0.37	NS	NS								
C.V.(%)		3.22		2.22	7.35	1.05	0.83								
Mean of varieties:															
V1		4.71	*2*	233	3.24	28.74	90.00	11.18						4.02	*4*
V2		2.70	*4*	166	2.83	26.66	75.00	3.18						4.42	*2*
V3		5.25	*1*	246	2.92	28.94	87.67	12.59						4.38	*3*
V4														3.36	*5*
V5		4.52	*3*	220	2.49	29.21	91.00	3.18						5.82	*1*
C.D.(0.05)		0.28		7.96	0.25	0.59	1.26								
C.V.(%)		5.25		2.93	6.96	1.64	1.17								
Expt. Mean		**4.29**		**216**	**2.87**	**28.38**	**86**								
Soil type		Silty Clay Loam													
pH		5.60													
Fertilizer levels (kg/ha)															
F1		45:20:20													
F2		90:40:40													
Varieties															
V1		IET 26565													
V2		Shalimar Rice-3													
V3		Vivekdhan-86													
V4		-													
V5		HPR1068(Local Check)													
Available NPK (kg/ha)		301:44.8:225													

Table-4.1(b): Summary of data on grain yield and ancillary character of selected NMT- medium hill (irrigated) cultures grown under tranpslanted conditions at graded levels of recommended nutrient(NPK) doses, kharif 2018.

Fertilizer-levels	Varieties	ALMORA Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	KHUDWANI Grain Yield (t/ha)	*Rank*	Panicle /m^2 (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
F1 - 50% RFD	V1	3.48	*8*	258	3.67	25.43	101		4.71	*7*	339	2.30	28.99	114	
	V2	3.71	*5*	268	3.79	26.39	109		5.04	*6*	362	2.20	26.48	108	
	V3	4.05	*1*	267	3.75	24.05	102		5.06	*5*	374	2.53	26.78	116	
	V4								4.41	*8*	300	2.71	26.37	111	
	V5	3.55	*7*	276	3.63	25.64	103		1.87	*11*	193	1.85	30.66	118	
	V6								5.63	*4*	373	2.74	26.37	99	
F2 - 100% RFD	V1	4.05	*1*	259	3.88	26.59	105	5.70	4.27	*9*	339	2.30	27.37	116	-4.19
	V2	3.81	*4*	281	3.68	25.05	109	1.00	7.65	*3*	418	2.51	26.26	110	24.86
	V3	3.84	*3*	273	3.84	26.38	104	-2.10	7.76	*2*	424	2.55	28.68	118	25.71
	V4								3.96	*10*	305	3.47	30.76	113	-4.29
	V5	3.57	*6*	259	3.71	25.63	105	0.20	1.47	*12*	229	2.43	0.00	100	-3.81
	V6								8.21	*1*	384	3.27	0.00	100	24.57
Interaction															
N at same V		0.24		NS	NS	NS	NS		0.72		NS	NS	1.52	3.04	
V at same N		0.26		NS	NS	NS	NS		0.78		NS	NS	1.96	3.00	
Means of N levels:															
F1		3.70	*2*	267	3.71	25.38	104		4.45	*2*	NS	0.19	1.77	NS	
F2		3.82	*1*	268	3.78	25.91	106	1.20	5.55	*1*	6.29	5.24	5.32	0.92	10.48
C.D.(0.05)		NS		NS	NS	NS	NS		0.54		NS		0.03		
C.V.(%)		3.18		4.13	2.96	1.93	2.56		7.48		12.87		0.07		
Mean of varieties:															
V1		3.77	*2*	259	3.78	26.01	103	5.70	4.49	*4*	339	2.30	28.18	115	-4.19
V2		3.76	*3*	275	3.74	25.72	109	1.00	6.35	*3*	390	2.36	26.37	109	24.86
V3		3.95	*1*	270	3.80	25.22	103	-2.10	6.41	*2*	399	2.54	27.73	117	25.71
V4									4.19	*5*	303	3.09	28.57	112	-4.29
V5		3.56	*4*	268	3.67	25.64	104	0.20	1.67	*6*	211	2.14	15.33	109	-3.81
V6									6.92	*1*	379	3.01	13.19	99	24.57
C.D.(0.05)		0.17		NS	NS	NS	2.14		0.51		31.81	0.35	1.08	2.15	
C.V.(%)		3.56		7.62	2.76	4.10	1.62		8.46		7.84	11.22	3.84	1.62	
Expt. Mean		**3.76**		**268**	**3.74**	**25.65**	**105**		**5.00**		**337**	**2.57**	**23.23**	**110**	
Soil type		-							Sandy clay loam						
pH		7.30							6.90						

Table 4.1(b): Contd.

Fertilizer-levels	Varieties	ALMORA Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	KHUDWANI Grain Yield (t/ha)	*Rank*	Panicle /m² (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
Fertilizer levels (kg/ha)															
F1		50:30:20							60:30:15						
F2		100:60:40							120:60:30						
Varieties															
V1		IET 26579							IET 26579						
V2		IET 26594							IET 26594						
V3		IET 25838							IET 25838						
V4		-							Vivekdhan-62						
V5		V L Dhan-65 (N)							V L Dhan-65 (N)						
V6		-							Local check - Shalimar Rice 1						
Available NPK in Soil		311:12.18:234							205:11.5:212						

Table 4.1(b) (Contd…)

Fertilizer-levels	Varieties	MALAN							UPPER SHILLONG				
		Grain Yield (t/ha)	***Rank***	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Test Wt(g)**	**Days for 50% flowering**	**Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)**	**Grain Yield (t/ha)**	***Rank***	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)**
F1 - 50% RFD	V1	4.89	*3*	217	2.59	25.76	88						
	V2	4.52	*6*	248	2.49	26.71	88		0.90	*4*	105	1.79	
	V3	3.59	*11*	243	2.70	27.17	92						
	V4	3.56	*12*	178	2.56	27.15	93						
	V5	4.65	*5*	220	2.81	25.37	94						
	V6	3.60	*10*	214	2.18	26.97	87		2.03	*2*	144	2.17	
F2 - 100% RFD	V1	5.72	*1*	288	2.86	29.51	88	9.76					
	V2	4.87	*4*	272	2.75	26.99	86	4.12	1.60	*3*	136	2.85	8.75
	V3	4.05	*7*	261	2.91	29.71	92	5.41					
	V4	3.88	*9*	185	2.81	27.46	94	3.76					
	V5	4.96	*2*	260	2.88	25.50	94	3.65					
	V6	3.94	*8*	231	2.30	27.65	87	4.00	2.53	*1*	182	3.33	6.25
Interaction													
N at same V		NS		9.11	NS	1.05	NS		NS		NS	NS	
V at same N		NS		9.48	NS	1.58	NS		NS		NS	NS	
Means of N levels:													
F1		4.14	*2*	220	2.56	26.52	85		1.47	*2*	124	1.98	
F2		4.57	*1*	250	2.75	27.80	86	5.12	2.07	*1*	159	3.09	7.50
C.D.(0.05)		0.32		5.80	0.08	NS	NS		0.12		9.38	0.21	
C.V.(%)		5.15		1.72	2.10	4.15	0.92		2.83		2.67	3.26	
Mean of varieties:													
V1		5.31	*1*	253	2.73	27.64	88	9.76					
V2		4.70	*3*	260	2.62	26.85	86	4.12	1.25	*2*	120	2.32	8.75
V3		3.82	*4*	252	2.81	28.44	92	5.41					
V4		3.72	*6*	182	2.69	27.31	94	3.76					
V5		4.81	*2*	240	2.85	25.44	94	3.65					
V6		3.77	*5*	223	2.24	27.31	87	4.00	2.28	*1*	163	2.75	6.25
C.D.(0.05)		0.17		6.44	0.11	0.75	1.34		0.07		9.64	0.24	
C.V.(%)		3.24		2.28	3.48	2.28	1.24		3.65		6.64	9.26	
Expt. Mean		**4.35**		**235**	**2.65**	**27.16**	**90**		**1.77**		**142**	**2.54**	
Soil type		Silty Clay Loam							-				
pH		5.80							-				

Table 4.1(b) (Contd…)

Fertilizer-levels	Varieties	MALAN							UPPER SHILLONG				
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle Weight (g)	Test Wt(g)	Days for 50% flowering	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle Weight (g)	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)
Fertilizer levels (kg/ha)													
F1		45:20:20							30:30:20				
F2		90:40:40							60:60:40				
Varieties													
V1		IET 26579							-				
V2		IET 26594							IET 26594				
V3		IET 25838							-				
V4		Vivekdhan-62							-				
V5		V L Dhan-65 (N)							-				
V6		Local Check(HPR 2143)							Local Check (MEG-1)				
Available NPK in Soil		324:42.5:355							NA:6.72:246				

Table 4.1(b) (Contd…)

Fertilizer-levels	Varieties	WANGBAL					Over All Mean	*Rank*
		Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle Weight (g)	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)		
F1 - 50% RFD	V1	3.75	*4*	295	7.20		4.21	*4*
	V2	5.00	*1*	350	7.10		3.83	*9*
	V3	3.13	*5*	280	7.50		3.96	*7*
	V4						3.99	*6*
	V5	5.00	*1*	260	7.20		3.77	*10*
	V6						3.75	*11*
F2 - 100% RFD	V1	2.29	*7*	280	7.00	-16.20	4.08	*5*
	V2	4.17	*3*	280	7.00	-9.26	4.42	*3*
	V3	2.50	*6*	280	7.20	-6.94	4.54	*2*
	V4						3.92	*8*
	V5	1.88	*8*	285	7.30	-34.72	2.97	*12*
	V6						4.89	*1*
Interaction								
N at same V								
V at same N								
Means of N levels:								
F1		4.22	*1*	296	7.25		3.59	*2*
F2		2.71	*2*	281	7.13	-16.78	3.74	*1*
C.D.(0.05)								
C.V.(%)								
Mean of varieties:								
V1		3.02	*3*	288	7.10	-16.20	4.15	*3*
V2		4.58	*1*	315	7.05	-9.26	4.13	*4*
V3		2.81	*4*	280	7.35	-6.94	4.25	*2*
V4							3.95	*5*
V5		3.44	*2*	273	7.25	-34.72	3.37	*6*
V6							4.32	*1*
C.D.(0.05)								
C.V.(%)								
Expt. Mean		**3.46**		**289**	**7.19**			
Soil type		Silty Clay Loam						
pH		5.60						

Table 4.1(b) (Contd…)

Fertilizer-levels	Varieties	WANGBAL Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle Weight (g)	Nutrient res. (kg grain/kg Nutrient) (Base level 50% RDF)	Over All Mean	*Rank*
Fertilizer levels (kg/ha)								
F1		40:30:20						
F2		80:60:40						
Varieties								
V1		IET 26579						
V2		IET 26594						
V3		IET 25838						
V4		-						
V5		V L Dhan-65 (N)						
V6		-						
Available NPK in Soil		-						

NMT 1(c) Early (Transplanted)

Five AVT-2 entries (IET 26767, IET 26803, IET 26477, IET 24914, and IET 25713) were evaluated for their response to low and optimum level of nutrients on grain yield in comparison to standard varieties i.e. Sahbhagidhan, Vandana, Govind, NDR-97, Varalu, CR Dhan 201 and local checks at thirteen locations **viz. Chiplima, Faizabad (100:60:40), Ghaghraghat (120:60:40), Jagdalpur (80:50:30), Mandya (100:50:50), Nagina (120:60:40), Puducherry (120:40:40), Ranchi (60:30:20) Rewa (100:60:40), Sabour (100:40:20), Vadgaon (100:50:50), Varanasi (120:60:60) and Maruteru (90:60:60)** The experiments were arranged in a split plot design at all the locations**.** The treatments were two levels of fertilizer input (50% and 100% RDF) as main plot and varieties assigned to sub plots. The data received from these locations are summarized and presented in **Table 4.1(c)**.

Different doses of RDF (50% and 100%) exhibited significant differences in grain yield at most of the locations except **Ghagharaghat, Jagdalpur, Mandya, Ranchi and Sabour**. Grain yield increased with increasing level of input from 50% to 100% RFD. Application of 100% NPK recorded significantly higher yield at **Faizabad** (3.98 t/ha), **Chiplima** (3.83 t/h), **Nagina** (4.33 t/ha), **Puducherry** (6.87 t/ha), **Rewa** (5.17 t/ha) and **Maruteru** (5.18 t/ha). Nutrient response (kg grain / kg nutrient) was higher at 100 % RDF at **Chiplima** (5.30), **Mandya** (7.10), **Nagina** (16.52), Ranchi (6.73) **Rewa** (6.93) and **Maruteru** (5.95 t/ha) compared to 50% NPK. Negative nutrient response (kg grain /kg NPK) at 100% NPK was recorded at **Jagdalpur** (-1.83)

Grain yield differences among the tested genotypes were significant at all the locations except **Chiplima** and **Maruteru**. Significant mean maximum yield was recorded by IET 25713 at **Faizabad** (4.69 t/ha), **Jagdalpur** (10.29 t/ha), **Vadgaon** (4.70 t/ha) and **Varanasi**; IET 24914 at **Mandya** (6.96 t/ha), IET 26767 at **Nagina** (3.89 t/ha) and **Puducherry** (7.17 t/ha); IET 26477 at **Sabour** (5.21 t/ha). Mean over the locations, the performance of IET 25713 (5.13 t/ha) followed by IET 26477 (5.05 t/ha) were promising over Sahbhagidhan (4.41 t/ha) and Govind (4.13 t/ha). Interaction effects of nutrient levels x cultivars on grain yield was non-significant at all locations.

In this trial, recommended input of nutrients (100% RDF) was found to be promising with 13.52% higher grain yield and also exhibited higher nutrient efficiency. IET 25713 and IET 26477 recorded higher grain yield of 5.13 and 5.05 t/ha, respectively were the promising entries as compared to standard and local checks.

Table 4.1(C): Summary of data on grain yield and ancillary characters of selected NMT Early (TP) cultures grown under transplanted conditions at low and medium recommended fertilizer doses, kharif 2019.

F-levels	Varieties	CHIPLIMA							FAIZABAD						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.56	10	193	6.20	24.67	99		4.22	6	256	3.29	23.77	85	
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	3.55	11	164	6.87	26.33	93		4.52	3	253	3.56	23.97	84	
	V4	3.19	14	180	6.27	25.33	94		4.15	7	255	3.23	22.60	85	
	V5	3.53	12	176	8.40	23.00	98		4.51	4	255	3.31	23.40	85	
	V6	3.85	4	205	4.77	30.67	99		2.90	16	257	2.90	20.40	81	
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	3.08	16	174	4.47	24.33	87		3.16	14	253	2.82	21.43	79	
	V9	-		-	-	-	-		-		-	-	-	-	
	V10	3.32	13	220	4.10	25.33	86		3.33	12	257	2.65	22.33	83	
	V11	-		-	-	-	-		-		-	-	-	-	
	V12	3.15	15	184	4.63	24.67	85		3.26	13	255	3.62	23.63	81	
F2: Medium input (100% NPK)	V1	3.77	5	231	6.84	22.00	100	2.63	4.45	5	266	3.24	25.67	85	2.30
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	3.89	3	208	7.30	23.67	94	4.25	4.55	2	267	4.13	26.23	87	0.30
	V4	3.74	7	196	7.73	23.33	94	6.88	4.08	8	267	3.65	23.47	86	-0.70
	V5	3.75	6	196	9.33	25.67	101	2.75	4.87	1	264	3.09	24.43	86	3.60
	V6	4.08	1	238	5.39	25.00	100	2.88	3.13	15	263	3.00	22.40	81	2.30
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	3.69	9	249	5.50	24.33	88	7.63	3.43	10	268	3.01	24.57	77	2.70
	V9	-		-	-	-	-		-		-	-	-	-	
	V10	3.97	2	243	5.03	25.67	88	8.13	3.39	11	257	2.78	23.77	83	0.60
	V11	-		-	-	-	-		-		-	-	-	-	
	V12	3.73	8	209	4.40	23.33	86	7.25	3.92	9	266	3.53	25.60	85	6.60
Interaction															
F at same V		NS		NS	NS	1.53	NS		NS		3.12	NS	0.57	NS	
V at same F		NS		NS	NS	1.55	NS		NS		3.29	NS	0.54	NS	
F1		3.40	2	187	5.71	25.54	93		3.76	2	255	3.17	22.69	83	
F2		3.83	1	221	6.44	24.13	94	5.30	3.98	1	265	3.30	24.52	84	2.21
C.D.(0.05)		0.28		16.28	0.06	0.78	0.47		0.19		1.94	NS	0.11	NS	
C.V.(%)		6.33		6.42	0.81	2.53	0.41		3.88		0.60	18.29	0.37	2.94	

Table 4.1(C): Contd.

N-levels	Varieties	CHIPLIMA Grain Yield (t/ha)	Rank	Panicle /m² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	FAIZABAD Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:															
	V1	3.67	3	212	6.52	23.34	100	2.63	4.34	3	261	3.27	24.72	85	2.30
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	3.72	2	186	7.09	25.00	94	4.25	4.54	2	260	3.85	25.10	86	0.30
	V4	3.47	6	188	7.00	24.33	94	6.88	4.12	4	261	3.44	23.04	85	-0.70
	V5	3.64	5	186	8.87	24.34	100	2.75	4.69	1	260	3.20	23.92	86	3.60
	V6	3.97	1	222	5.08	27.84	99	2.88	3.02	8	260	2.95	21.40	81	2.30
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	3.39	8	211	4.99	24.33	88	7.63	3.30	7	261	2.92	23.00	78	2.70
	V9	-		-	-	-	-		-		-	-	-	-	
	V10	3.65	4	232	4.57	25.50	87	8.13	3.36	6	257	2.72	23.05	83	0.60
	V11	-		-	-	-	-		-		-	-	-	-	
	V12	3.44	7	196	4.52	24.00	85	7.25	3.59	5	261	3.58	24.62	83	6.60
C.D.(0.05)		NS		16.73	0.43	1.08	1.05		0.24		2.21	0.34	0.40	1.75	
C.V. (%)		8.87		6.93	6.02	3.68	0.95		5.17		0.72	8.94	1.45	1.77	
Expt. Mean		**3.62**		**204**	**6.08**	**24.83**	**93**		**3.87**		**260**	**3.24**	**23.60**	**83**	
Soil type		Sandy Loam							-						
pH		7.12							7.60						
N - levels (kg/ha)															
F1		40:20:20							50:30:20						
F2		80:40:40							100:60:40						
Recomd N:P:K (kg/ha)		80:40:40							100:60:40						
Varieties															
V1		IET 26767							IET 26767						
V2		-							-						
V3		IET 26477							IET 26477						
V4		IET 24914							IET 24914						
V5		IET 25713							IET 25713						
V6		NC- Sahbhagidhan							NC- Sahbhagidhan						
V7		-							-						
V8		ZC-Govind (NW)							ZC-Govind (NW)						
V9		-							-						
V10		Varalu							Varalu						
V11		-							-						
V12		Khandagiri (Local Check)							Barani Deep (Local check)						
Available N:P:K (kg/ha)		118.75:40.08:116.93							200:24:234						

Table 4.1(C): Contd.

F-levels	Varieties	GHAGHRAGHAT					JAGDALPUR					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	3.47	14	190	3.20		7.26	14	355	3.39	26.93	
	V2	-		-	-		-		-	-	-	
	V3	3.86	5	225	3.50		11.04	2	314	5.35	29.32	
	V4	3.94	3	186	3.47		8.55	7	273	3.89	30.63	
	V5	3.61	11	213	3.38		8.95	5	279	4.67	29.98	
	V6	3.22	15	181	2.57		9.13	4	340	2.61	29.78	
	V7	-		-	-		-		-	-	-	
	V8	2.69	18	147	2.60		7.47	13	250	3.09	27.32	
	V9	-		-	-		-		-	-	-	
	V10	3.11	16	154	3.18		8.43	9	259	3.49	22.90	
	V11	4.03	1	164	2.48		-		-	-	-	
	V12	3.74	7	196	3.42		8.31	10	329	3.70	31.01	
F2: Medium input (100% NPK)	V1	3.64	10	205	3.30	1.55	9.15	3	333	3.06	27.33	23.63
	V2	-		-	-		-		-	-	-	
	V3	3.72	8	227	3.57	-1.27	8.46	8	293	5.85	32.47	-32.25
	V4	4.02	2	205	3.53	0.73	8.66	6	298	4.92	29.24	1.37
	V5	3.67	9	220	3.45	0.55	11.62	1	288	5.00	30.40	33.38
	V6	3.57	12	197	2.71	3.18	7.83	12	330	2.73	29.09	-16.25
	V7	-		-	-		-		-	-	-	
	V8	3.01	17	167	2.92	2.91	7.05	16	312	3.47	29.11	-5.25
	V9	-		-	-		-		-	-	-	
	V10	3.53	13	176	3.34	3.82	7.26	14	301	2.72	22.66	-14.63
	V11	3.84	6	190	2.57	-1.73	-		-	-	-	
	V12	3.92	4	202	3.50	1.64	7.94	11	332	3.22	31.14	-4.63
Interaction												
F at same V		NS		NS	NS		NS		NS	NS	NS	
V at same F		NS		NS	NS		NS		NS	NS	NS	
F1		3.52	2	184	3.09		8.64	1	300	3.77	28.48	
F2		3.66	1	199	3.21	1.26	8.50	2	311	3.87	28.93	-1.83
C.D.(0.05)		NS		NS	NS		NS		NS	NS	NS	
C.V.(%)		6.25		7.54	5.74		8.15		11.68	22.86	4.10	

Table 4.1(C): Contd.

N-levels	Varieties	GHAGHRAGHAT Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	JAGDALPUR Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:												
	V1	3.56	6	198	3.25	1.55	8.21	5	344	3.23	27.13	23.63
	V2	-		-	-		-		-	-	-	
	V3	3.79	4	226	3.54	-1.27	9.75	2	303	5.60	30.90	-32.25
	V4	3.98	1	196	3.50	0.73	8.61	3	286	4.41	29.94	1.37
	V5	3.64	5	216	3.42	0.55	10.29	1	284	4.84	30.19	33.38
	V6	3.40	7	189	2.64	3.18	8.48	4	335	2.67	29.44	-16.25
	V7	-		-	-		-		-	-	-	
	V8	2.85	9	157	2.76	2.91	7.26	8	281	3.28	28.22	-5.25
	V9	-		-	-		-		-	-	-	
	V10	3.32	8	165	3.26	3.82	7.85	7	280	3.11	22.78	-14.63
	V11	3.94	2	177	2.53	-1.73	-		-	-	-	
	V12	3.83	3	199	3.46	1.64	8.13	6	331	3.46	31.08	-4.63
C.D.(0.05)		0.52		22.21	0.16		1.43		NS	0.87	2.09	
C.V. (%)		12.38		9.95	4.40		14.14		17.83	19.34	6.14	
Expt. Mean		**3.59**		**191**	**3.15**		**8.57**		**305**	**3.82**	**28.71**	
Soil type		Sandy Loam					-					
pH		8.06					6.50					
N - levels (kg/ha)												
	F1	60:30:20					40:25:15					
	F2	120:60:40					80:50:30					
Recommd N:P:K (kg/ha)		120:60:40					80:50:30					
Varieties												
	V1	IET 26767					IET 26767					
	V2	-					-					
	V3	IET 26477					IET 26477					
	V4	IET 24914					IET 24914					
	V5	IET 25713					IET 25713					
	V6	NC- Sahbhagidhan					NC- Sahbhagidhan					
	V7	-					-					
	V8	ZC-Govind (NW)					ZC-Govind (NW)					
	V9	-					-					
	V10	Varalu					Varalu					
	V11	CR Dhan 201 (W&S)					-					
	V12	NDR 359 (Local check)					Samleswari (Local Check)					
Available N:P:K (kg/ha)		-					246:15:312					

Table 4.1(C): Contd.

N-levels	Varieties	MANDYA							NAGINA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1	V1	5.51	12	311	3.60	26.31	89		2.83	9	255	3.57	26.67	91	
	V2	-		-	-	-	-		2.51	12	233	3.36	26.30	95	
	V3	6.46	6	310	4.49	28.49	98		2.58	10	233	3.47	26.37	96	
	V4	6.81	4	298	4.59	28.74	98		2.58	10	241	3.18	26.30	98	
	V5	5.70	11	305	3.89	29.21	98		2.22	16	228	3.52	26.27	96	
	V6	5.17	14	323	2.80	28.79	88		2.46	13	226	2.92	26.39	87	
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	4.88	16	317	2.91	29.98	87		2.44	15	206	2.96	26.40	84	
	V9	-		-	-	-	-		-		-	-	-	-	
	V10	5.72	10	325	3.76	21.30	91		2.45	14	212	2.98	27.07	98	
	V11	-		-	-	-	-		-		-	-	-	-	
	V12	5.22	13	314	3.38	16.40	98		-		-	-	-	-	
F2	V1	6.27	7	295	3.88	28.85	90	7.60	4.95	1	323	3.60	26.69	93	19.27
	V2	-		-	-	-	-		4.21	6	291	3.36	26.39	95	15.45
	V3	7.00	2	309	4.61	28.13	97	5.40	4.25	4	302	3.48	26.42	97	15.18
	V4	7.14	1	317	4.65	29.37	98	3.30	4.25	4	292	3.20	26.36	97	15.18
	V5	6.84	3	315	4.07	31.60	98	11.40	4.37	3	290	3.52	26.31	87	19.55
	V6	6.55	5	347	2.88	27.97	88	13.80	4.39	2	285	2.95	26.42	86	17.55
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	4.89	15	335	3.30	28.70	88	0.10	4.09	8	292	2.98	26.41	85	15.00
	V9	-		-	-	-	-		-		-	-	-	-	
	V10	6.26	8	292	3.88	21.60	90	5.40	4.10	7	273	2.98	26.42	98	15.00
	V11	-		-	-	-	-		-		-	-	-	-	
	V12	6.25	9	321	3.39	15.49	98	10.30	-		-	-	-	-	
Interaction															
F at same V		NS		NS	NS	NS	NS		0.23		NS	NS	NS	1.34	
V at same F		NS		NS	NS	NS	NS		0.24		NS	NS	NS	1.31	
F1		5.68	2	313	3.68	26.15	93		2.51	2	229	3.25	26.47	93	
F2		6.40	1	316	3.83	26.46	93	7.16	4.33	1	294	3.26	26.43	92	16.52
C.D.(0.05)		NS		NS	NS	NS	NS		0.14		18.03	0.00	NS	0.47	
C.V.(%)		12.06		3.06	4.17	2.40	0.96		3.39		5.55	0.08	1.15	0.41	

Table 4.1(C): Contd.

N-levels	Varieties	MANDYA							NAGINA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:															
V1		5.89	5	303	3.74	27.58	90	7.60	3.89	1	289	3.59	26.68	92	19.27
V2		-		-	-	-	-		3.36	5	262	3.36	26.35	95	15.45
V3		6.73	2	310	4.55	28.31	98	5.40	3.42	3	268	3.48	26.40	97	15.18
V4		6.98	1	308	4.62	29.06	98	3.30	3.42	3	266	3.19	26.33	98	15.18
V5		6.27	3	310	3.98	30.41	98	11.40	3.30	6	259	3.52	26.29	92	19.55
V6		5.86	6	335	2.84	28.38	88	13.80	3.43	2	256	2.94	26.41	87	17.55
V7		-		-	-	-	-		-		-	-	-	-	
V8		4.89	8	326	3.11	29.34	88	0.10	3.27	8	249	2.97	26.41	85	15.00
V9		-		-	-	-	-		-		-	-	-	-	
V10		5.99	4	309	3.82	21.45	91	5.40	3.28	7	243	2.98	26.75	98	15.00
V11		-		-	-	-	-		-		-	-	-	-	
V12		5.74	7	317	3.39	15.95	98	10.30	-		-	-	-	-	
C.D.(0.05)		0.74		NS	0.45	1.30	0.81		0.16		13.69	0.01	NS	0.95	
C.V. (%)		10.40		9.98	10.14	4.19	0.73		4.06		4.43	0.30	1.08	0.86	
Expt. Mean		**6.04**		**315**	**3.76**	**26.31**	**93**		**3.42**		**261**	**3.25**	**26.45**	**93**	
Soil type		Red Sandy loam							-						
pH		6.99							7.70						
N - levels (kg/ha)															
F1		50:25:25							60:30:20						
F2		100:50:50							120:60:40						
Recomd N:P:K (kg/ha)		100:50:50							120:60:40						
Varieties															
V1		IET 26767							IET 26767						
V2		-							IET 26803						
V3		IET 26477							IET 26477						
V4		IET 24914							IET 24914						
V5		IET 25713							IET 25713						
V6		NC- Sahbhagidhan							NC- Sahbhagidhan						
V7		-							-						
V8		ZC-Govind (NW)							ZC-Govind (NW)						
V9		-							-						
V10		Varalu							Varalu						
V11		-							-						
V12		Gangavathi sona (Local Check)							-						
Available N:P:K (kg/ha)		348:115:287							21:18:209						

Table 4.1(C): Contd.

N-levels	Varieties	PUDUCHERRY						RANCHI					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1	V1	6.94	4	352	4.88	24.7		3.68	9	225	3.10	67	
	V2	-		-	-	-		-		-	-	-	
	V3	6.59	10	325	5.24	25.41		3.35	13	210	3.02	74	
	V4	6.85	7	331	5.71	25.1		4.02	3	240	3.15	75	
	V5	6.90	6	345	5.37	24.21		3.52	11	206	2.97	73	
	V6	6.48	13	290	3.64	24.22		3.91	5	242	3.15	80	
	V7	-		-	-	-		-		-	-	-	
	V8	6.39	14	302	3.05	24.7		3.23	15	192	3.00	70	
	V9	-		-	-	-		-		-	-	-	
	V10	6.25	16	277	3.5	20.73		3.01	16	184	2.76	64	
	V11	-		-	-	-		-		-	-	-	
	V12	6.27	15	289	3.51	17.56		3.32	14	205	2.85	63	
F2	V1	7.40	1	379	5.99	24.76	4.60	4.02	3	246	3.13	70	6.18
	V2	-		-	-	-		-		-	-	-	
	V3	6.91	5	349	6.15	25.69	3.20	3.89	6	235	3.09	78	9.82
	V4	7.00	3	351	6.95	25.42	1.50	4.21	2	254	3.17	79	3.45
	V5	7.18	2	362	5.98	23.94	2.80	3.72	8	225	3.02	76	3.64
	V6	6.54	12	352	4.31	24.81	0.60	4.34	1	261	3.22	84	7.82
	V7	-		-	-	-		-		-	-	-	
	V8	6.69	8	346	3.38	25.18	3.00	3.78	7	228	3.10	74	10.00
	V9	-		-	-	-		-		-	-	-	
	V10	6.57	11	327	4.32	20.47	3.20	3.42	12	211	2.85	69	7.45
	V11	-		-	-	-		-		-	-	-	
	V12	6.65	9	348	4.3	17.8	3.80	3.62	10	220	2.97	67	5.45
Interaction													
F at same V		NS		NS	NS	NS		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS		NS		NS	NS	NS	
F1		6.58	2	314	4.36	23.33		3.51	2	213	3.00	71	
F2		6.87	1	352	5.17	23.51	2.84	3.88	1	235	3.07	75	6.73
C.D.(0.05)		0.13		13.13	0.25	NS		NS		NS	0.03	1.08	
C.V.(%)		1.55		3.18	4.3	0.92		8.51		8.01	0.89	1.19	

Table 4.1(C): Contd.

N-levels	Varieties	PUDUCHERRY Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	RANCHI Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:													
V1		7.17	1	366	5.44	24.73	4.60	3.85	3	236	3.12	68.67	6.18
V2		-		-	-	-		-		-	-	-	
V3		6.75	4	337	5.70	25.55	3.20	3.62	4	223	3.06	76.33	9.82
V4		6.93	3	341	6.33	25.26	1.50	4.12	2	247	3.16	77.00	3.45
V5		7.04	2	353	5.68	24.08	2.80	3.62	4	216	3.00	74.50	3.64
V6		6.51	6	321	3.98	24.52	0.60	4.13	1	252	3.19	82.33	7.82
V7		-		-	-	-		-		-	-	-	
V8		6.54	5	324	3.22	24.94	3.00	3.51	6	210	3.05	72.00	10.00
V9		-		-	-	-		-		-	-	-	
V10		6.41	8	302	3.91	20.60	3.20	3.22	8	198	2.81	66.67	7.45
V11		-		-	-	-		-		-	-	-	
V12		6.46	7	318	3.91	17.68	3.80	3.47	7	213	2.91	65.00	5.45
C.D.(0.05)		0.35		21.79	0.35	0.95		0.43		25.65	0.12	0.77	
C.V. (%)		4.38		5.54	6.25	3.42		9.91		9.68	3.30	0.90	
Expt. Mean		**6.73**		**333**	**4.77**	**23.42**		**3.69**		**224**	**3.03**	**72.81**	
Soil type		Clay loam						Sandy Loam					
pH		5.83						5.90					
N - levels (kg/ha)													
F1		60:20:20						30:15:10					
F2		120:40:40						60:30:20					
Recomnd N:P:K (kg/ha)		120:40:40						60:30:20					
Varieties													
V1		IET 26767						IET 26767					
V2		-						-					
V3		IET 26477						IET 26477					
V4		IET 24914						IET 24914					
V5		IET 25713						IET 25713					
V6		NC- Sahbhagidhan						NC- Sahbhagidhan					
V7		-						-					
V8		ZC-Govind (NW)						ZC-Govind (NW)					
V9		-						-					
V10		Varalu						Varalu					
V11		-						-					
V12		Co 51 (Local Check)						BVD 110 (Local Check)					
Available N:P:K (kg/ha)		123:25:143						212:34:157					

Table 4.1(C): Contd.

N-levels	Varieties	REWA							SABOUR					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1	V1	4.53	19	257	2.40	22.83	73		3.97	8	199	5.71	85	
	V2	4.67	17	256	2.53	21.00	67		-		-	-	-	
	V3	4.70	15	274	2.37	23.23	73		4.88	3	246	9.45	75	
	V4	4.97	13	255	2.50	21.47	80		-		-	-	-	
	V5	4.43	21	266	2.43	24.97	82		-		-	-	-	
	V6	3.97	23	256	2.47	24.87	81		4.15	7	230	5.60	85	
	V7	4.10	22	273	2.43	22.87	72		-		-	-	-	
	V8	5.10	10	268	2.40	23.93	79		3.11	10	222	7.55	89	
	V9	4.77	14	269	2.40	25.10	80		-		-	-	-	
	V10	3.93	24	267	2.33	24.87	81		-		-	-	-	
	V11	4.50	20	270	2.53	23.13	77		-		-	-	-	
	V12	5.27	5	268	2.43	24.97	83		4.72	4	242	7.95	89	
F2	V1	5.17	7	299	2.90	23.37	76	6.40	4.17	6	217	8.68	85	2.50
	V2	5.13	8	297	2.90	21.57	72	4.60	-		-	-	-	
	V3	5.13	8	300	2.97	23.80	78	4.30	5.53	1	259	12.02	76	8.13
	V4	5.47	3	302	3.37	22.03	86	5.00	-		-	-	-	
	V5	5.30	4	306	3.10	25.47	87	8.70	-		-	-	-	
	V6	5.07	11	302	3.30	25.40	87	11.00	4.61	5	244	7.63	85	5.75
	V7	4.70	15	298	3.37	23.47	80	6.00	-		-	-	-	
	V8	5.57	2	298	3.30	24.80	84	4.70	3.41	9	237	9.35	89	3.75
	V9	5.20	6	301	3.17	25.10	88	4.30	-		-	-	-	
	V10	4.57	18	304	2.80	25.50	88	6.40	-		-	-	-	
	V11	5.07	11	303	3.03	23.80	84	5.70	-		-	-	-	
	V12	5.63	1	303	3.33	25.57	91	3.60	5.14	2	257	10.48	89	5.25
Interaction														
F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	
F1		4.58	2	265	2.44	23.60	77		4.17	2	228	7.25	85	
F2		5.17	1	301	3.13	24.16	83	6.93	4.57	1	242	9.63	85	5.08
C.D.(0.05)		0.16		7.35	0.02	0.14	0.67		NS		NS	NS	NS	
C.V.(%)		3.14		2.56	0.73	0.58	0.82		13.05		6.19	23.60	0.37	

Table 4.1(C): Contd.

N-levels	Varieties	REWA							SABOUR					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:														
	V1	4.85	8	278	2.65	23.10	75	6.40	4.07	4	208	7.20	85	2.50
	V2	4.90	6	277	2.72	21.29	70	4.60	-		-	-	-	
	V3	4.92	5	287	2.67	23.52	76	4.30	5.21	1	252	10.74	76	8.13
	V4	5.22	3	279	2.94	21.75	83	5.00	-		-	-	-	
	V5	4.87	7	286	2.77	25.22	84	8.70	-		-	-	-	
	V6	4.52	10	279	2.89	25.14	84	11.00	4.38	3	237	6.62	85	5.75
	V7	4.40	11	286	2.90	23.17	76	6.00	-		-	-	-	
	V8	5.34	2	283	2.85	24.37	81	4.70	3.26	5	230	8.45	89	3.75
	V9	4.99	4	285	2.79	25.10	84	4.30	-		-	-	-	
	V10	4.25	12	285	2.57	25.19	85	6.40	-		-	-	-	
	V11	4.79	9	287	2.78	23.47	80	5.70	-		-	-	-	
	V12	5.45	1	285	2.88	25.27	87	3.60	4.93	2	250	9.22	89	5.25
C.D.(0.05)		0.33		NS	0.20	0.46	2.30		0.78		26.20	1.49	0.68	
C.V. (%)		5.84		2.75	6.20	1.65	2.48		14.64		9.10	14.38	0.66	
Expt. Mean		**4.87**		**283**	**2.78**	**23.88**	**80**		**4.37**		**235**	**8.44**	**85**	
Soil type		Clay							-					
pH		6.20							7.80					
N - levels (kg/ha)														
	F1	50:30:20							50:20:10					
	F2	100:60:40							100:40:20					
Recomnd N:P:K (kg/ha)		100:60:40							100:40:20					
Varieties														
	V1	IET 26767							IET 26767					
	V2	IET 26803							-					
	V3	IET 26477							IET 26477					
	V4	IET 24914							-					
	V5	IET 25713							-					
	V6	NC- Sahbhagidhan							NC- Sahbhagidhan					
	V7	Vandana							-					
	V8	ZC-Govind (NW)							ZC-Govind (NW)					
	V9	Narendra 97 E							-					
	V10	Varalu							-					
	V11	CR Dhan 201 (W&S)							-					
	V12	IR 36 (Local check)							Sabour Harshit (Local check)					
Available N:P:K (kg/ha)		302:20:416							155:27:193					

Table 4.1(C): Contd.

N-levels	Varieties	VADGAON							VARANASI						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1	V1	3.64	12	213	3.28	23.58	83		3.89	5	198	3.57	26.04	94	
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	3.76	11	220	3.38	22.53	81		3.75	6	177	3.28	26.68	92	
	V4	3.81	10	222	3.42	24.03	84		2.80	11	232	1.86	23.58	88	
	V5	3.96	9	237	3.59	22.75	81		3.73	7	204	3.11	27.62	92	
	V6	3.31	16	193	2.98	22.36	79		1.62	15	276	1.70	24.26	88	
	V7	3.45	13	202	3.10	23.32	83		-		-	-	-	-	
	V8	3.38	14	198	3.05	22.88	80		1.53	16	207	2.19	21.10	73	
	V9	-		-	-	-	-		-		-	-	-	-	
	V10	-		-	-	-	-		2.09	12	190	2.62	20.40	84	
	V11	-		-	-	-	-		-		-	-	-	-	
	V12	3.35	15	196	3.01	22.61	81		2.97	9	187	3.07	26.90	92	
F2	V1	4.97	4	313	4.47	24.48	86	13.30	4.33	2	239	3.29	28.30	94	3.67
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	5.03	3	317	4.52	23.92	84	12.70	3.95	4	200	3.62	26.12	92	1.67
	V4	5.09	2	325	4.58	24.25	85	12.80	3.29	8	296	2.27	25.12	87	4.08
	V5	5.43	1	342	4.89	23.69	83	14.70	4.91	1	246	3.66	28.40	91	9.83
	V6	4.59	7	290	4.14	23.26	81	12.80	1.67	13	317	1.79	25.44	88	0.42
	V7	4.73	5	298	4.26	23.58	83	12.80	-		-	-	-	-	
	V8	4.69	6	295	4.22	23.57	83	13.10	1.64	14	274	2.19	24.08	72	0.92
	V9	-		-	-	-	-		-		-	-	-	-	
	V10	-		-	-	-	-		2.83	10	191	2.71	20.80	84	6.17
	V11	-		-	-	-	-		-		-	-	-	-	
	V12	4.59	7	289	4.13	23.55	81	12.40	4.16	3	215	3.25	26.32	92	9.92
Interaction															
F at same V		NS		NS	NS	NS	NS		0.43		14.24	NS	1.11	NS	
V at same F		NS		NS	NS	NS	NS		0.43		13.56	NS	1.38	NS	
F1		3.58	2	210	3.23	23.01	81		2.80	2	209	2.68	24.57	88	
F2		4.89	1	309	4.40	23.79	83	13.08	3.35	1	247	2.85	25.57	88	4.58
C.D.(0.05)		0.29		19.81	0.27	NS	NS		0.22		3.24	0.08	NS	NS	
C.V.(%)		5.49		6.15	5.79	4.69	3.88		5.74		1.15	2.31	3.75	0.44	

Table 4.1(C): Contd.

N-levels / Varieties	VADGAON							VARANASI						
	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:														
V1	4.31	4	263	3.88	24.03	84	13.30	4.11	2	218	3.43	27.17	94	3.67
V2	-		-	-	-	-		-		-	-	-	-	
V3	4.40	3	268	3.95	23.23	82	12.70	3.85	3	188	3.45	26.40	92	1.67
V4	4.45	2	274	4.00	24.14	84	12.80	3.05	5	264	2.07	24.35	88	4.08
V5	4.70	1	290	4.24	23.22	82	14.70	4.32	1	225	3.39	28.01	92	9.83
V6	3.95	8	241	3.56	22.81	80	12.80	1.65	7	296	1.75	24.85	88	0.42
V7	4.09	5	250	3.68	23.45	83	12.80	-		-	-	-	-	
V8	4.04	6	247	3.64	23.23	81	13.10	1.59	8	240	2.19	22.59	73	0.92
V9	-		-	-	-	-		-		-	-	-	-	
V10	-		-	-	-	-		2.46	6	191	2.67	20.60	84	6.17
V11	-		-	-	-	-		-		-	-	-	-	
V12	3.97	7	242	3.57	23.08	81	12.40	3.57	4	201	3.16	26.61	92	9.92
C.D.(0.05)	0.18		10.74	0.16	NS	NS		0.30		10.07	0.23	0.79	0.56	
C.V. (%)	3.52		3.50	3.48	3.37	3.11		8.28		3.74	7.19	2.65	0.54	
Expt. Mean	**4.24**		**259**	**3.81**	**23.40**	**82**		**3.07**		**228**	**2.76**	**25.07**	**88**	
Soil type	-							Sandy loam						
pH	7.60							7.32						
N - levels (kg/ha)														
F1	50:25:25							60:30:30						
F2	100:50:50							120:60:60						
Recomnd N:P:K (kg/ha)	100:50:50							120:60:60						
Varieties														
V1	IET 26767							IET 26767						
V2	-							-						
V3	IET 26477							IET 26477						
V4	IET 24914							IET 24914						
V5	IET 25713							IET 25713						
V6	NC- Sahbhagidhan							NC- Sahbhagidhan						
V7	Vandana							-						
V8	ZC-Govind (NW)							ZC-Govind (NW)						
V9	-							-						
V10	-							Varalu						
V11	-							-						
V12	Phule Radha (Local check)							HUR 1309 (Local Check)						
Available N:P:K (kg/ha)	172:18:234							241:153:190						

Table 4.1(C): Contd.

N-levels	Varieties	MARUTERU Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Over all mean	Rank
F1	V1	4.91	7	342	3.54	20.24	74		4.49	16
	V2	4.73	10	331	3.41	19.42	78		3.97	22
	V3	4.68	11	329	3.37	19.21	81		4.90	8
	V4	4.43	13	314	3.19	18.24	80		4.68	12
	V5	4.86	8	339	3.5	19.34	76		4.66	13
	V6	4.39	14	312	3.16	23.11	79		4.20	20
	V7	-		-	-	-	-		3.78	24
	V8	4.26	15	305	3.07	20.42	76		3.90	23
	V9	-		-	-	-	-		4.77	9
	V10	4.2	16	301	3.02	18.51	76		4.17	21
	V11	-		-	-	-	-		4.27	19
	V12	-		-	-	-	-		4.51	15
F2	V1	5.72	1	384	4.12	20.54	76	7.71	5.23	2
	V2	5.47	2	370	3.94	19.63	80	7.05	4.94	7
	V3	5.39	4	371	3.89	19.42	82	6.76	5.21	3
	V4	5.05	5	350	3.64	18.44	82	5.90	5.17	5
	V5	5.47	2	374	3.94	19.84	76	5.81	5.59	1
	V6	4.95	6	344	3.56	23.24	81	5.33	4.72	10
	V7	-		-	-	-	-		4.72	11
	V8	4.75	9	333	3.42	20.71	78	4.67	4.36	18
	V9	-		-	-	-	-		5.20	4
	V10	4.66	12	327	3.36	18.54	78	4.38	4.60	14
	V11	-		-	-	-	-		4.46	17
	V12	-		-	-	-	-		5.05	6
Interaction										
F at same V		NS		NS	NS	NS	NS			
V at same F		NS		NS	NS	NS	NS			
F1		4.56	2	322	3.28	19.81	78		4.41	2
F2		5.18	1	357	3.73	20.05	79	5.95	4.97	1
C.D.(0.05)		0.27		15.85	0.33	NS	NS			
C.V.(%)		4.55		3.76	7.64	1.61	2.49			

Table 4.1(C): Contd.

N-levels	Varieties	MARUTERU							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
Mean of varieties:										
V1		5.32	1	363	3.83	20.39	75	7.71	4.86	5
V2		5.10	3	351	3.68	19.53	79	7.05	4.45	8
V3		5.04	4	350	3.63	19.32	82	6.76	5.05	2
V4		4.74	5	332	3.42	18.34	81	5.90	4.92	4
V5		5.17	2	357	3.72	19.59	76	5.81	5.13	1
V6		4.67	6	328	3.36	23.18	80	5.33	4.46	7
V7		-		-	-	-	-		4.25	11
V8		4.51	7	319	3.25	20.57	77	4.67	4.13	12
V9		-		-	-	-	-		4.99	3
V10		4.43	8	314	3.19	18.53	77	4.38	4.38	9
V11		-		-	-	-	-		4.36	10
V12		-		-	-	-	-		4.78	6
C.D.(0.05)		NS		21.43	0.28	0.45	1.8			
C.V. (%)		13.31		5.34	6.73	1.91	1.94			
Expt. Mean		**4.87**		**339**	**3.51**	**19.93**	**78**		**4.69**	
Soil type		Delta alluvial								
pH		7.16								
N - levels (kg/ha)										
F1		45:30:30								
F2		90:60:60								
Recommended N:P:K (kg/ha)		90:60:60								
Varieties										
V1		IET 26767								
V2		IET 26803								
V3		IET 26477								
V4		IET 24914								
V5		IET 25713								
V6		NC- Sahbhagidhan								
V7		-								
V8		ZC-Govind (NW)								
V9		-								
V10		Varalu								
V11		-								
V12		-								
Available N:P:K of soil (kg/ha)		151:36:257								

NMT 1(d) IME (Transplanted)

AVT-2 IME cultures (IET 24950, and IET 25745) were evaluated at seventeen locations *viz.,* **Aduthurai (150:60:60), Chinsurah (80:40:40), Chiplima (80:40:40), Dhangain (120:60:40), Faizabad (120:60:40), Gangavathi (150:75:75), Kanpur (120:60:60), Karjat (100:50:50), Kota (120:60:40), Mandya (100:50:50), Nagina (120:60:40), Navsari (100:30:0), Nawagam (100:25:0), Pantnagar (120:60:40), Pattambi (90:45:45), Puducherry (120:40:40) and Varanasi (120:60:40)** in comparison to high yielding standard checks (IR 64, PR 113, Lalat, Karjat 7, MTU 1010, HC-US 312 and local check) under two recommended dose of fertiliser (50 or 100% and 150% RDF). The details and data received from these locations are summarized and presented in **Table 4.1(d)**.

Application of different nutrient levels significantly influenced the grain yield at most of the locations and the maximum increase in grain yield was observed with 150% RDF except at **Chinsurah, Nagina, Navsari, Nawagam, Pantnagar and Varanasi.** Application of 100 or 150% RDF recorded significantly higher grain yields at **Aduthurai** (4.58 t/ha), **Chiplima** (4.60 t/ha), **Dhangain** (4.23 t/ha), **Faizabad** (4.37 t/ha), **Kanpur** (2.83 t/ha), **Kota** (6.41 t/ha), **Mandya** (5.68 t/ha) and **Pattambi** (5.19 t/ha) and **Puducherry** (7.05 t/ha) except at **Karjat**. Nutrient response (kg grain/kg nutrient was found to be higher with the application of 100% RDF at **Aduthurai** (9.60), **Chiplima** (8.05), **Dhangain** (20.33), **Faizabad** (2.34), **Gangavathi** (1.46), **Mandya** (4.90) and **Puducherry** (3.26).

Grain yield differences among the tested varieties were found to be significant at all the locations. Highest grain yield was recorded by IET 24950 at **Aduthurai** (4.65 t/ha), **Dhangain** (4.90 t/ha), **Faizabad** (5.67 t/ha), **Gangavathi** (9.96 t/ha), **Kanpur** (2.99 t/ha), **Kota** (6.99 t/ha), **Nagina** (4.70 t/ha), **Pantnagar** (4.96 t/ha), **Puducherry** (7.34 t/ha) and **Varanasi** (7.11 t/ha). While, IET 25745 at **Chinsurah** (5.90 t/ha), **Chiplima** (4.70 t/ha), **Karjat** (3.88 t/ha), **Mandya** (5.54 t/ha), **Navsari** (4.11 t/ha) and **Nawagam** (6.49 t/ha). Mean over the locations performance, IET 24950 (5.50 t/ha) recorded higher yields. Interaction effects among RDF x varieties was found to be non-significant at all the locations except at **Gangavathi, Karjat, Pattambi** and **Varanasi**.

In this trial, mean over the locations, nutrient management with higher RDF application recorded better yield over 50 or 100% RDF. IET 24950 (5.50 t/ha) and IET 25745 (5.22 t/ha) performed better and recorded higher mean grain yield over the locations as compared to other cultures.

Table 4.1(d): Summary of data on grain yield and ancillary characters of selected AVT -2 IME cultures grown under upland conditions at grade level of recommended fertilizer doses, kharif 2019.

N-levels	Varieties	ADUTHURAI					CHINSURAH					
		Grain Yield (t/ha)	**Rank**	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)**	**Grain Yield (t/ha)**	**Rank**	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Days for 50% Flowering**	**Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)**
F1: Low input (50% NPK)	V1	4.23	*6*	273	3.79		5.60	*3*	275	3.80	89	
	V2	3.80	*8*	281	3.56		5.40	*4*	258	3.72	90	
	V3	3.60	*10*	315	2.67		3.69	*8*	248	3.25	83	
	V4	-		-	-		-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	-		-	-		-		-	-	-	
	V7	3.77	*9*	303	2.62		3.56	*9*	282	3.14	80	
	V8	-		-	-		-		-	-	-	
	V9	3.90	*7*	310	2.65		3.54	*10*	282	2.59	82	
F2: Medium input (100% NPK)	V1	5.07	*1*	285	3.83	11.20	6.10	*2*	313	4.14	91	7.14
	V2	4.53	*2*	291	3.66	9.73	6.39	*1*	303	4.06	91	14.14
	V3	4.37	*5*	322	2.78	10.27	4.65	*5*	282	3.42	83	13.71
	V4	-		-	-		-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	-		-	-		-		-	-	-	
	V7	4.43	*4*	320	2.77	8.80	4.21	*6*	308	3.23	80	9.29
	V8	-		-	-		-		-	-	-	
	V9	4.50	*3*	325	2.73	8.00	3.85	*7*	317	3.34	82	4.43
F3: High input (150% NPK)	V1	-		-	-		-		-	-	-	
	V2	-		-	-		-		-	-	-	
	V3	-		-	-		-		-	-	-	
	V4	-		-	-		-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	-		-	-		-		-	-	-	
	V7	-		-	-		-		-	-	-	
	V8	-		-	-		-		-	-	-	
	V9	-		-	-		-		-	-	-	
Interaction												
N at same V		NS		NS	NS		NS		NS	NS	NS	
V at same N		NS		NS	NS		NS		NS	NS	NS	
Means of F levels:												
F1		3.86	*2*	296	3.06		4.36	*2*	269	3.30	85	
F2		4.58	*1*	309	3.15	9.60	5.04	*1*	304	3.64	85	9.74
F3		-		-	-		-		-	-	-	
C.D.(0.05)		0.05		3.94	0.08		NS		14.45	NS	0.50	
C.V.(%)		0.75		0.83	1.64		14.25		3.21	8.97	0.37	

Table 4.1(d): Contd.

N-levels	Varieties	ADUTHURAI Grain Yield (t/ha)	ADUTHURAI Rank	ADUTHURAI Panicle/m² (No.)	ADUTHURAI Panicle Weight (g)	ADUTHURAI Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	CHINSURAH Grain Yield (t/ha)	CHINSURAH Rank	CHINSURAH Panicle/m² (No.)	CHINSURAH Panicle Weight (g)	CHINSURAH Days for 50% Flowering	CHINSURAH Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:												
	V1	4.65	*1*	279	3.81	11.20	5.85	*2*	294	3.97	90	7.14
	V2	4.17	*3*	286	3.61	9.73	5.90	*1*	281	3.89	91	14.14
	V3	3.99	*5*	319	2.73	10.27	4.17	*3*	265	3.34	83	13.71
	V4	-		-	-		-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	-		-	-		-		-	-	-	
	V7	4.10	*4*	312	2.70	8.80	3.89	*4*	295	3.19	80	9.29
	V8	-		-	-		-		-	-	-	
	V9	4.20	*2*	318	2.69	8.00	3.70	*5*	300	2.97	82	4.43
	C.D.(0.05)	0.16		2.80	0.05		0.37		22.65	0.29	0.59	
	C.V.(%)	3.09		0.76	1.32		6.44		6.46	6.79	0.57	
Expt. Mean		**4.22**		**302**	**3.11**		**4.70**		**287**	**3.47**	**85**	
	Soil type	Clay					Clay loam					
	pH	8.20					7.85					
N - levels (kg/ha)												
	F1	75:60:60					35:17.5:17.5					
	F2	150:60:60					70:35:35					
	F3	-					-					
Recommended N:P:K (kg/ha)		150:60:60					70:35:35					
Varieties												
	V1	IET 24950					IET 24950					
	V2	IET 25745					IET 25745					
	V3	NC- IR 64					NC- IR 64					
	V4	-					-					
	V5	-					-					
	V6	-					-					
	V7	MTU 1010 (C & S)					MTU 1010 (C & S)					
	V8	-					-					
	V9	ADT 53 (Local check)					Ajit (Local check)					
Available N:P:K (kg/ha)		268:24:322					530:119:364					

Table 4.1(d): Contd.

N-levels	Varieties	CHIPLIMA Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	DHANGAIN Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.14	*7*	196	7.14	23.67	102		4.07	*5*	297	5.07	90	
	V2	4.38	*4*	209	6.73	24.67	102		3.87	*6*	287	4.48	89	
	V3	3.78	*9*	230	3.90	23.67	101		2.43	*14*	260	2.43	83	
	V4	-		-	-	-	-		-		-	-	-	
	V5	3.69	*10*	227	3.87	23.67	95		2.63	*12*	275	2.88	100	
	V6	-		-	-	-	-		-		-	-	-	
	V7	-		-	-	-	-		2.70	*11*	275	3.16	81	
	V8	-		-	-	-	-		2.83	*10*	282	3.63	92	
	V9	3.79	*8*	210	4.45	30.33	97		2.53	*13*	268	2.83	94	
F2: Medium input (100% NPK)	V1	5.01	*2*	216	7.67	25.00	102	10.88	5.73	*1*	310	5.10	90	27.67
	V2	5.02	*1*	198	7.83	28.67	102	8.00	5.57	*2*	306	4.98	89	28.33
	V3	4.41	*3*	246	4.40	31.00	101	7.88	3.17	*9*	267	2.88	83	12.33
	V4	-		-	-	-	-		-		-	-	-	
	V5	4.25	*6*	264	4.87	24.67	95	7.00	3.37	*7*	280	3.43	100	12.33
	V6	-		-	-	-	-		-		-	-	-	
	V7	-		-	-	-	-		4.23	*4*	284	3.47	81	25.50
	V8	-		-	-	-	-		4.30	*3*	289	3.70	92	24.50
	V9	4.31	*5*	238	4.76	24.67	96	6.50	3.23	*8*	278	3.29	94	11.67
F3: High input (150% NPK)	V1	-		-	-	-	-		-		-	-	-	
	V2	-		-	-	-	-		-		-	-	-	
	V3	-		-	-	-	-		-		-	-	-	
	V4	-		-	-	-	-		-		-	-	-	
	V5	-		-	-	-	-		-		-	-	-	
	V6	-		-	-	-	-		-		-	-	-	
	V7	-		-	-	-	-		-		-	-	-	
	V8	-		-	-	-	-		-		-	-	-	
	V9	-		-	-	-	-		-		-	-	-	
Interaction														
N at same V		NS		NS	NS	1.60	NS		NS		NS	NS	NS	
V at same N		NS		NS	NS	1.63	NS		NS		NS	NS	NS	
Means of F levels:														
F1		3.96	*2*	214	5.22	25.20	99		3.01	*2*	278	3.50	90	
F2		4.60	*1*	232	5.91	26.80	99	8.05	4.23	*1*	288	3.84	90	20.33
F3		-		-	-	-	-		-		-	-	-	
C.D.(0.05)		0.43		15.17	0.67	0.99	NS		0.48		NS	NS	NS	
C.V.(%)		6.35		4.32	7.62	2.43	0.37		9.92		4.72	38.96	0.30	

Table 4.1(d): Contd.

N-levels	Varieties	CHIPLIMA							DHANGAIN					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:														
V1		4.58	*2*	206	7.41	24.34	102	10.88	4.90	*1*	304	5.09	90	27.67
V2		4.70	*1*	203	7.28	26.67	102	8.00	4.72	2	296	4.73	89	28.33
V3		4.10	*3*	238	4.15	27.34	101	7.88	2.80	*7*	263	2.66	83	12.33
V4		-		-	-	-	-		-		-	-	-	
V5		3.97	*5*	246	4.37	24.17	95	7.00	3.00	*5*	278	3.16	100	12.33
V6		-		-	-	-	-		-		-	-	-	
V7		-		-	-	-	-		3.47	*4*	280	3.32	81	25.50
V8		-		-	-	-	-		3.57	*3*	285	3.67	92	24.50
V9		4.05	*4*	224	4.61	27.50	97	6.50	2.88	*6*	273	3.06	94	11.67
C.D.(0.05)		0.37		28.30	0.52	1.13	0.56		0.42		14.52	0.80	0.71	
C.V.(%)		7.12		10.36	7.64	3.56	0.46		9.79		4.31	18.29	0.67	
Expt. Mean		**4.28**		**223**	**5.56**	**26.00**	**99**		**3.62**		**283**	**3.67**	**90**	
Soil type		Sandy loam							Loamy					
pH		7.12							6.80					
N - levels (kg/ha)														
F1		40:20:20							60:60:40					
F2		80:40:40							120:60:40					
F3		-							-					
Recomnd N:P:K (kg/ha)		80:40:40							120:60:40					
Varieties														
V1		IET 24950							IET 24950					
V2		IET 25745							IET 25745					
V3		NC- IR 64							NC- IR 64					
V4		-							-					
V5		Lalat (E & NE)							Lalat (E & NE)					
V6		-							-					
V7		-							MTU 1010 (C & S)					
V8		-							HC- US 312					
V9		Mandakini (Local check)							R.Bhagwati (Local check)					
Available N:P:K (kg/ha)		119:40:117							154:14:183					

Table 4.1(d): Contd.

N-levels	Varieties	FAIZABAD							GANGAVATHI						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Ran k	Panicle/m² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	5.40	*3*	256	3.23	25.4	96		9.54	*4*	308	3.86	26.4	96	
	V2	5.24	*4*	255	4.02	25.7	98		8.00	*14*	349	2.59	23.3	91	
	V3	3.13	*15*	255	3.25	23.0	98		8.17	*13*	348	3.30	24.1	95	
	V4	3.49	*12*	257	3.35	23.2	97		9.29	*5*	377	3.28	24.9	103	
	V5	3.63	*10*	256	3.01	23.2	97		8.78	*9*	385	2.22	24.7	92	
	V6	3.00	*16*	257	2.24	21.3	90		8.27	*10*	462	1.83	25.7	92	
	V7	4.05	*8*	258	2.23	23.6	87		9.69	*3*	345	2.79	27.0	89	
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	4.74	*7*	256	3.16	24.6	96		7.90	*15*	372	2.32	21.5	103	
F2: Medium input (100% NPK)	V1	5.93	*1*	257	3.67	26.3	98	4.42	10.37	*1*	308	3.76	26.8	95	5.53
	V2	5.50	*2*	256	3.30	26.5	98	2.17	8.89	*7*	360	2.28	25.8	89	5.93
	V3	3.16	*14*	255	3.24	24.6	97	0.25	8.85	*8*	392	3.13	22.5	96	4.53
	V4	3.62	*11*	257	3.44	24.6	96	1.08	8.20	*12*	360	2.82	28.2	103	-7.27
	V5	3.71	*9*	258	2.97	24.6	98	0.67	8.21	*11*	420	2.16	20.8	92	-3.80
	V6	3.20	*13*	259	2.69	22.5	93	1.67	7.83	*16*	432	1.92	24.5	92	-2.93
	V7	4.77	*6*	259	3.14	23.9	89	6.00	10.11	*2*	373	2.26	25.4	90	2.80
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	5.04	*5*	260	3.25	24.8	96	2.50	8.93	*6*	392	2.68	21.8	101	6.87
F3: High input (150% NPK)	V1	-		-	-	-	-		-		-	-	-	-	
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	-		-	-	-	-		-		-	-	-	-	
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		-		-	-	-	-	
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	-		-	-	-	-		-		-	-	-	-	
Interaction															
N at same V		0.22		NS	NS	0.34	NS		0.87		NS	NS	1.4	NS	
V at same N		0.22		NS	NS	0.38	NS		1.02		NS	NS	1.7	NS	
Means of F levels:															
F1		4.09	*2*	256	3.06	23.8	95		8.71	*2*	368	2.77	24.7	95	
F2		4.37	*1*	257	3.21	24.7	96	2.34	8.92	*1*	379	2.63	24.5	95	1.46
F3		-		-	-	-	-		-		-	-	-	-	
C.D.(0.05)		0.07		NS	NS	0.26	NS		NS		NS	0.13	NS	NS	
C.V.(%)		1.41		0.65	23.48	0.87	1.44		7.30		7.60	3.89	4.10	1.06	

Table 4.1(d): Contd.

N-levels	Varieties	FAIZABAD							GANGAVATHI						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:															
V1		5.67	*1*	256	3.45	25.9	97	4.42	9.96	*1*	308	3.81	26.6	96	5.53
V2		5.37	*2*	256	3.66	26.1	98	2.17	8.45	*6*	354	2.44	24.6	90	5.93
V3		3.15	*7*	255	3.25	23.8	98	0.25	8.51	*4*	370	3.22	23.3	95	4.53
V4		3.56	*6*	257	3.40	23.9	97	1.08	8.75	*3*	368	3.05	26.5	103	-7.27
V5		3.67	*5*	257	2.99	23.9	98	0.67	8.50	*5*	402	2.19	22.8	92	-3.80
V6		3.10	*8*	258	2.47	21.9	91	1.67	8.05	*8*	447	1.88	25.1	92	-2.93
V7		4.41	*4*	258	2.69	23.8	88	6.00	9.90	*2*	359	2.53	26.2	89	2.80
V8		-		-	-	-	-		-		-	-	-	-	
V9		4.89	*3*	258	3.21	24.7	96	2.50	8.42	*7*	382	2.50	21.6	102	6.87
C.D.(0.05)		0.16		NS	0.64	0.24	1.69		0.61		35.30	0.26	1.01	2.59	
C.V.(%)		3.16		1.07	17.15	0.84	1.50		5.89		7.99	8.24	3.48	2.31	
Expt. Mean		**4.23**		**257**	**3.14**	**24.2**	**95**		**8.81**		**374**	**2.70**	**24.6**	**95**	
Soil type		Sandy loam							Black clay						
pH		7.60							-						
N - levels (kg/ha)															
F1		60:30:30							75:37.5:37.5						
F2		120:60:60							150:75:75						
F3		-							-						
Recomnd N:P:K (kg/ha)		120:60:60							150:75:75						
Varieties															
V1		IET 24950							IET 24950						
V2		IET 25745							IET 25745						
V3		NC- IR 64							NC- IR 64						
V4		ZC- PR 113 (N)							ZC- PR 113 (N)						
V5		Lalat (E & NE)							Lalat (E & NE)						
V6		Karjat 7 (W)							Karjat 7 (W)						
V7		MTU 1010 (C & S)							MTU 1010 (C & S)						
V8		-							-						
V9		NDR 2065 (Local check)							GNV-10-89 (Local check)						
Available N:P:K (kg/ha)		200:24:234							-						

Table 4.1(d): Contd.

N-levels	Varieties	KANPUR							KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	-		-	-	-	-		3.96	*2*	148	2.67	26.30	93	
	V2	-		-	-	-	-		4.81	*1*	131	3.67	29.37	97	
	V3	-		-	-	-	-		3.58	*3*	139	2.57	27.17	86	
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		3.12	*5*	164	1.90	24.97	84	
	V7	-		-	-	-	-		3.18	*4*	133	2.39	28.60	84	
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	-		-	-	-	-		-		-	-	-	-	
F2: Medium input (100% NPK)	V1	2.75	*5*	320	2.65	23.84	81		2.64	*9*	157	2.78	26.43	95	-13.20
	V2	2.07	*7*	279	2.61	20.84	81		2.95	*6*	143	3.78	29.50	98	-18.60
	V3	2.59	*6*	373	2.01	15.28	77		2.75	*8*	155	2.56	27.47	87	-8.30
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		2.58	*10*	172	2.08	25.81	85	-5.40
	V7	1.88	*8*	281	1.79	22.60	77		2.93	*7*	143	2.57	29.27	86	-2.50
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	0.93	*10*	225	1.18	15.38	74		-		-	-	-	-	
F3: High input (150% NPK)	V1	3.22	*1*	330	3.39	24.09	82	3.92	-		-	-	-	-	
	V2	3.12	*3*	311	3.32	21.35	81	8.75	-		-	-	-	-	
	V3	3.13	*2*	297	2.29	16.62	71	4.50	-		-	-	-	-	
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		-		-	-	-	-	
	V7	2.88	*4*	226	2.15	24.00	74	8.33	-		-	-	-	-	
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	1.79	*9*	240	1.39	16.11	71	7.17	-		-	-	-	-	
Interaction															
N at same V		NS		5.50	0.04	0.28	NS		0.13		2.13	NS	NS	NS	
V at same N		NS		6.82	0.05	0.33	NS		0.13		2.06	NS	NS	NS	
Means of F levels:															
F1		-		-	-	-	-		3.73	*1*	143	2.64	27.28	89	
F2		2.04	*2*	296	2.05	19.59	78		2.77	*2*	154	2.75	27.70	90	-9.60
F3		2.83	*1*	281	2.51	20.43	76	6.53	-		-	-	-	-	
C.D.(0.05)		0.56		6.02	0.03	0.27	1.72		0.07		0.99	NS	0.20	0.29	
C.V.(%)		14.67		1.33	0.77	0.85	1.43		1.36		0.43	3.93	0.47	0.20	

Table 4.1(d): Contd.

N-levels	Varieties	KANPUR							KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:															
V1		2.99	*1*	325	3.02	23.97	82	3.92	3.30	*2*	153	2.73	26.37	94	-13.20
V2		2.60	*3*	295	2.97	21.10	81	8.75	3.88	*1*	137	3.73	29.44	97	-18.60
V3		2.86	*2*	335	2.15	15.95	74	4.50	3.17	*3*	147	2.57	27.32	87	-8.30
V4		-		-	-	-	-		-		-	-	-	-	
V5		-		-	-	-	-		-		-	-	-	-	
V6		-		-	-	-	-		2.85	*5*	168	1.99	25.39	85	-5.40
V7		2.38	*4*	254	1.97	23.30	75	8.33	3.06	*4*	138	2.48	28.94	85	-2.50
V8		-		-	-	-	-		-		-	-	-	-	
V9		1.36	*5*	233	1.29	15.75	72	7.17	-		-	-	-	-	
C.D.(0.05)		0.19		3.89	0.03	0.20	2.08		0.09		1.51	0.09	0.28	0.64	
C.V.(%)		6.30		1.10	1.13	0.81	2.22		2.36		0.83	2.87	0.84	0.59	
Expt. Mean		**2.44**		**288**	**2.28**	**20.01**	**77**		**3.25**		**149**	**2.70**	**27.49**	**90**	
Soil type		Sandy clay loam							-						
pH		7.89							-						
N - levels (kg/ha)															
F1		-							50:25:25						
F2		120:60:60							100:50:50						
F3		180:90:90							-						
Recomnd N:P:K (kg/ha)		120:60:60							100:50:50						
Varieties															
V1		IET 24950							IET 24950						
V2		IET 25745							IET 25745						
V3		NC- IR 64							NC- IR 64						
V4		-							ZC- PR 113 (N)						
V5		-							Lalat (E & NE)						
V6		-							Karjat 7 (W)						
V7		MTU 1010 (C & S)							MTU 1010 (C & S)						
V8		-							-						
V9		Ramraj (Local check)							GNV-10-89 (Local check)						
Available N:P:K (kg/ha)		238:18:172							-						

Table 4.1(d): Contd.

N-levels	Varieties	KOTA Grain Yield (t/ha)	KOTA Rank	KOTA Panicle/m^2 (No.)	KOTA Panicle Weight (g)	KOTA Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	MANDYA Grain Yield (t/ha)	MANDYA Rank	MANDYA Panicle/m^2 (No.)	MANDYA Panicle Weight (g)	MANDYA Test wt(g)	MANDYA Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	6.45	*4*	291	4.76		5.69	*4*	270	5.02	25.12	
	V2	4.72	*12*	226	3.18		6.47	*2*	279	4.73	29.45	
	V3	5.60	*8*	263	3.52		4.52	*9*	270	4.19	23.16	
	V4	6.05	*6*	276	3.90		-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	5.30	*10*	248	3.41		-		-	-	-	
	V7	-		-	-		4.88	*7*	288	3.37	24.22	
	V8	-		-	-		-		-	-	-	
	V9	5.06	*11*	242	3.33		4.40	*10*	264	4.36	22.70	
F2: Medium input (100% NPK)	V1	7.53	*1*	319	5.58	9.82	6.12	*3*	311	5.17	25.10	4.30
	V2	5.51	*9*	243	3.45	7.18	6.61	*1*	292	5.00	30.30	1.40
	V3	6.49	*3*	288	3.81	8.09	5.21	*6*	332	4.21	24.17	6.90
	V4	6.86	*2*	300	4.24	7.36	-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	6.17	*5*	265	3.72	7.91	-		-	-	-	
	V7	-		-	-		5.64	*5*	295	3.45	24.88	7.60
	V8	-		-	-		-		-	-	-	
	V9	5.92	*7*	260	3.56	7.82	4.83	*8*	276	4.37	23.73	4.30
F3: High input (150% NPK)	V1	-		-	-		-		-	-	-	
	V2	-		-	-		-		-	-	-	
	V3	-		-	-		-		-	-	-	
	V4	-		-	-		-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	-		-	-		-		-	-	-	
	V7	-		-	-		-		-	-	-	
	V8	-		-	-		-		-	-	-	
	V9	-		-	-		-		-	-	-	
Interaction												
N at same V		NS		NS	NS		NS		NS	NS	NS	
V at same N		NS		NS	NS		NS		NS	NS	NS	
Means of F levels:												
F1		5.53	*2*	258	3.68		5.19	*2*	274	4.33	24.93	
F2		6.41	*1*	279	4.06	8.03	5.68	*1*	301	4.44	25.64	4.90
F3		-		-	-		-		-	-	-	
C.D.(0.05)		0.34		17.60	0.31		0.18		NS	NS	NS	
C.V.(%)		3.98		4.57	5.57		2.08		15.96	2.94	5.57	

Table 4.1(d): Contd.

N-levels	Varieties	KOTA					MANDYA					
		Grain Yield (t/ha)	**Rank**	**Panicle/m² (No.)**	**Panicle Weight (g)**	**Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)**	**Grain Yield (t/ha)**	**Rank**	**Panicle/m² (No.)**	**Panicle Weight (g)**	**Test wt(g)**	**Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)**
Mean of varieties:												
	V1	6.99	*1*	305	5.17	9.82	5.91	*2*	290	5.10	25.11	4.30
	V2	5.12	*6*	235	3.32	7.18	6.54	*1*	285	4.87	29.88	1.40
	V3	6.05	*3*	276	3.67	8.09	4.87	*4*	301	4.20	23.67	6.90
	V4	6.46	*2*	288	4.07	7.36	-		-	-	-	
	V5	-		-	-		-		-	-	-	
	V6	5.74	*4*	257	3.57	7.91	-		-	-	-	
	V7	-		-	-		5.26	*3*	292	3.41	24.55	7.60
	V8	-		-	-		-		-	-	-	
	V9	5.49	*5*	251	3.45	7.82	4.62	*5*	270	4.37	23.22	4.30
C.D.(0.05)		0.42		15.32	0.37		0.54		NS	0.29	2.09	
C.V.(%)		5.85		4.74	7.87		8.19		9.37	5.40	6.76	
Expt. Mean		**5.97**		**268**	**3.87**		**5.44**		**288**	**4.39**	**25.28**	
Soil type		Clay loam					Sandy loam					
pH		7.80					6.89					
N - levels (kg/ha)												
F1		60:30:20					50:25:25					
F2		120:60:40					100:50:50					
F3		-					-					
Recommended N:P:K (kg/ha)		120:60:40					100:50:50					
Varieties												
	V1	IET 24950					IET 24950					
	V2	IET 25745					IET 25745					
	V3	NC- IR 64					NC- IR 64					
	V4	ZC- PR 113 (N)					-					
	V5	-					-					
	V6	Karjat 7 (W)					-					
	V7	-					MTU 1010 (C & S)					
	V8	-					-					
	V9	Ratna (Local check)					KMP-175 (Local check)					
Available N:P:K (kg/ha)		318:60:523					352:103:265					

Table 4.1(d): Contd.

N-levels	Varieties	NAGINA							NAVSARI						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.65	*2*	323	3.44	26.43	98		3.34	*7*	270	4.32	24.93	99	
	V2	4.61	*4*	316	3.38	26.41	85		4.13	*1*	256	4.71	27.34	100	
	V3	4.29	*7*	302	3.46	26.42	104		2.58	*16*	269	3.06	23.64	91	
	V4	-		-	-	-	-		2.64	*15*	253	3.50	28.82	101	
	V5	-		-	-	-	-		3.11	*11*	281	2.79	28.38	98	
	V6	-		-	-	-	-		2.24	*18*	301	3.19	22.71	90	
	V7	4.20	*8*	292	3.39	26.41	105		3.30	*9*	272	3.64	25.35	94	
	V8	-		-	-	-	-		2.89	*12*	259	4.85	21.74	98	
	V9	-		-	-	-	-		3.46	*5*	265	4.36	31.97	91	
F2: Medium input (100% NPK)	V1	4.75	*1*	345	3.47	26.48	99	0.91	3.48	*4*	285	4.80	24.13	100	2.15
	V2	4.65	*2*	328	3.40	26.41	87	0.36	4.08	*2*	265	4.36	28.17	101	-0.77
	V3	4.37	*5*	314	3.49	26.43	106	0.73	2.66	*14*	249	3.10	22.27	92	1.23
	V4	-		-	-	-	-		2.76	*13*	257	3.36	28.07	102	1.85
	V5	-		-	-	-	-		3.31	*8*	249	2.80	28.02	99	3.08
	V6	-		-	-	-	-		2.47	*17*	309	2.70	22.92	90	3.54
	V7	4.36	*6*	311	3.48	26.43	108	1.45	3.46	*5*	264	4.09	25.58	95	2.46
	V8	-		-	-	-	-		3.17	*10*	253	4.24	22.31	99	4.31
	V9	-		-	-	-	-		3.68	*3*	255	4.49	31.19	92	3.38
F3: High input (150% NPK)	V1	-		-	-	-	-		-		-	-	-	-	
	V2	-		-	-	-	-		-		-	-	-	-	
	V3	-		-	-	-	-		-		-	-	-	-	
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		-		-	-	-	-	
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	-		-	-	-	-		-		-	-	-	-	
Interaction															
N at same V		NS		NS	0.02	NS	NS		NS		NS	NS	NS	NS	
V at same N		NS		NS	0.02	NS	NS		NS		NS	NS	NS	NS	
Means of F levels:															
F1		4.44	*2*	308	3.42	26.42	98		3.08	*2*	269	3.82	26.10	96	
F2		4.53	*1*	324	3.46	26.44	100	0.86	3.23	*1*	265	3.77	25.85	97	2.36
F3		-		-	-	-	-		-		-	-	-	-	
C.D.(0.05)		NS		12.93	0.01	0.02	NS		NS		NS	NS	NS	NS	
C.V.(%)		1.39		2.33	0.16	0.04	0.83		8.59		7.41	7.54	6.34	1.07	

Table 4.1(d): Contd.

N-levels	Varieties	NAGINA Grain Yield (t/ha)	NAGINA Rank	NAGINA Panicle/m^2 (No.)	NAGINA Panicle Weight (g)	NAGINA Test wt(g)	NAGINA Days for 50% Flowering	NAGINA Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	NAVSARI Grain Yield (t/ha)	NAVSARI Rank	NAVSARI Panicle/m^2 (No.)	NAVSARI Panicle Weight (g)	NAVSARI Test wt(g)	NAVSARI Days for 50% Flowering	NAVSARI Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:															
V1		4.70	*1*	334	3.46	26.46	99	0.91	3.41	*3*	278	4.56	24.53	100	2.15
V2		4.63	*2*	322	3.39	26.41	86	0.36	4.11	*1*	260	4.54	27.76	101	-0.77
V3		4.33	*3*	308	3.48	26.43	105	0.73	2.62	*8*	259	3.08	22.96	92	1.23
V4		-		-	-	-	-		2.70	*7*	255	3.43	28.45	102	1.85
V5		-		-	-	-	-		3.21	*5*	265	2.80	28.20	99	3.08
V6		-		-	-	-	-		2.36	*9*	305	2.95	22.82	90	3.54
V7		4.28	*4*	302	3.44	26.42	107	1.45	3.38	*4*	268	3.87	25.47	95	2.46
V8		-		-	-	-	-		3.03	*6*	256	4.55	22.03	99	4.31
V9		-		-	-	-	-		3.57	*2*	260	4.43	31.58	92	3.38
C.D.(0.05)		0.13		10.43	0.01	0.02	0.81		0.41		12.99	0.34	2.06	1.46	
C.V.(%)		2.23		2.62	0.30	0.07	0.65		11.15		4.16	7.76	6.81	1.29	
Expt. Mean		**4.49**		**316**	**3.44**	**26.43**	**99**		**3.15**		**267**	**3.80**	**25.97**	**96**	
Soil type		-							Clay						
pH		7.70							7.88						
N - levels (kg/ha)															
F1		60:30:20							50:15:0						
F2		120:60:40							100:30:0						
F3		-							-						
Recommended N:P:K (kg/ha)		120:60:40							100:30:0						
Varieties															
V1		IET 24950							IET 24950						
V2		IET 25745							IET 25745						
V3		NC- IR 64							NC- IR 64						
V4		-							ZC- PR 113 (N)						
V5		-							Lalat (E & NE)						
V6		-							Karjat 7 (W)						
V7		MTU 1010 (C & S)							MTU 1010 (C & S)						
V8		-							HC- US 312						
V9		-							GNR-3 (Local check)						
Available N:P:K (kg/ha)		21:18:209							154:149:331						

Table 4.1(d): Contd.

N-levels	Varieties	NAWAGAM							PANTNAGAR						
		Grain Yield (t/ha)	Rank	Panicle/ m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/ m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	5.78	*6*	205	4.78	21.53	103		-		-	-	-	-	
	V2	6.20	*2*	241	5.88	24.13	105		-		-	-	-	-	
	V3	5.17	*7*	193	3.20	28.20	102		-		-	-	-	-	
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		-		-	-	-	-	
	V7	4.20	*10*	219	3.16	21.87	100		-		-	-	-	-	
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	4.42	*9*	179	4.76	15.13	109		-		-	-	-	-	
F2: Medium input (100% NPK)	V1	6.11	*3*	232	4.49	21.87	107	5.28	4.72	*3*	256	2.05	25.02	85	
	V2	6.78	*1*	272	5.45	22.67	108	9.28	4.53	*5*	250	2.01	21.76	81	
	V3	5.04	*8*	265	3.53	23.80	105	-2.08	3.73	*10*	238	1.76	24.54	75	
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		-		-	-	-	-	
	V7	5.82	*5*	275	3.17	22.40	100	25.92	4.06	*9*	258	1.76	22.70	75	
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	5.85	*4*	230	5.34	16.00	108	22.88	4.49	*7*	250	1.59	26.02	75	
F3: High input (150% NPK)	V1	-		-	-	-	-		5.19	*1*	274	2.43	25.59	76	4.27
	V2	-		-	-	-	-		5.01	*2*	270	2.30	22.17	89	4.36
	V3	-		-	-	-	-		4.60	*4*	231	2.48	24.93	79	7.91
	V4	-		-	-	-	-		-		-	-	-	-	
	V5	-		-	-	-	-		-		-	-	-	-	
	V6	-		-	-	-	-		-		-	-	-	-	
	V7	-		-	-	-	-		4.43	*8*	271	1.85	23.07	75	3.36
	V8	-		-	-	-	-		-		-	-	-	-	
	V9	-		-	-	-	-		4.52	*6*	246	2.02	26.51	80	0.27
Interaction															
N at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	4.29	
V at same N		NS		NS	NS	NS	NS		NS		NS	NS	NS	5.20	
Means of F levels:															
F1		5.15	*2*	207	4.36	22.17	104								
F2		5.92	*1*	255	4.40	21.35	106	12.26	4.31	*2*	250	1.83	24.01	78	
F3		-		-	-	-	-		4.75	*1*	258	2.22	24.45	80	4.04
									-		-	-	-	-	
C.D.(0.05)		NS		NS	NS	NS	0.50		NS		NS	0.05	NS	NS	
C.V.(%)		8.82		14.01	17.19	16.81	0.30		8.03		4.17	1.63	1.60	3.60	

Table 4.1(d): Contd.

N-levels	Varieties	NAWAGAM							PANTNAGAR						
		Grain Yield (t/ha)	**Rank**	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Test wt(g)**	**Days for 50% Flowering**	**Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)**	**Grain Yield (t/ha)**	**Rank**	**Panicle/m^2 (No.)**	**Panicle Weight (g)**	**Test wt(g)**	**Days for 50% Flowering**	**Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)**
Mean of varieties:															
V1		5.95	*2*	218	4.64	21.70	105	5.28	4.96	*1*	265	2.24	25.31	81	4.27
V2		6.49	*1*	256	5.67	23.40	107	9.28	4.77	*2*	260	2.16	21.97	85	4.36
V3		5.11	*4*	229	3.37	26.00	104	-2.08	4.17	*5*	235	2.12	24.74	77	7.91
V4		-		-	-	-	-		-		-	-	-	-	
V5		-		-	-	-	-		-		-	-	-	-	
V6		-		-	-	-	-		-		-	-	-	-	
V7		5.01	*5*	247	3.17	22.14	100	25.92	4.25	*4*	264	1.81	22.89	75	3.36
V8		-		-	-	-	-		-		-	-	-	-	
V9		5.14	*3*	205	5.05	15.57	109	22.88	4.51	*3*	248	1.81	26.27	78	0.27
C.D.(0.05)		0.57		34.35	0.64	3.01	1.67		0.24		NS	0.22	1.07	3.03	
C.V.(%)		8.39		12.15	11.87	11.29	1.30		4.25		7.28	8.83	3.62	3.14	
Expt. Mean		**5.54**		**231**	**4.38**	**21.76**	**105**		**4.53**		**254**	**2.03**	**24.23**	**79**	
Soil type		Clay loam							Silt loam						
pH		7.63							7.60						
N - levels (kg/ha)															
F1		50:12.5							-						
F2		100:25:0							120:60:40						
F3		-							180:90:60						
Recomnd N:P:K (kg/ha)		100:25:0							120:60:60						
Varieties															
V1		IET 24950							IET 24950						
V2		IET 25745							IET 25745						
V3		NC- IR 64							NC- IR 64						
V4		-							-						
V5		-							-						
V6		-							-						
V7		MTU 1010 (C & S)							MTU 1010 (C & S)						
V8		-							-						
V9		GAR-13 (Local check)							Pant Dhan 12 (Local check)						
Available N:P:K (kg/ha)		-							230:22:215						

Table 4.1(d): Contd.

N-levels	Varieties	PATTAMBI						PUDUCHERRY				
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle Weight (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
F1: Low input (50% NPK)	V1	4.87	*8*	105	4.48	87		7.27	*2*	4.52	22.98	
	V2	2.55	*12*	82	3.37	101		7.01	*4*	4.12	23.10	
	V3	4.69	*9*	170	5.00	87		6.48	*9*	3.57	22.80	
	V4							-		-	-	
	V5							-		-	-	
	V6							-		-	-	
	V7	7.10	*2*	197	5.48	57		6.23	*10*	3.33	18.70	
	V8							-		-	-	
	V9	2.11	*14*	187	4.98	57		6.65	*8*	3.84	16.69	
F2: Medium input (100% NPK)	V1	5.70	*6*	114	4.77	91	18.44	7.41	*1*	4.75	23.21	1.40
	V2	3.50	*11*	112	3.38	99	21.11	7.27	*2*	4.31	23.33	2.60
	V3	6.19	*5*	170	5.00	89	33.33	6.92	*6*	3.99	22.80	4.40
	V4							-		-	-	
	V5							-		-	-	
	V6							-		-	-	
	V7	7.07	*3*	189	5.48	57	-0.67	6.68	*7*	3.67	19.01	4.50
	V8							-		-	-	
	V9	2.20	*13*	212	5.78	60	2.00	6.99	*5*	4.19	16.98	3.40
F3: High input (150% NPK)	V1	5.17	*7*	108	4.45	100	3.33	-		-	-	
	V2	4.13	*10*	115	5.10	100	17.56	-		-	-	
	V3	6.79	*4*	158	4.83	88	23.33	-		-	-	
	V4							-		-	-	
	V5							-		-	-	
	V6							-		-	-	
	V7	7.79	*1*	187	5.13	60	7.67	-		-	-	
	V8				0.00			-		-	-	
	V9	2.07	*15*	192	5.38	60	-0.44	-		-	-	
Interaction												
N at same V		0.78		NS	NS	2.71		NS		NS	NS	
V at same N		0.70		NS	NS	2.56		NS		NS	NS	
Means of F levels:												
F1		4.26	3	148	4.66	78		6.73	*2*	3.88	20.85	
F2		4.93	2	159	4.88	79	14.84	7.05	*1*	4.18	21.07	3.26
F3		5.19	1	152	4.15	82	10.29	-		-	-	
C.D.(0.05)		0.16		NS	NS	1.40		0.18		0.02	0.03	
C.V.(%)		5.04		17.51	19.66	2.73		1.65		0.27	0.08	

Table 4.1(d): Contd.

N-levels	Varieties	PATTAMBI						PUDUCHERRY				
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Days for 50% Flowering	N res. (kg grain/kg N) (Base level 30 kg N/ha)	Grain Yield (t/ha)	Rank	Panicle Weight (g)	Test wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)
Mean of varieties:												
V1		5.25	*3*	109	4.57	93	10.89	7.34	*1*	4.64	23.10	1.40
V2		3.39	*4*	103	3.95	100	19.33	7.14	*2*	4.22	23.22	2.60
V3		5.89	*2*	166	4.94	88	28.33	6.70	*4*	3.78	22.80	4.40
V4								-		-	-	
V5								-		-	-	
V6								-		-	-	
V7		7.32	*1*	191	5.36	58	3.50	6.46	*5*	3.50	18.86	4.50
V8								-		-	-	
V9		2.13	*5*	197	5.38	59	0.78	6.82	*3*	4.02	16.84	3.40
C.D.(0.05)		0.45		23.36	0.92	1.56		0.36		0.27	1.14	
C.V.(%)		9.62		15.67	19.40	2.02		4.29		5.39	4.44	
Expt. Mean		**4.80**		**153**	**4.84**	**79**		**6.89**		**4.03**	**20.96**	
Soil type		Sandy Loam						Clay loam				
pH		5.60						5.80				
N - levels (kg/ha)												
F1		45:45:45						60:20:20				
F2		90:45:45						120:40:40				
F3		135:45:45						-				
Recomnd N:P:K (kg/ha)		90:45:45						120:40:40				
Varieties												
V1		IET 24950						IET 24950				
V2		IET 25745						IET 25745				
V3		NC- IR 64						NC- IR 64				
V4		-						-				
V5		-						-				
V6		-						-				
V7		MTU 1010 (C & S)						MTU 1010 (C & S)				
V8		-						-				
V9		Jaya (Local check)						Co 52 (Local check)				
Available N:P:K of soil (kg/ha)		200:21:89						123:25:143				

Table 4.1(d): Contd.

N-levels	Varieties	VARANASI							Over all Mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)		
F1: Low input (50% NPK)	V1	5.90	*4*	211	4.88	26.82	96		5.39	2
	V2	6.07	*3*	191	4.34	27.98	98		5.15	6
	V3	3.04	*10*	194	3.24	22.98	74		4.32	19
	V4	-		-	-	-	-		5.37	4
	V5	-		-	-	-	-		4.37	18
	V6	-		-	-	-	-		4.39	17
	V7	3.08	*9*	303	2.25	21.60	72		4.61	11
	V8	-		-	-	-	-		2.86	22
	V9	5.88	*5*	243	2.65	22.02	93		4.49	15
F2: Medium input (100% NPK)	V1	8.31	*1*	216	5.52	25.84	95	17.85	5.75	1
	V2	7.48	*2*	244	5.16	27.44	94	10.44	5.37	3
	V3	3.12	*8*	219	3.19	23.98	74	0.59	4.57	13
	V4	-		-	-	-	-		5.36	5
	V5	-		-	-	-	-		4.57	12
	V6	-		-	-	-	-		4.45	16
	V7	3.25	*7*	317	2.17	20.26	72	1.26	4.86	8
	V8	-		-	-	-	-		3.74	21
	V9	5.03	*6*	285	2.59	23.24	94	-6.30	4.65	10
F3: High input (150% NPK)	V1	-		-	-	-	-		4.53	14
	V2	-		-	-	-	-		4.09	20
	V3	-		-	-	-	-		4.84	9
	V4	-		-	-	-	-			
	V5	-		-	-	-	-			
	V6	-		-	-	-	-			
	V7	-		-	-	-	-		5.03	7
	V8	-		-	-	-	-			
	V9	-		-	-	-	-		2.79	23
Interaction										
N at same V		0.38		15.34	NS	NS	0.91			
V at same N		1.26		16.38	NS	NS	0.84			
Means of F levels:										
F1		4.79	*2*	228	3.47	24.28	87		4.73	2
F2		5.44	*1*	256	3.73	24.15	86	4.77	4.94	1
F3		-		-	-	-	-		4.26	3
C.D.(0.05)		NS		11.36	NS	NS	0.29			
C.V.(%)		20.71		2.99	10.80	2.22	0.21			

Table 4.1(d): Contd.

N-levels	Varieties	VARANASI Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle Weight (g)	Test wt(g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Over all Mean	Rank
Mean of varieties:										
V1		7.11	*1*	213	5.20	26.33	95	17.85	5.50	1
V2		6.78	*2*	217	4.75	27.71	96	10.44	5.22	3
V3		3.08	*5*	206	3.22	23.48	74	0.59	4.44	7
V4		-		-	-	-	-		5.36	2
V5		-		-	-	-	-		4.47	6
V6		-		-	-	-	-		4.42	8
V7		3.17	*4*	310	2.21	20.93	72	1.26	4.69	4
V8		-		-	-	-	-		3.30	9
V9		5.46	*3*	264	2.62	22.63	94	-6.30	4.48	5
C.D.(0.05)		0.27		10.85	0.42	1.10	0.64			
C.V.(%)		4.26		3.66	9.58	3.72	0.61			
Expt. Mean		**5.12**		**242**	**3.60**	**24.22**	**86**		**4.79**	
Soil type		Sandy loam								
pH		7.31								
N - levels (kg/ha)										
F1		150:60:60								
F2		225:90:90								
F3		-								
Recommended N:P:K (kg/ha)		120:60:40								
Varieties										
V1		IET 24950								
V2		IET 25745								
V3		NC- IR 64								
V4		-								
V5		-								
V6		-								
V7		MTU 1010 (C & S)								
V8		-								
V9		HUBR 2-1 (Local check)								
Available N:P:K of soil (kg/ha)		246:18:188								

NMT 1(e) IM(Transplanted)

Three AVT-2 entries (IET 27263, IET 26418 and IET 26420) of medium duration were evaluated for their response to nutrients on grain yield at thirteen different locations viz., **Chinsurah (120:60:60),Chiplima (80:40:40), Coimbatore (150:50:50), Dhangain (120:60:40), Faizabad (120:60:60), Jagdalpur (100:60:40), Karjat (100:60:60), Kaul (150:60:60), Kota(120:60:40), Nagina (120:60:40), Pantnagar (120:60:40), Titabar (60:20:40)** and **Maruteru (90:60:60)** under two different levels of nutrient input (100% and 150% RDF). The details and data received from these locations are summarized and presented in Table 4.1 (e).

Application of different nutrient levels significantly influenced the grain yield at all the locations and the maximum increase in grain yield was observed with 150% RDF except **Coimbatore, Faizabad, Kaul, Kota** and **Nagina**. Application of 150% RDF recorded higher grain yields at **Chinsurah** (4.15 t/ha), **Chiplima** (4.95 t/ha), **Dhangain** (5.91 t/ha), **Jagdalpur** (5.65 t/ha), **Karjat** (4.22 t/ha), **Pantnagar** (4.64 t/ha), **Titabar** (5.28 t/ha) and **Maruteru** (5.39 t/ha). Higher nutrient response was recorded with 150% RDF at **Chinsurah** (4.23), **Chiplima** (7.54), **Dhangain** (13.14), **Jagdalpur** (8.91), **Karjat** (6.91), **Pantnagar** (5.35), **Titabar** (7.88) and **Maruteru** (2.46) indicating higher nutrient requirement at these locations.

Grain yield differences among the tested varieties were found to be significant at all the locations. Highest grain yield was recorded by IET 27263 at **Coimbatore** (6.18 t/ha), **Dhangain** (7.21 t/ha), **Faizabad** (6.03 t/ha), **Jagdalpur** (5.92 t/ha), **Kaul** (6.03 t/ha), **Pantnagar** (4.76 t/ha), **Maruteru** (5.60 t/ha) and **Titabar** (5.79 t/ha). At **Chiplima** (6.166 t/ha), **Kota** 98.37 t/ha), **Nagina** (4.62 t/ha) IET 26420 recorded higher grain yield. Mean over the locations IET 27263 (5.66 t/ha) and IET 26420 (5.44 t/ha) over local checks. Interaction effects among RDF x varieties was found to be non-significant at all the locations except at **Karjat** where significant interaction was noted. Significant interaction for grain yield was noted with application of 150% RDF with IET cultures at **Karjat**.

In this trial, mean over the locations nutrient management with 150% RDF was found to be promising and IET 27263 and IET 26420 were found to be promising on the basis of overall mean grain yield.

Table 4.1 (e): Summary of data on grain yield and ancillary characters of selected Irrigated Medium (Transplanted) cultures grown under transplanted conditions at low and medium recommended fertilizer doses, kharif 2019.

F-levels	Varieties	CHINSURAH						CHIPLIMA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.13	5	289	3.19	97		4.65	8	172	7.73	23.0	106	
	V2	3.40	11	271	3.16	99		5.10	7	192	5.07	29.0	106	
	V3	3.87	9	264	3.12	100		5.92	2	203	4.80	27.0	111	
	V4	-		-	-	-		-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	3.37	12	258	3.08	77		3.26	12	162	6.23	26.7	99	
	V7	4.14	4	272	2.71	85		3.02	14	200	5.77	32.0	107	
	V8	3.96	7	302	3.26	91		3.16	13	210	4.60	32.3	99	
	V9	-		-	-	-		5.34	6	224	5.57	23.7	108	
F2	V1	4.27	3	318	3.43	98	1.75	5.60	5	158	7.93	28.7	109	11.88
	V2	3.76	10	316	3.72	99	4.50	5.68	4	199	5.30	29.7	108	7.25
	V3	4.06	6	304	3.87	100	2.37	6.39	1	223	6.03	25.7	112	5.88
	V4	-		-	-	-		-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	3.92	8	289	3.19	77	6.88	3.45	11	195	6.30	26.3	100	2.38
	V7	4.42	2	320	3.67	86	3.50	4.09	9	222	5.33	28.3	108	13.38
	V8	4.47	1	317	3.34	92	6.38	3.65	10	210	4.20	31.0	102	6.13
	V9	-		-	-	-		5.81	3	235	5.60	28.7	109	5.88
Interaction														
F at same V		NS		NS	NS	NS		NS		NS	NS	3.14	NS	
V at same F		NS		NS	NS	NS		NS		NS	NS	4.03	NS	
F1		3.81	2	276	3.09	92		4.35	2	195	5.68	27.67	105	
F2		4.15	1	311	3.54	92	4.23	4.95	1	206	5.81	28.33	107	7.54
C.D.(0.05)		0.28		11.98	NS	NS		0.41		9.91	NS	NS	NS	
C.V.(%)		4.89		2.85	10.53	0.83		6.66		3.73	8.63	9.61	1.77	

Table 4.1 (e): Contd.

F-levels	Varieties	CHINSURAH						CHIPLIMA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:														
	V1	4.20	3	303	3.31	98	1.75	5.13	4	165	7.83	25.8	107	11.88
	V2	3.58	6	293	3.44	99	4.50	5.39	3	195	5.19	29.3	107	7.25
	V3	3.97	4	284	3.50	100	2.37	6.16	1	213	5.42	26.3	112	5.88
	V4	-		-	-	-		-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	3.65	5	274	3.14	77	6.88	3.36	7	179	6.27	26.5	100	2.38
	V7	4.28	1	296	3.19	85	3.50	3.56	5	211	5.55	30.2	108	13.38
	V8	4.22	2	310	3.30	91	6.38	3.41	6	210	4.40	31.7	101	6.13
	V9	-		-	-	-		5.58	2	229	5.59	26.2	109	5.88
C.D.(0.05)		0.33		15.23	NS	0.70		0.43		14.37	0.48	2.22	1.09	
C.V. (%)		6.93		4.31	7.45	0.63		7.72		6.02	7.06	6.65	0.86	
Expt. Mean		**3.98**		**293**	**3.31**	**92**		**4.65**		**200**	**5.75**	**28.0**	**106**	
Soil type		Clay Loam						Sandy loam						
pH		7.85						7.12						
N - levels (kg/ha)														
F1		80:40:40						80:40:40						
F2		120:60:60						120:60:60						
Recommended N:P:K (kg/ha)		80:40:40						80:40:40						
Varieties														
V1		IET 27263						IET 27263						
V2		IET 26418						IET 26418						
V3		IET 26420						IET 26420						
V4		-						-						
V5		-						-						
V6		NDR 8002 (E&C)						NDR 8002 (E&C)						
V7		Jaya (NE & S)						Jaya (NE & S)						
V8		Akshayadhan (W)						Akshayadhan (W)						
V9		-						Pratikshya (Local Check)						
Available N:P:K of soil (kg/ha)		530:119:364						119:40:117						

Table 4.1 (e): Contd.

F-levels	Varieties	COIMBATORE							DHANGAIN					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	5.94	3	259	4.66	25.4	102		6.62	3	290	5.16	107	
	V2	4.78	10	230	3.05	23.4	98		5.43	7	269	3.99	110	
	V3	5.20	8	236	3.31	24.3	107		6.18	4	277	4.08	110	
	V4	-		-	-	-	-		-		-	-	-	
	V5	-		-	-	-	-		-		-	-	-	
	V6	4.20	12	263	4.07	26.1	93		5.22	9	267	3.72	84	
	V7	4.09	14	293	4.10	24.6	92		3.92	14	261	2.26	94	
	V8	4.93	9	277	3.49	24.5	102		4.43	11	266	3.49	89	
	V9	5.78	4	249	5.09	13.8	102		4.03	13	265	3.14	106	
F2	V1	6.42	1	302	4.17	25.6	102	3.84	7.80	1	294	5.50	109	19.67
	V2	5.38	7	237	3.22	24.0	98	4.80	6.15	5	279	4.08	113	12.00
	V3	5.72	5	309	4.06	24.6	107	4.16	7.18	2	284	4.38	112	16.67
	V4	-		-	-	-	-		-		-	-	-	
	V5	-		-	-	-	-		-		-	-	-	
	V6	4.40	11	314	3.77	26.3	94	1.60	6.12	6	279	3.97	87	15.00
	V7	4.18	13	255	4.39	24.7	92	0.72	4.13	12	264	3.43	97	3.50
	V8	5.42	6	255	3.98	24.8	102	3.92	5.27	8	278	3.51	92	14.00
	V9	5.99	2	271	4.66	13.7	103	1.68	4.70	10	273	3.48	109	11.17
Interaction														
F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	
F1		4.99	2	258	3.97	23.14	99		5.12	2	271	3.69	100	
F2		5.36	1	277	4.04	23.39	100	4.63	5.91	1	279	4.05	103	13.14
C.D.(0.05)		NS		NS	NS	NS	NS		0.75		NS	0.27	0.20	
C.V.(%)		14.77		30.21	11.91	1.02	0.27		10.29		2.90	5.30	0.15	

Table 4.1 (e): Contd.

F-levels	Varieties	COIMBATORE							DHANGAIN					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:														
	V1	6.18	1	280	4.42	25.5	102	3.84	7.21	1	292	5.33	108	19.67
	V2	5.08	5	234	3.14	23.7	98	4.80	5.79	3	274	4.04	111	12.00
	V3	5.46	3	272	3.69	24.5	107	4.16	6.68	2	280	4.23	111	16.67
	V4	-		-	-	-	-		-		-	-	-	
	V5	-		-	-	-	-		-		-	-	-	
	V6	4.30	6	289	3.92	26.2	94	1.60	5.67	4	273	3.85	85	15.00
	V7	4.14	7	274	4.25	24.7	92	0.72	4.03	7	263	2.85	95	3.50
	V8	5.18	4	266	3.74	24.6	102	3.92	4.85	5	272	3.50	91	14.00
	V9	5.89	2	260	4.88	13.8	102	1.68	4.37	6	269	3.31	108	11.17
	C.D.(0.05)	0.39		NS	0.97	0.26	0.42		0.42		10.73	0.90	0.70	
	C.V. (%)	6.33		16.86	20.39	0.92	0.35		6.37		3.28	19.51	0.58	
	Expt. Mean	**5.17**		**268**	**4.00**	**23.27**	**100**		**5.51**		**275**	**3.87**	**101**	
	Soil type	Clay Loam							Loamy					
	pH	7.96							6.80					
N - levels (kg/ha)														
	F1	150:50:50							120:60:40					
	F2	225:75:75							180:60:40					
	Recommended N:P:K (kg/ha)	150:50:50							120:60:40					
Varieties														
	V1	IET 27263							IET27263					
	V2	IET 26418							IET26418					
	V3	IET 26420							IET26420					
	V4	-												
	V5	-												
	V6	NDR 8002 (E&C)							NDR 8002					
	V7	Jaya (NE & S)							Jaya					
	V8	Akshayadhan (W)							Akshaydhan (W)					
	V9	Co 52 (Local Check)							R. Sweta (LC)					
Available N:P:K of soil (kg/ha)		272:26:537							154:14:183					

Table 4.1 (e): Contd.

F-levels	Varieties	FAIZABAD						JAGDALPUR						
		Grain Yield (t/ha)	Rank	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	5.44	6	4.83	25.5	105		5.11	8	252	3.96	28.6	80	
	V2	5.40	7	4.41	23.5	108		4.51	13	324	3.82	26.1	82	
	V3	5.61	5	3.60	21.9	107		5.16	7	290	3.16	25.9	80	
	V4	5.24	8	3.83	21.6	97		-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	5.01	11	3.30	21.5	95		4.60	12	286	3.51	26.0	62	
	V7	3.99	15	3.58	21.5	97		4.72	11	374	3.24	26.8	78	
	V8	3.23	16	3.63	21.5	99		5.04	9	232	3.36	26.1	75	
	V9	4.68	13	3.16	23.0	97		4.19	14	287	3.11	26.9	68	
F2	V1	6.62	1	5.31	26.9	105	19.67	6.73	1	257	4.01	29.2	82	16.20
	V2	6.45	2	4.61	28.3	107	17.50	6.21	2	336	3.87	26.6	83	17.00
	V3	5.63	4	3.08	22.5	107	0.33	5.74	3	303	3.20	26.5	81	5.80
	V4	5.93	3	3.78	22.3	97	11.50	-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	5.14	10	3.27	21.5	95	2.17	5.29	6	286	3.68	26.3	64	6.90
	V7	4.84	12	3.15	22.3	97	14.17	5.31	5	397	3.38	27.2	80	5.90
	V8	4.11	14	3.73	21.4	99	14.67	5.50	4	240	3.53	26.6	76	4.60
	V9	5.24	8	4.37	22.4	98		4.79	10	316	3.22	28.0	70	6.00
Interaction														
F at same V		NS		NS	1.17	NS		NS		NS	NS	NS	NS	
V at same F		NS		NS	1.17	NS		NS		NS	NS	NS	NS	
F1		4.83	2	3.79	22.5	101		4.76	2	292	3.45	26.6	75	
F2		5.50	1	3.91	23.4	101	8.38	5.65	1	305	3.56	27.2	77	8.91
C.D.(0.05)		NS		NS	0.52	NS		0.10		2.66	NS	0.25	NS	
C.V.(%)		11.39		18.57	1.83	1.03		1.49		0.67	2.60	0.69	1.61	

Table 4.1 (e): Contd.

F-levels	Varieties	FAIZABAD Grain Yield (t/ha)	Rank	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 50% RDF)	JAGDALPUR Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:														
V1		6.03	1	5.07	26.2	105	19.67	5.92	1	255	3.99	28.9	81	16.20
V2		5.93	2	4.51	25.9	107	17.50	5.36	3	330	3.85	26.3	83	17.00
V3		5.62	3	3.34	22.2	107	0.33	5.45	2	296	3.18	26.2	80	5.80
V4		5.59	4	3.81	21.9	97	11.50	-		-	-	-	-	
V5		-		-	-	-		-		-	-	-	-	
V6		5.08	5	3.29	21.5	95	2.17	4.95	6	286	3.60	26.2	63	6.90
V7		4.42	7	3.37	21.9	97	14.17	5.02	5	386	3.31	27.0	79	5.90
V8		3.67	8	3.68	21.5	99	14.67	5.27	4	236	3.45	26.4	76	4.60
V9		4.96	6	3.77	22.7	97		4.49	7	302	3.17	27.4	69	6.00
C.D.(0.05)		0.59		0.78	0.83	0.83		0.59		60.15	0.50	NS	0.78	
C.V. (%)		9.65		17.13	3.04	0.69		9.57		16.90	11.95	9.11	0.86	
Expt. Mean		**5.16**		**3.85**	**22.97**	**101**		**5.21**		**299**	**3.50**	**26.90**	**76**	
Soil type		Sandy loam						-						
pH		7.60						6.50						
N - levels (kg/ha)														
F1		120:60:60						100:60:40						
F2		180:60:60						150:90:60						
Recommended N:P:K (kg/ha)		120:60:60:25						100:60:40						
Varieties														
V1		IET 27263						IET 27263						
V2		IET 26418						IET 26418						
V3		IET 26420						IET 26420						
V4		NC-NDR 359						-						
V5		-						-						
V6		NDR 8002 (E&C)						NDR 8002 (E&C)						
V7		Jaya (NE & S)						Jaya (NE & S)						
V8		Akshayadhan (W)						Akshayadhan (W)						
V9		NDR 3112 1 (Local Check)						Samleswari (Local Check)						
Available N:P:K of soil (kg/ha)		200:24:234						248:14:296						

Table 4.1 (e): Contd.

F-levels	Varieties	KAUL						KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	5.97	4	212	3.09	26.5		4.33	7	135	2.34	25.4	101	
	V2	5.63	6	221	2.81	26.3		3.75	10	156	2.03	23.6	101	
	V3	5.47	8	227	2.68	24.3		4.35	5	149	2.35	26.3	104	
	V4	-		-	-	-		-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	-		-	-	-		2.89	12	161	1.57	24.5	88	
	V7	-		-	-	-		3.28	11	127	1.77	23.7	95	
	V8	-		-	-	-		1.50	14	67	0.81	25.4	98	
	V9	6.75	2	285	2.64	25.7		4.57	4	170	2.47	24.4	92	
F2	V1	6.09	3	218	3.12	26.8	0.89	5.09	2	159	2.75	26.2	102	7.60
	V2	5.66	5	228	2.77	26.0	0.22	4.25	8	163	2.30	24.6	101	5.00
	V3	5.63	6	232	2.70	24.1	1.19	4.88	3	162	2.64	27.3	105	5.30
	V4	-		-	-	-		-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	-		-	-	-		4.35	5	167	2.35	25.3	88	14.60
	V7	-		-	-	-		4.00	9	143	2.16	25.5	97	7.20
	V8	-		-	-	-		1.76	13	73	0.95	25.8	98	2.60
	V9	6.83	1	288	2.64	25.9	0.59	5.18	1	192	2.80	25.4	93	6.10
Interaction														
F at same V		NS		NS	NS	NS		0.11		3.86	0.06	NS	NS	
V at same F		NS		NS	NS	NS		0.10		4.03	0.06	NS	NS	
F1		5.96	2	236	2.81	25.69		3.52	2	138	1.91	24.77	97	
F2		6.05	1	241	2.81	25.69	0.72	4.22	1	151	2.28	25.73	98	6.91
C.D.(0.05)		NS		NS	NS	NS		0.04		2.36	0.02	0.36	NS	
C.V.(%)		7.07		7.90	2.52	6.94		0.74		1.23	0.80	1.07	0.63	

Table 4.1 (e): Contd.

F-levels	Varieties	KAUL						KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:														
	V1	6.03	2	215	3.11	26.65	0.89	4.71	2	147	2.55	25.80	102	7.60
	V2	5.65	3	225	2.79	26.14	0.22	4.00	4	159	2.17	24.13	101	5.00
	V3	5.55	4	229	2.69	24.19	1.19	4.62	3	155	2.50	26.80	104	5.30
	V4	-		-	-	-		-		-	-	-	-	
	V5	-		-	-	-		-		-	-	-	-	
	V6	-		-	-	-		3.62	6	164	1.96	24.89	88	14.60
	V7	-		-	-	-		3.64	5	135	1.97	24.62	96	7.20
	V8	-		-	-	-		1.63	7	70	0.88	25.60	98	2.60
	V9	6.79	1	286	2.64	25.80	0.59	4.88	1	181	2.64	24.90	93	
C.D.(0.05)		0.63		29.08	0.21	NS		0.08		2.73	0.04	0.36	0.58	
C.V. (%)		8.31		9.68	6.02	7.85		1.65		1.59	1.61	1.20	0.50	
Expt. Mean		**6.00**		**239**	**2.81**	**25.69**		**3.87**		**144**	**2.09**	**25.25**	**97**	
Soil type		Clay Loam						-						
pH		8.10						-						
N - levels (kg/ha)														
F1		150:60:60						100:50:50						
F2		225:90:90						150:75:75						
Recommended N:P:K (kg/ha)		150:60:60:25						100:50:50						
Varieties														
	V1	IET 27263						IET 27263						
	V2	IET 26418						IET 26418						
	V3	IET 26420						IET 26420						
	V4	-						-						
	V5	-						-						
	V6	-						NDR 8002 (E&C)						
	V7	-						Jaya (NE & S)						
	V8	-						Akshayadhan (W)						
	V9	HKR 127 (Local Check)						Karjat -3 (Local Check)						
Available N:P:K of soil (kg/ha)		160:16:420						-						

Table 4.1 (e): Contd.

F-levels	Varieties	KOTA Grain Yield (t/ha)	KOTA Rank	KOTA Panicle/m² (No.)	KOTA Panicle wt (g)	KOTA Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	NAGINA Grain Yield (t/ha)	NAGINA Rank	NAGINA Panicle/m² (No.)	NAGINA Panicle wt (g)	NAGINA Test wt (g)	NAGINA Days 50% flowering	NAGINA Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	7.38	5	332	5.18		4.39	7	274	2.64	23.7	115	
	V2	5.63	12	284	3.67		4.46	6	268	2.61	23.8	117	
	V3	8.24	2	370	5.59		4.54	4	288	2.69	23.9	113	
	V4	7.15	7	321	5.09		-		-	-	-	-	
	V5	-		-	-		-		-	-	-	-	
	V6	-		-	-		4.32	8	242	2.40	22.2	114	
	V7	6.90	8	312	4.90		4.09	10	258	2.16	23.2	106	
	V8	6.05	10	289	4.25		4.01	12	262	2.48	23.5	98	
	V9	-		-	-		-		-	-	-	-	
F2	V1	7.62	3	341	5.26	2.18	4.65	2	284	2.72	23.8	112	2.36
	V2	5.83	11	291	3.88	1.82	4.63	3	280	2.63	23.9	117	1.55
	V3	8.49	1	377	5.63	2.27	4.69	1	292	2.77	24.0	114	1.36
	V4	7.47	4	330	5.17	2.91	-		-	-	-	-	
	V5	-		-	-		-		-	-	-	-	
	V6	-		-	-		4.50	5	263	2.50	22.2	116	1.64
	V7	7.23	6	317	4.69	3.00	4.16	9	270	2.16	22.6	107	0.64
	V8	6.30	9	295	4.43	2.27	4.08	11	255	2.50	23.7	98	0.64
	V9	-		-	-		-		-	-	-	-	
Interaction													
F at same V		NS		NS	NS		NS		NS	0.02	0.28	NS	
V at same F		NS		NS	NS		NS		NS	0.02	0.33	NS	
F1		6.89	2	318	4.78		4.30	2	265	2.50	23.37	111	
F2		7.16	1	325	4.84	2.41	4.45	1	274	2.55	23.37	111	1.36
C.D.(0.05)		NS		NS	NS		NS		3.11	0.01	NS	NS	
C.V.(%)		3.88		5.63	7.75		3.67		0.80	0.40	0.80	0.94	

Table 4.1 (e): Contd.

F-levels	Varieties	KOTA					NAGINA						
		Grain Yield (t/ha)	**Rank**	**Panicle/m^2 (No.)**	**Panicle wt (g)**	**Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)**	**Grain Yield (t/ha)**	**Rank**	**Panicle/m^2 (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Days 50% flowering**	**Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)**
Mean of varieties:													
V1		7.50	2	337	5.22	2.18	4.52	3	279	2.68	23.76	114	2.36
V2		5.73	6	288	3.78	1.82	4.55	2	274	2.62	23.83	117	1.55
V3		8.37	1	374	5.61	2.27	4.62	1	290	2.73	23.94	114	1.36
V4		7.31	3	326	5.13	2.91	-		-	-	-	-	
V5		-		-	-		-		-	-	-	-	
V6		-		-	-		4.41	4	253	2.45	22.19	115	1.64
V7		7.07	4	315	4.80	3.00	4.13	5	264	2.16	22.92	106	0.64
V8		6.18	5	292	4.34	2.27	4.05	6	259	2.49	23.60	98	0.64
V9		-		-	-		-		-	-	-	-	
C.D.(0.05)		0.51		15.48	0.36		0.13		14.95	0.02	0.20	2.34	
C.V. (%)		6.03		4.00	6.26		2.53		4.60	0.56	0.71	1.76	
Expt. Mean		**7.02**		**322**	**4.81**		**4.38**		**270**	**2.52**	**23.37**	**111**	
Soil type		Clay loam					-						
pH		7.80					7.70						
N - levels (kg/ha)													
F1		120:60:40					120:60:40						
F2		180:90:60					180:90:60						
Recommended N:P:K (kg/ha)		120:60:40					120:60:40:25						
Varieties													
V1		IET 27263					IET 26027						
V2		IET 26418					IET 25997						
V3		IET 26420					IET 25785						
V4		NC-NDR 359					NC- NDR 359						
V5		-					-						
V6		-					-						
V7		Jaya (NE & S)					Jaya (NE & S)						
V8		Akshayadhan (W)					Akshayadhan (W)						
V9		-					-						
Available N:P:K of soil (kg/ha)		318:60:523					21:18.3:209						

Table 4.1 (e): Contd.

F-levels	Varieties	PANTNAGAR							TITABAR						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.49	5	242	2.19	27.9	107		5.46	3	213	6.02	21.4	109	
	V2	3.56	11	223	2.00	23.1	108		5.12	7	199	5.11	21.2	109	
	V3	3.42	12	222	1.81	23.4	113		4.83	11	218	5.06	21.1	109	
	V4	4.36	6	234	2.16	24.2	100		-		-	-	-	-	
	V5	4.29	7	241	2.05	27.5	100		4.41	15	216	5.57	17.5	99	
	V6	-		-	-	-	-		4.47	14	186	5.24	20.5	88	
	V7	-		-	-	-	-		4.17	16	198	4.88	19.7	94	
	V8	-		-	-	-	-		4.94	9	217	5.98	22.8	98	
	V9	4.18	9	232	2.17	24.9	99		5.05	8	200	5.40	19.0	101	
F2	V1	5.02	1	257	2.40	28.1	108	4.82	6.11	1	262	6.61	21.8	112	10.83
	V2	4.28	8	240	2.23	23.9	108	6.55	5.83	2	226	6.05	21.6	112	11.83
	V3	4.13	10	243	1.95	23.7	110	6.45	5.16	6	254	5.58	21.4	111	5.50
	V4	4.94	2	253	2.42	25.4	99	5.27	-		-	-	-	-	
	V5	4.80	3	253	2.32	27.8	101	4.64	4.78	12	236	6.12	19.9	102	6.17
	V6	-		-	-	-	-		4.90	10	224	6.12	23.2	90	7.17
	V7	-		-	-	-	-		4.59	13	219	5.22	21.4	99	7.00
	V8	-		-	-	-	-		5.46	3	254	6.61	23.9	101	8.67
	V9	4.66	4	245	2.28	25.0	100	4.36	5.40	5	242	6.35	19.3	104	5.83
Interaction															
F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS	
F1		4.05	2	232	2.06	25.15	105		4.81	2	206	5.41	20.41	101	
F2		4.64	1	249	2.27	25.65	104	5.35	5.28	1	240	6.08	21.56	104	7.88
C.D.(0.05)		0.16		NS	0.16	NS	NS		0.18		4.46	0.62	0.25	0.47	
C.V.(%)		2.64		6.17	5.30	4.43	0.58		2.83		1.61	8.68	0.97	0.37	

Table 4.1 (e): Contd.

F-levels	Varieties	PANTNAGAR							TITABAR						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:															
V1		4.76	1	250	2.30	27.96	108	4.82	5.79	1	237	6.32	21.61	110	10.83
V2		3.92	5	231	2.12	23.47	108	6.55	5.48	2	213	5.58	21.40	111	11.83
V3		3.78	6	232	1.88	23.55	112	6.45	5.00	5	236	5.32	21.24	110	5.50
V4		4.65	2	244	2.29	24.80	100	5.27	-		-	-	-	-	
V5		4.55	3	247	2.19	27.68	101	4.64	4.60	7	226	5.85	18.71	101	6.17
V6		-		-	-	-	-		4.69	6	205	5.68	21.86	89	7.17
V7		-		-	-	-	-		4.38	8	209	5.05	20.56	96	7.00
V8		-		-	-	-	-		5.20	4	236	6.30	23.39	100	8.67
V9		4.42	4	239	2.23	24.95	99	4.36	5.23	3	221	5.88	19.14	103	5.83
C.D.(0.05)		0.36		10.39	0.12	1.64	1.54		0.17		18.48	0.45	1.15	0.73	
C.V. (%)		6.79		3.59	4.61	5.36	1.22		2.83		7.02	6.60	4.63	0.60	
Expt. Mean		**4.34**		**240**	**2.17**	**25.40**	**104**		**5.04**		**223**	**5.75**	**20.99**	**102**	
Soil type		Silt Loam							Silty Clay Loam						
pH		7.60							5.20						
N - levels (kg/ha)															
F1		120:60:40							60:20:40						
F2		180:90:60							90:30:60						
Recommended N:P:K (kg/ha)		120:60:40							60:20:40						
Varieties															
V1		IET 27263							IET 27263						
V2		IET 26418							IET 26418						
V3		IET 26420							IET 26420						
V4		NC-NDR 359							-						
V5		ZC- Pant Dhan-19 (N)							ZC- Pant Dhan-19 (N)						
V6		-							NDR 8002 (E&C)						
V7		-							Jaya (NE & S)						
V8		-							Akshayadhan (W)						
V9		Pant Dhan 26 (Local Check)							Numoli (Local Check)						
Available N:P:K (kg/ha)		230:22:215							508:20:130						

Table 4.1 (e): Contd.

F-levels	Varieties	MARUTERU							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
F1	V1	5.47	3	295	3.86	18.54	107		5.34	7
	V2	5.13	8	273	3.64	18.55	104		4.76	11
	V3	5.28	5	282	3.78	19.2	105		5.24	8
	V4	-		-	-	-	-		5.58	4
	V5	-		-	-	-	-		4.35	15
	V6	4.6	12	260	3.51	17.12	107		4.19	18
	V7	4.86	11	263	3.46	20.14	104		4.29	16
	V8	5.02	10	268	3.57	19.42	106		4.21	17
	V9	-		-	-	-	-		4.95	9
F2	V1	5.73	1	300	3.92	18.63	108	1.93	5.98	2
	V2	5.39	4	291	3.71	18.25	107	1.93	5.35	6
	V3	5.71	2	298	3.8	19.17	108	3.19	5.65	3
	V4	-		-	-	-	-		6.11	1
	V5	-		-	-	-	-		4.79	10
	V6	5.22	6	278	3.66	17.15	108	4.59	4.73	13
	V7	5.12	9	270	3.51	23.92	105	1.93	4.73	12
	V8	5.18	7	274	3.58	19.43	107	1.19	4.65	14
	V9	-		-	-	-	-		5.40	5
Interaction										
F at same V		NS		NS	NS	0.52	NS			
V at same F		NS		NS	NS	0.53	NS			
F1		5.06	2	274	3.64	18.83	106		4.80	2
F2		5.39	1	285	3.70	19.43	107	2.46	5.28	1
C.D.(0.05)		0.08		NS	NS	0.29	NS			
C.V.(%)		1.04		7.17	6.37	1.06	1.41			

Table 4.1 (e): Contd.

F-levels	Varieties	MARUTERU							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
Mean of varieties:										
V1		5.60	1	298	3.89	18.59	108	1.93	5.66	2
V2		5.26	3	282	3.68	18.40	106	1.93	5.05	5
V3		5.50	2	290	3.79	19.19	107	3.19	5.44	3
V4		-		-	-	-	-		5.85	1
V5		-		-	-	-	-		4.57	6
V6		4.91	6	269	3.59	17.14	108	4.59	4.46	8
V7		4.99	5	267	3.49	22.03	105	1.93	4.51	7
V8		5.10	4	271	3.58	19.43	107	1.19	4.43	9
V9		-		-	-	-	-		5.18	4
C.D.(0.05)		0.46		NS	NS	0.37	1.43			
C.V. (%)		7.32		7.88	7.46	1.6	1.12			
Expt. Mean		**5.23**		**279**	**3.67**		**106**		**5.04**	
Soil type		Delta alluvial								
pH		7.16								
N - levels (kg/ha)										
F1		90:60:60								
F2		135:90:90								
Recommended N:P:K (kg/ha)		90:60:60								
Varieties										
V1		IET27263								
V2		IET26418								
V3		IET26420								
V4		-								
V5		-								
V6		NDR 8002								
V7		Jaya								
V8		Akshaydhan (W)								
V9		-								
Available N:P:K of soil (kg/ha)		151:36:257								

NMT 1(f) Late

Four AVT-2 Late entries (IET 26927, IET 26974, IET 25948 and IET 26948 were evaluated for its response to levels nutrients on grain yield at nine locations i.e. **Aduthurai (150:60:60), Chinsurah (80:40:40), Chiplima (80:40:40), Dhangain (80:40:40), Karjat (150:50:50), Mandya (100:50:50), Nagina (120:60:40), Pusa (120:60:40)** and **Maruteru** (90:60:60) under two levels of RDF (100% and 150% RDF). The details and data received from these locations are summarized and presented in Table 4.1.1 (f).

Fertilizer levels application significantly influenced the grain yield at all locations exept Chiplima, Maruteru and Mandya locations and the maximum grain yield was recorded at all the locations with 150% RDF. Application of 150% RDF had higher grain yields at **Aduthurai** (5.29 t/ha), **Chinsurah** (5.43 t/ha), **Dhangain** (6.68 t/ha), **Karjat** (3.67 t/ha), **Nagina** (4.54 t/ha) and **Pusa** (3.82 t/ha). Higher nutrient response (kg grain/kg nutrient) was with 150% RDF over 100% RDF at **Aduthurai** (2.79), **Chinsurah**(2.88), **Dhangain** (4.34), **Karjat** (2.64), **Nagina** (1.48) and **Pusa** (5.57).

Grain yield differences among the tested varieties were found to be significant at all the locations. Significantly higher mean maximum grain yield was recorded by IET 26927 at **Aduthurai** (5.70 t/ha), **Chiplima** (6.72 t/ha) and **Nagina** (4.69 t/ha) while, IET 26974 at **Chinsurah** (5.75 t/ha), **Mandya** (8.40 t/ha) and **Aduthurai** (7.21 t/ha). Higher grain yield was with IET 25948 at **Dhangain** (7.43 t/ha) and IET 26948 at **Karjat** (4.28 t/ha). Interaction effects among RDF x varieties was found to be non-significant at all the location except **Karjat**. Mean over the locations the performance of IET 26974 (5.61 t/ha) and IET 26948 (5.52 t/ha) and IET 25948 (5.51 t/ha) was promising over other cultures.

In this trial, 150% RDF was found to be promising with 7.3% increased grain yield and also exhibited higher nutrient recovery efficiency. IET cultures were found to be promising in terms of higher grain yield at most of the locations (IET 26974, IET 26948 and IET 25948).

Table 4.1 (f): Summary of data on grain yield and ancillary characters of selected late cultures grown under transplanted conditions at low and medium recommended fertilizer doses, kharif 2019.

F-levels	Varieties	ADUTHURAI					CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt(g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	5.53	2	319	3.70		5.13	14	264	3.19	116	
	V2	4.90	10	333	3.27		5.69	2	313	3.16	111	
	V3	4.83	13	292	3.02		5.17	12	299	2.93	110	
	V4	4.80	14	328	2.78		5.55	6	258	3.12	112	
	V5	4.73	15	331	2.71		4.46	16	286	3.07	111	
	V6	4.73	15	348	2.80		5.15	13	315	3.21	112	
	V7	4.90	10	337	2.81		5.28	9	328	3.44	110	
	V8	4.90	10	346	2.92		5.18	11	322	3.23	110	
F2	V1	5.87	1	330	3.86	2.52	5.47	8	318	2.93	116	4.25
	V2	5.37	3	342	3.39	3.48	5.81	1	316	3.22	111	1.50
	V3	5.10	9	303	3.16	2.00	5.50	7	272	2.71	110	4.13
	V4	5.13	7	337	2.89	2.44	5.57	5	304	3.20	112	0.25
	V5	5.13	7	340	2.80	2.96	4.60	15	280	2.91	111	1.75
	V6	5.17	6	358	2.88	3.26	5.60	4	351	3.53	112	5.62
	V7	5.23	5	347	2.92	2.44	5.65	3	356	3.57	111	4.63
	V8	5.33	4	355	3.02	3.19	5.25	10	325	3.18	111	0.88
Interaction												
F at same V		NS		NS	NS		NS		NS	NS	NS	
V at same F		NS		NS	NS		NS		NS	NS	NS	
F1		4.92	2	329	3.00		5.20	2	298	3.17	111	
F2		5.29	1	339	3.12	2.79	5.43	1	315	3.16	112	2.88
C.D.(0.05)		0.11		3.53	0.04		0.22		14.6	NS	0.36	
C.V.(%)		1.77		0.85	1.08		3.32		3.83	8.97	0.26	

Table 4.1 (f): Contd.

F-levels	Varieties	ADUTHURAI					CHINSURAH					
		Grain Yield (t/ha)	**Rank**	**Panicle/m^2 (No.)**	**Panicle wt(g)**	**Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)**	**Grain Yield (t/ha)**	**Rank**	**Panicle/m^2 (No.)**	**Panicle wt(g)**	**Days 50% flowering**	**Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)**
Mean of varieties:												
V1		5.70	1	324	3.78	2.52	5.30	6	291	3.06	116	4.25
V2		5.14	2	338	3.33	3.48	5.75	1	315	3.19	111	1.50
V3		4.97	5	298	3.09	2.00	5.34	5	285	2.82	110	4.13
V4		4.97	5	333	2.84	2.44	5.56	2	281	3.16	112	0.25
V5		4.93	8	335	2.76	2.96	4.53	8	283	2.99	111	1.75
V6		4.95	7	353	2.84	3.26	5.38	4	333	3.37	112	5.62
V7		5.07	4	342	2.87	2.44	5.47	3	342	3.51	111	4.63
V8		5.12	3	350	2.97	3.19	5.22	7	323	3.21	111	0.88
C.D.(0.05)		0.14		4.12	0.05		0.33		22.6	0.33	0.57	
C.V. (%)		2.4		1.04	1.4		5.32		6.23	8.73	0.43	
Expt. Mean		**5.10**		**334**	**3.06**		**5.32**		**307**	**3.16**	**112**	
Soil type		Clay					Clay Loam					
pH		8.30					7.85					
N - levels (kg/ha)												
F1		150:60:60					80:40:40					
F2		225:90:90					120:60:60					
Recommended N:P:K (kg/ha)		150:60:60					80:40:40					
Varieties												
V1		IET 26927					IET 26927					
V2		IET 26974					IET 26974					
V3		IET 25948					IET 25948					
V4		IET 26948					IET 26948					
V5		Samba Masuri					Samba Masuri					
V6		Swarna					Swarna					
V7		Pushyami					Pushyami					
V8		LC - CR 1009					LC - Sujala					
Available N:P:K of soil (kg/ha)		28.5:72.5:132					530:119:364					

Table 4.1 (f): Contd.

F-levels	Varieties	CHIPLIMA Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	DHANGAIN Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	6.52	5	250	4.60	23.67	120		4.13	16	233	3.05	116	
	V2	5.85	11	243	5.13	24.33	109		5.85	12	252	3.16	108	
	V3	5.98	9	245	7.20	26.00	108		7.17	4	292	5.82	110	
	V4	6.14	7	258	5.93	25.00	112		6.95	7	279	4.18	116	
	V5	5.34	14	217	4.73	17.67	111		5.40	14	251	3.11	108	
	V6	-		-	-	-	-		6.97	6	279	4.66	116	
	V7	5.39	12	229	5.80	22.67	113		6.80	9	266	3.91	113	
	V8	5.36	13	223	6.13	25.67	106		6.37	11	263	3.30	112	
F2	V1	6.91	2	266	3.13	23.33	121	4.88	5.00	15	254	3.12	116	7.91
	V2	6.61	4	244	6.20	24.33	110	9.50	6.50	10	280	3.39	109	5.91
	V3	6.62	3	260	6.33	25.00	110	8.00	7.68	1	302	6.02	111	4.64
	V4	6.92	1	268	7.40	27.33	113	9.75	7.23	3	280	4.61	118	2.55
	V5	6.15	6	245	4.33	19.00	112	10.13	5.77	13	262	3.37	110	3.36
	V6	-		-	-	-	-		7.33	2	297	5.21	118	3.27
	V7	6.03	8	237	6.27	22.67	115	8.00	7.10	5	282	4.29	115	2.73
	V8	5.96	10	244	6.47	27.33	108	7.50	6.85	8	281	3.48	114	4.36
Interaction														
F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	
F1		5.80	2	238	5.65	23.57	111		6.21	2	264	3.90	112	
F2		6.46	1	252	5.73	24.14	113	8.25	6.68	1	280	4.19	114	4.34
C.D.(0.05)		NS		NS	NS	NS	1.08		0.34		NS	NS	0.62	
C.V.(%)		13.54		9.75	12.32	2.96	0.73		4.23		6.93	15.92	0.44	

Table 4.1 (f): Contd.

F-levels	Varieties	CHIPLIMA Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	DHANGAIN Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:														
	V1	6.72	1	258	3.87	23.50	120	4.88	4.57	8	244	3.09	116	7.91
	V2	6.23	4	244	5.67	24.33	110	9.50	6.18	6	266	3.28	108	5.91
	V3	6.30	3	252	6.77	25.50	109	8.00	7.43	1	297	5.92	111	4.64
	V4	6.53	2	263	6.67	26.17	112	9.75	7.09	3	280	4.40	117	2.55
	V5	5.75	5	231	4.53	18.34	112	10.13	5.59	7	257	3.24	109	3.36
	V6	-		-	-	-	-		7.15	2	288	4.94	117	3.27
	V7	5.71	6	233	6.04	22.67	114	8.00	6.95	4	274	4.10	114	2.73
	V8	5.66	7	234	6.30	26.50	107	7.50	6.61	5	272	3.39	113	4.36
	C.D.(0.05)	0.39		19.24	0.92	1.19	0.69		0.58		14.54	1.27	0.71	
	C.V. (%)	5.33		6.59	13.55	4.17	0.52		7.58		4.52	26.5	0.53	
	Expt. Mean	**6.13**		**245**	**5.69**	**24**	**112**		**6.44**		**272**	**4.04**	**113**	
	Soil type	Sandy loam							Loamy					
	pH	7.12							6.80					
N - levels (kg/ha)														
	F1	80:40:40							120:60:40					
	F2	120:60:60							180:60:40					
Recommended N:P:K (kg/ha)		80:40:40							120:60:40					
Varieties														
	V1	IET 26927							IET 26927					
	V2	IET 26974							IET 26974					
	V3	IET 25948							IET 25948					
	V4	IET 26948							IET 26948					
	V5	Samba Masuri							Samba Masuri					
	V6	-							Swarna					
	V7	Pushyami							Pushyami					
	V8	LC - Subarna							LC - R. Mahsuri-1					
Available N:P:K of soil (kg/ha)		118.75:40.008:116.928							154:14.4:183					

Table 4.1 (f): Contd.

F-levels	Varieties	KARJAT						MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	3.26	10	131	1.60	107		5.36	13	353	4.50	25.12	121	
	V2	3.50	9	112	1.72	103		7.71	3	326	5.09	22.04	107	
	V3	3.73	6	107	1.83	104		8.06	2	368	6.00	32.72	112	
	V4	4.14	2	112	2.03	106		6.66	8	324	3.79	22.34	114	
	V5	2.79	15	137	1.37	107		6.02	10	347	3.11	16.58	111	
	V6	3.61	7	114	1.77	100		4.89	16	397	2.62	20.88	112	
	V7	2.77	16	102	1.36	105		6.61	9	320	4.87	22.11	107	
	V8	2.93	14	145	1.44	97		5.26	14	349	3.26	16.86	112	
F2	V1	3.80	5	136	1.87	109	4.32	5.68	12	333	3.96	26.56	120	3.20
	V2	3.60	8	117	1.77	103	0.80	9.09	1	326	5.26	22.39	108	13.80
	V3	4.12	3	115	2.02	105	3.12	7.29	5	368	5.32	32.09	111	-7.70
	V4	4.41	1	122	2.17	107	2.16	7.37	4	379	3.88	22.86	114	7.10
	V5	3.12	13	144	1.53	107	2.64	6.67	7	386	3.03	17.23	111	6.50
	V6	4.00	4	125	1.96	101	3.12	5.10	15	374	3.44	21.68	112	2.10
	V7	3.13	12	109	1.54	105	2.88	6.78	6	332	5.62	22.93	107	1.70
	V8	3.19	11	155	1.56	99	2.08	5.85	11	401	2.90	16.67	112	5.90
Interaction														
F at same V		0.11		1.8	0.05	0.73		NS		NS	NS	NS	NS	
V at same F		0.14		1.69	0.07	1.01		NS		NS	NS	NS	NS	
F1		3.34	2	120	1.64	104		6.32	2	348	4.16	22.33	112	
F2		3.67	1	128	1.80	105	2.64	6.73	1	362	4.18	22.80	112	4.08
C.D.(0.05)		0.12		0.18	0.06	NS		NS		NS	NS	NS	NS	
C.V.(%)		2.64		0.12	3.03	0.73		8.06		4.89	6.07	2.61	0.26	

Table 4.1 (f): Contd.

F-levels	Varieties	KARJAT						MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	Mean of varieties:													
	V1	3.53	5	134	1.74	108	4.32	5.52	7	343	4.23	25.84	121	3.20
	V2	3.55	4	115	1.75	103	0.80	8.40	1	326	5.18	22.22	108	13.80
	V3	3.93	2	111	1.93	105	3.12	7.68	2	368	5.66	32.41	112	-7.70
	V4	4.28	1	117	2.10	107	2.16	7.02	3	351	3.84	22.60	114	7.10
	V5	2.96	7	140	1.45	107	2.64	6.35	5	367	3.07	16.91	111	6.50
	V6	3.81	3	120	1.87	101	3.12	5.00	8	385	3.03	21.28	112	2.10
	V7	2.95	8	106	1.45	105	2.88	6.70	4	326	5.25	22.52	107	1.70
	V8	3.06	6	150	1.50	98	2.08	5.56	6	375	3.08	16.77	112	5.90
	C.D.(0.05)	0.08		1.28	0.04	0.52		1.13		40.37	0.62	1.23	0.72	
	C.V. (%)	1.92		0.87	1.9	0.42		14.64		9.61	12.53	4.6	0.54	
	Expt. Mean	**3.51**		**124**	**1.72**	**104**		**6.53**		**355**	**4.17**	**22.6**	**112**	
	Soil type	-						Red Sandy Loam						
	pH	-						6.75						
	N - levels (kg/ha)													
	F1	150:50:50						100:50:50						
	F2	225:75:75						150:75:75						
	Recomnd N:P:K (kg/ha)	150:50:50						100:50:50						
	Varieties													
	V1	IET 26927						IET 26927						
	V2	IET 26974						IET 26974						
	V3	IET 25948						IET 25948						
	V4	IET 26948						IET 26948						
	V5	Samba Masuri						Samba Masuri						
	V6	Swarna						Swarna						
	V7	Pushyami						Pushyami						
	V8	LC - Karjat 2						LC - BPT 5204						
	Available N:P:K (kg/ha)	-						398:105:280						

Table 4.1 (f): Contd.

F-levels	Varieties	NAGINA							PUSA			
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.62	4	322	3.64	26.74	122		3.06	14	258	
	V2	4.53	6	324	3.60	26.69	120		3.18	12	264	
	V3	4.47	7	322	3.56	25.90	123		3.01	16	263	
	V4	4.46	8	320	3.59	26.70	120		3.32	10	265	
	V5	4.23	15	301	3.48	26.42	114		3.13	13	261	
	V6	4.19	16	294	3.20	26.36	113		3.31	11	263	
	V7	4.24	14	293	2.95	26.42	116		3.02	15	259	
	V8	4.28	13	295	3.52	26.31	116		3.65	7	271	
F2	V1	4.76	1	298	3.65	27.10	124	1.27	3.47	9	271	3.73
	V2	4.72	2	343	3.61	26.70	120	1.73	3.71	4	272	4.82
	V3	4.59	5	325	3.58	25.92	127	1.09	3.70	5	270	6.27
	V4	4.64	3	324	3.56	26.70	120	1.64	3.78	3	272	4.18
	V5	4.44	9	314	3.50	26.43	115	1.91	3.69	6	269	5.09
	V6	4.39	11	305	3.21	26.38	114	1.82	4.08	2	278	7.00
	V7	4.37	12	309	2.96	26.44	116	1.18	3.48	8	267	4.18
	V8	4.41	10	322	3.52	26.32	117	1.18	4.67	1	287	9.27
Interaction												
F at same V		NS		NS	NS	NS	NS		NS		NS	
V at same F		NS		NS	NS	NS	NS		NS		NS	
F1		4.38	2	309	3.44	26.44	118		3.21	2	263	
F2		4.54	1	317	3.45	26.50	119	1.48	3.82	1	273	5.57
C.D.(0.05)		0.09		NS	NS	NS	NS		0.27		NS	
C.V.(%)		1.57		3.84	0.43	0.6	1.12		6.19		9.77	

Table 4.1 (f): Contd.

F-levels	Varieties	NAGINA							PUSA			
		Grain Yield (t/ha)	**Rank**	**Panicle/m^2 (No.)**	**Panicle wt(g)**	**Test wt(g)**	**Days 50% flowering**	**Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)**	**Grain Yield (t/ha)**	**Rank**	**Panicle/m^2 (No.)**	**Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)**
Mean of varieties:												
V1		4.69	1	310	3.65	26.92	123	1.27	3.27	7	264	3.73
V2		4.63	2	333	3.61	26.70	120	1.73	3.45	4	268	4.82
V3		4.53	4	324	3.57	25.91	125	1.09	3.36	6	267	6.27
V4		4.55	3	322	3.58	26.70	120	1.64	3.55	3	269	4.18
V5		4.34	5	307	3.49	26.43	115	1.91	3.41	5	265	5.09
V6		4.29	7	300	3.21	26.37	114	1.82	3.70	2	271	7.00
V7		4.31	6	301	2.96	26.43	116	1.18	3.25	8	263	4.18
V8									4.16	1	279	9.27
C.D.(0.05)		0.11		18.74	0.01	0.17	1.61		0.28		NS	
C.V. (%)		2.08		5.06	0.32	0.55	1.15		6.63		4.07	
Expt. Mean		**4.48**		**314**	**3.44**	**26.49**	**119**		**3.52**		**268**	
Soil type		-							-			
pH		7.70							-			
N - levels (kg/ha)												
F1		120:60:40							120:60:40			
F2		180:90:60							180:90:60			
Recommended N:P:K (kg/ha)		120:60:40							120:60:40			
Varieties												
V1		IET 26927							IET 26927			
V2		IET 26974							IET 26974			
V3		IET 25948							IET 25948			
V4		IET 26948							IET 26948			
V5		Samba Masuri							Samba Masuri			
V6		Swarna							Swarna			
V7		Pushyami							Pushyami			
V8		LC - NDR 8002							LC - Rajendra Mahsuri			
Available N:P:K of soil (kg/ha)		21:18.33:209							-			

Table 4.1 (f): Contd.

F-levels	Varieties	MARUTERU							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
F1	V1	6.38	4	290	5.64	20.21	116		4.89	13
	V2	7.03	2	299	5.71	22.41	118		5.36	5
	V3	6.2	6	286	5.53	20.19	115		5.40	4
	V4	6.02	7	283	4.23	20.14	114		5.34	6
	V5	5.1	14	288	3.97	14.72	112		4.58	16
	V6	5.67	10	290	4.31	18.5	111		4.82	14
	V7	5.52	11	277	5.31	20.2	113		4.95	12
	V8	-		-	-	-	-		4.74	15
F2	V1	6.5	3	295	5.76	20.25	119	0.89	5.27	8
	V2	7.38	1	295	5.88	22.4	120	2.59	5.87	1
	V3	5.98	8	288	5.65	20.2	117	-1.63	5.62	3
	V4	6.25	5	290	5.53	20.16	116	1.70	5.70	2
	V5	5.26	12	291	4.29	14.78	114	1.19	4.98	11
	V6	5.11	13	278	4.01	18.7	112	-4.15	5.10	10
	V7	5.84	9	290	4.41	20.22	115	2.37	5.29	7
	V8	-		-	-	-	-		5.19	9
Interaction										
F at same V		NS		NS	0.22	NS	NS			
V at same F		NS		NS	0.25	NS	NS			
F1		5.99	2	288	4.96	19.48	114		5.04	2
F2		6.05	1	290	5.08	19.53	116	0.42	5.41	1
C.D.(0.05)		NS		NS	NS	NS	NS			
C.V.(%)		10.69		5.94	2.94	0.64	1.75			

Table 4.1 (f): Contd.

F-levels	Varieties	MARUTERU Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt(g)	Test wt(g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Over all mean	Rank
Mean of varieties:										
	V1	6.44	2	293	5.70	20.23	118	0.89	5.08	5
	V2	7.21	1	297	5.80	22.41	119	2.59	5.61	1
	V3	6.09	4	287	5.59	20.20	116	-1.63	5.51	3
	V4	6.14	3	287	4.88	20.15	115	1.70	5.52	2
	V5	5.18	7	290	4.13	14.75	113	1.19	4.78	8
	V6	5.39	6	284	4.16	18.60	112	-4.15	4.96	7
	V7	5.68	5	284	4.86	20.21	114	2.37	5.12	4
	V8	-		-	-	-	-		5.05	6
C.D.(0.05)		0.41		NS	0.15	0.79	3.7			
C.V. (%)		5.72		10.25	2.55	3.4	2.7			
Expt. Mean		**6.02**		**289**	**5.02**	**19.51**	**115**		**5.23**	
Soil type		Delta alluvial								
pH		7.16								
N - levels (kg/ha)										
F1		90:60:60								
F2		135:90:90								
Recommended N:P:K (kg/ha)		90:60:60								
Varieties										
V1		IET 26927								
V2		IET 26974								
V3		IET 25948								
V4		IET 26948								
V5		Samba Masuri								
V6		Swarna								
V7		Pushyami								
V8		-								
Available N:P:K of soil (kg/ha)		151:36:257								

NMT 1(g) MS

Five entries (IET 26549, IET 27136, IET 25802, IET 25798 and IET 24990) of medium slender group were evaluated for their response to levels of nutrients on grain yield at seven different locations i.e., **Dhangain (120:60:40), Karjat (100:50:50), Kaul (150:60:60), Mandya (100:50:50), Nagina (120:60:40), Raipur (120:60:40)** and **Maruteru (90:60:60)** under two levels of RDF (100% and 150% RDF). The details and data received from these locations are summarized and presented in Table 4.1 (g).

RDF doses significantly influenced the grain yield at four locations (**Dhangain, Karjat, Mandya** and **Raipur**) and the maximum increase in grain yield was observed with 150% RDF at most of the location except at **Nagina, Kaul** and **Maruteru**. Application of 150% RDF recorded higher green yield at **Dhangain** (6.48 t/ha), **Karjat** (3.91 t/ha), **Mandya** (7.37 t/ha) and **Raipur** (6.40 t/ha). Average over the locations, higher mean grain yield of 5.98 t/ha was recorded with 150% RDF and was 8.5% higher than yield obtained with 100% RDF. Higher nutrient response was recorded with 150% RDF at Dhangain (8.34), **Karjat** (5.92), **Mandya** (7.00) and **Raipur** (6.83).

Grain yield differences among the tested varieties were found significant at all the locations. Significantly higher mean maximum grain yield was recorded by IET 25802 at **Kaul** (8.84 t/ha) and **Nagina** (5.11 t/ha) while IET 24990 at **Maruteru** (6.08 t/ha). The interaction effect between fertilizer levels and varieties was found to be non-significant at all the locations except **Raipur**. Mean over the locations, cultivar IET 25802 (6.24 t/ha) was found to be high yielder followed by IET 25798 (5.94 t/ha) and IET 26549 (5.91 t/ha).

In this trial, application of 150% RDF was found to be promising and also exhibited higher nutrient recovery. Entries like IET 25802, IET 25798 and IET 26549 were found to be promising with better yields over other test entries.

Table 4.1(g): Summary of data on grain yield and ancillary characters of selected NMT MS cultures grown under transplanted conditions at low and medium recommended fertilizer doses, kharif 2019.

F-levels	Varieties	DHANGAIN						KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	6.03	8	290	4.19	104		3.07	17	201	1.86	25.37	103	
	V2	5.38	12	275	4.08	101		3.16	15	208	1.90	24.33	99	
	V3	5.98	9	286	4.08	101		3.41	14	214	2.04	24.90	104	
	V4	5.12	15	260	3.34	88		3.12	16	196	1.86	25.80	94	
	V5	5.17	14	285	3.37	103		4.08	5	187	2.44	24.60	99	
	V6	-		-	-	-		-		-	-	-	-	
	V7	6.37	4	291	5.29	99		3.62	9	204	2.15	23.67	97	
	V8	5.07	16	279	3.08	95		4.19	3	197	2.48	23.30	96	
	V9	5.37	13	277	3.37	104		3.69	8	226	2.19	22.80	102	
	V10	-		-	-	-		2.60	18	183	1.53	22.27	110	
F2	V1	7.25	2	296	5.04	106	11.09	3.62	9	204	2.19	25.53	103	6.88
	V2	6.30	5	286	4.48	103	8.36	3.62	9	210	2.18	24.53	100	5.75
	V3	6.88	3	295	4.57	103	8.18	3.93	6	216	2.35	25.13	105	6.50
	V4	6.12	7	267	3.72	92	9.09	3.50	13	198	2.09	26.07	95	4.75
	V5	6.20	6	292	4.07	105	9.36	4.42	2	190	2.65	24.90	101	4.25
	V6	-		-	-	-		-		-	-	-	-	
	V7	7.58	1	300	5.37	101	11.00	4.12	4	207	2.45	23.87	99	6.25
	V8	5.88	10	294	3.33	96	7.36	4.61	1	200	2.73	23.53	97	5.25
	V9	5.62	11	289	3.08	106	2.27	3.86	7	230	2.30	23.07	103	2.13
	V10	-		-	-	-		3.52	12	187	2.07	22.50	111	11.50
Interaction														
F at same V		NS		NS	NS	NS		NS		NS	NS	NS	0.84	
V at same F		NS		NS	NS	NS		NS		NS	NS	NS	0.81	
F1		5.56	2	280	3.85	99		3.44	2	202	2.05	24.12	100	
F2		6.48	1	290	4.21	102	8.34	3.91	1	205	2.33	24.35	102	5.92
C.D.(0.05)		0.04		NS	NS	0.31		0.05		0.84	0.03	0.06	0.16	
C.V.(%)		0.55		6.06	19.86	0.25		1.18		0.35	1.26	0.19	0.13	

Table 4.1(g): Contd.

F-levels	Varieties	DHANGAIN						KARJAT						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:														
V1		6.64	2	293	4.62	105	11.09	3.35	7	202	2.03	25.45	103	6.88
V2		5.84	4	280	4.28	102	8.36	3.39	6	209	2.04	24.43	100	5.75
V3		6.43	3	291	4.33	102	8.18	3.67	5	215	2.20	25.02	104	6.50
V4		5.62	6	264	3.53	90	9.09	3.31	8	197	1.98	25.94	95	4.75
V5		5.69	5	289	3.72	104	9.36	4.25	2	189	2.55	24.75	100	4.25
V6		-		-	-	-		-		-	-	-	-	0.00
V7		6.98	1	295	5.33	100	11.00	3.87	3	206	2.30	23.77	98	6.25
V8		5.48	8	287	3.21	96	7.36	4.40	1	199	2.61	23.42	97	5.25
V9		5.50	7	283	3.23	105	2.27	3.78	4	228	2.25	22.94	103	2.13
V10		-		-	-	-		3.06	9	185	1.80	22.39	111	11.50
C.D.(0.05)		0.56		15.37	1.13	0.7		0.17		1.77	0.1	0.24	0.6	
C.V. (%)		7.85		4.56	23.75	0.59		3.92		0.75	3.88	0.83	0.51	
Expt. Mean		**6.02**		**285**	**4.03**	**100**		**3.67**		**203**	**2.19**	**24.23**	**101**	
Soil type		Loamy						-						
pH		6.80						-						
N - levels (kg/ha)														
F1		120:60:40						100:50:50						
F2		180:60:40						150:75:75						
Recomnd N:P:K (kg/ha)		120:60:40						100:50:50						
Varieties														
V1		IET 26549						IET 26549						
V2		IET 27136						IET 27136						
V3		IET 25802						IET 25802						
V4		IET 25798						IET 25798						
V5		IET 24990						IET 24990						
V6		DRRH 3						DRRH 3						
V7		27 P 63						27 P 63						
V8		KRH 4						KRH 4						
V9		WGL 14						WGL 14						
V10		-						LC - Karjat 184						
Available N:P:K (kg/ha)		154:14.4:183						-						

Table 4.1(g): Contd.

F-levels	Varieties	KAUL						MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	6.9	10	330	2.35	19.53		7.56	3	382	3.92	18.77	104	
	V2	7.06	6	343	2.24	23.97		7.03	9	370	3.59	18.37	99	
	V3	8.76	2	327	2.99	23.10		7.07	8	318	4.88	24.02	109	
	V4	8.55	4	322	2.97	25.40		6.15	15	322	4.22	24.53	92	
	V5	5.69	14	274	2.35	21.07		6.25	13	345	3.37	18.47	105	
	V6	-		-	-	-		6.23	14	413	3.52	20.31	95	
	V7	7	7	255	3.04	24.50		-		-	-	-	-	
	V8	6.74	11	317	2.40	19.37		6.04	16	348	3.94	17.94	105	
	V9	4.54	16	267	1.91	19.70		7.03	9	327	4.17	18.85	99	
	V10	-		-	-	-		-		-	-	-	-	
F2	V1	6.94	9	339	2.27	19.50	0.30	8.11	2	436	3.96	18.09	105	5.50
	V2	7.09	5	342	2.27	24.27	0.22	7.22	6	385	3.77	19.51	99	1.90
	V3	8.91	1	337	2.98	22.97	1.11	7.30	4	360	4.67	23.98	109	2.30
	V4	8.61	3	323	2.93	25.10	0.44	7.16	7	303	4.01	23.97	93	10.10
	V5	5.74	13	274	2.37	21.13	0.37	6.50	12	308	3.53	20.09	104	2.50
	V6	-		-	-	-		7.26	5	377	4.17	19.93	95	10.30
	V7	6.73	12	260	3.02	24.20	-2.00	-		-	-	-	-	
	V8	6.96	8	320	2.39	19.40	1.63	6.74	11	347	3.69	18.21	105	7.00
	V9	4.66	15	267	1.95	19.60	0.89	8.67	1	362	3.88	18.61	99	16.40
	V10	-		-	-	-								
Interaction														
F at same V		NS		NS	NS	NS		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS		NS		NS	NS	NS	NS	
F1		6.91	2	304	2.53	22.08		6.67	2	353	3.95	20.16	101	
F2		6.96	1	308	2.52	22.02	0.37	7.37	1	360	3.96	20.30	101	7.00
C.D.(0.05)		NS		NS	NS	NS		0.37		NS	NS	NS	NS	
C.V.(%)		2.2		10.45	5.15	6.6		4.26		2.24	7.16	6.75	0.66	

Table 4.1(g): Contd.

F-levels	Varieties	KAUL						MANDYA						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:														
V1		6.92	4	335	2.31	19.52	0.30	7.84	2	409	3.94	18.43	105	5.50
V2		7.08	3	343	2.26	24.12	0.22	7.13	4	377	3.68	18.94	99	1.90
V3		8.84	1	332	2.99	23.04	1.11	7.19	3	339	4.78	24.00	109	2.30
V4		8.58	2	323	2.95	25.25	0.44	6.66	6	312	4.12	24.25	93	10.10
V5		5.72	7	274	2.36	21.10	0.37	6.38	8	327	3.45	19.28	104	2.50
V6		-		-	-	-		6.75	5	395	3.85	20.12	95	10.30
V7		6.87	5	258	3.03	24.35	-2.00	-		-	-	-	-	
V8		6.85	6	318	2.40	19.39	1.63	6.39	7	347	3.82	18.08	105	7.00
V9		4.60	8	267	1.93	19.65	0.89	7.85	1	344	4.03	18.73	99	16.40
V10		-		-	-	-								
C.D.(0.05)		0.8		37.02	0.17	2.27		0.68		49.35	0.38	2	0.73	
C.V. (%)		9.76		10.23	5.75	8.72		8.24		11.71	8.13	8.36	0.61	
Expt. Mean		**6.93**		**306**	**2.53**	**22.05**		**7.02**		**356**	**3.96**	**20.23**	**101**	
Soil type		Clay loam						Red sandy loam						
pH		8.10						6.54						
N - levels (kg/ha)														
F1		150:60:60						100:50:50						
F2		225:90:90						150:75:75						
Recomnd N:P:K (kg/ha)		150:60:60						100:50:50						
Varieties														
V1		IET 26549						IET 26549						
V2		IET 27136						IET 27136						
V3		IET 25802						IET 25802						
V4		IET 25798						IET 25798						
V5		IET 24990						IET 24990						
V6		-						DRRH 3						
V7		27 P 63						-						
V8		KRH 4						KRH 4						
V9		WGL 14						WGL 14						
V10		LC - Karjat 184						-						
Available N:P:K (kg/ha)		160:16:420						361:98:273						

Table 4.1(g): Contd.

F-levels	Varieties	NAGINA Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	RAIPUR Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.85	7	321	3.16	26.34	113		5.57	12	280	3.27	17.03	100	
	V2	4.69	10	312	3.36	26.38	104		4.39	16	271	3.80	19.31	98	
	V3	5.00	4	297	3.36	26.39	112		6.54	7	215	5.35	22.57	98	
	V4	4.83	9	306	3.48	26.42	91		5.79	9	268	3.85	22.63	85	
	V5	4.85	7	299	3.20	26.36	107		5.79	9	249	4.49	17.40	97	
	V6	4.54	14	290	3.52	26.31	109		5.80	8	264	3.73	18.07	95	
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	4.56	13	320	3.42	26.20	102		6.82	3	259	4.73	21.00	91	
	V9	4.37	16	318	3.38	26.28	107		4.46	15	271	3.08	16.43	100	
	V10	-		-	-	-	-		-		-	-	-	-	
F2	V1	5.13	2	338	3.16	26.36	114	2.55	5.59	11	284	3.38	17.60	100	0.18
	V2	4.95	5	317	3.38	26.39	106	2.36	5.54	13	274	3.97	19.36	97	10.45
	V3	5.21	1	311	3.43	26.40	114	1.91	6.78	4	255	5.69	22.60	98	2.18
	V4	4.92	6	337	3.50	26.43	95	0.82	7.46	1	271	4.09	22.87	85	15.18
	V5	5.08	3	313	3.21	26.38	108	2.09	6.73	5	253	4.52	17.48	97	8.55
	V6	4.62	11	336	3.52	26.32	109	0.73	6.66	6	271	4.14	18.13	94	7.82
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	4.61	12	330	3.46	26.27	104	0.45	7.01	2	311	4.80	21.10	90	1.73
	V9	4.47	15	321	3.45	26.29	108	0.91	5.40	14	289	3.45	16.73	100	8.55
	V10	-		-	-	-	-		-		-	-	-	-	
Interation															
F at same V		NS		NS	0.03	NS	NS		0.61		NS	NS	NS	NS	
V at same F		NS		NS	0.04	NS	NS		0.64		NS	NS	NS	NS	
F1		4.71	2	308	3.36	26.34	106		5.65	2	259	4.04	19.31	96	
F2		4.87	1	326	3.39	26.36	107	1.48	6.40	1	276	4.26	19.48	95	6.83
C.D.(0.05)		NS		12.74	NS	NS	0.31		0.34		8.59	0.19	NS	0.18	
C.V.(%)		3.18		3.24	0.77	0.13	0.23		4.6		2.58	3.59	3.18	0.15	

Table 4.1(g): Contd.

F-levels	Varieties	NAGINA							RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:															
	V1	4.99	2	330	3.16	26.35	114	2.55	5.58	6	282	3.33	17.32	100	0.18
	V2	4.82	5	315	3.37	26.39	105	2.36	4.97	7	273	3.89	19.34	97	10.45
	V3	5.11	1	304	3.40	26.40	113	1.91	6.66	2	235	5.52	22.59	98	2.18
	V4	4.88	4	321	3.49	26.43	93	0.82	6.63	3	269	3.97	22.75	85	15.18
	V5	4.97	3	306	3.21	26.37	107	2.09	6.26	4	251	4.51	17.44	97	8.55
	V6	4.58	7	313	3.52	26.32	109	0.73	6.23	5	267	3.94	18.10	95	7.82
	V7	-		-	-	-	-		-		-	-	-	-	
	V8	4.59	6	325	3.44	26.24	103	0.45	6.92	1	285	4.77	21.05	91	1.73
	V9	4.42	8	320	3.42	26.29	108	0.91	4.93	8	280	3.27	16.58	100	8.55
	V10	-		-	-	-	-		-		-	-	-	-	
C.D.(0.05)		0.16		NS	0.02	0.02	1.02		0.43		19.74	0.33	0.61	0.72	
C.V. (%)		2.85		4.75	0.51	0.07	0.81		6.11		6.24	6.76	2.66	0.64	
Expt. Mean		**4.79**		**317**	**3.37**	**26.35**	**106**		**6.02**		**268**	**4.15**	**19.39**	**95**	
Soil type		-							Clay loam						
pH		7.70							7.20						
N - levels (kg/ha)															
F1		120:60:40							120:60:40						
F2		180:90:60							180:90:60						
Recomnd N:P:K (kg/ha)		120:60:40							120:60:40						
Varieties															
V1		IET 26549							IET 26549						
V2		IET 27136							IET 27136						
V3		IET 25802							IET 25802						
V4		IET 25798							IET 25798						
V5		IET 24990							IET 24990						
V6		DRRH 3							DRRH 3						
V7		-							-						
V8		KRH 4							KRH 4						
V9		WGL 14							WGL 14						
V10		-							-						
Available N:P:K (kg/ha)		21:18.33:209							172.4:23.4:452.7						

Table 4.1(g): Contd.

F-levels	Varieties	MARUTERU Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Over all mean	Rank
F1	V1	5.91	6	293	3.83	18.12	104		5.70	10
	V2	5.84	8	291	3.76	16.2	98		5.36	17
	V3	5.63	10	275	3.59	15.51	97		6.06	5
	V4	5.74	9	281	3.69	15.89	100		5.61	11
	V5	5.92	5	295	3.83	16.48	100		5.39	16
	V6	-		-	-	-	-		5.52	14
	V7	5.33	16	261	3.35	15.53	101		5.58	12
	V8	5.55	12	268	3.53	15.24	99		5.57	13
	V9	5.43	14	264	3.43	15.63	103		4.98	18
	V10	-		-	-	-	-		2.60	20
F2	V1	6.23	1	302	4.24	18.14	105	3.05	6.12	4
	V2	6.22	3	298	4.11	16.21	100	3.62	5.85	8
	V3	5.91	6	296	3.89	15.55	98	2.67	6.42	1
	V4	6.03	4	297	4.01	15.9	102	2.76	6.26	2
	V5	6.23	1	301	4.21	16.5	103	2.95	5.84	9
	V6	-		-	-	-	-		6.18	3
	V7	5.4	15	270	3.58	15.51	102	0.67	5.96	6
	V8	5.6	11	284	3.69	15.25	102	0.48	5.92	7
	V9	5.51	13	278	3.6	15.66	105	0.76	5.46	15
	V10	-		-	-	-	-		3.52	19
Interation										
F at same V		NS		NS	NS	NS	NS			
V at same F		NS		NS	NS	NS	NS			
F1		5.67	2	279	3.63	16.08	100		5.51	2
F2		5.89	1	291	3.92	16.09	102	2.12	5.98	1
C.D.(0.05)		NS		11.34	0.21	NS	1.24			
C.V.(%)		6.56		3.21	4.46	2.79	0.99			

Table 4.1(g): Contd.

F-levels	Varieties	MARUTERU Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Over all mean	Rank
Mean of varieties:										
	V1	6.07	2	298	4.04	18.13	105	3.05	5.91	3
	V2	6.03	3	295	3.94	16.21	99	3.62	5.61	8
	V3	5.77	5	286	3.74	15.53	98	2.67	6.24	1
	V4	5.89	4	289	3.85	15.90	101	2.76	5.94	2
	V5	6.08	1	298	4.02	16.49	102	2.95	5.62	7
	V6	-		-	-	-	-		5.85	4
	V7	5.37		266	3.47	15.52	102	0.67	5.77	5
	V8	5.58	6	276	3.61	15.25	101	0.48	5.74	6
	V9	5.47	7	271	3.52	15.65	104	0.76	5.22	9
	V10	-		-	-	-	-		3.06	10
C.D.(0.05)		0.43		19.74	0.33	0.61	0.72			
C.V. (%)		6.11		6.24	6.76	2.66	0.64			
Expt. Mean		**5.78**		**285**	**3.77**	**16.08**	**101**		5.74	
Soil type		Delta alluvial								
pH		7.16								
N - levels (kg/ha)										
	F1	90:60:60								
	F2	135:90:90								
Recommended N:P:K (kg/ha)		90:60:60								
Varieties										
	V1	IET 26549								
	V2	IET 27136								
	V3	IET 25802								
	V4	IET 25798								
	V5	IET 24990								
	V6	-								
	V7	27 P 63								
	V8	KRH 4								
	V9	WGL 14								
	V10	-								
Available N:P:K of soil (kg/ha)		151:36:257								

NMT 1(i) AL and ISTVT

Saline tolerant culture (IET 27077) was evaluated for its response to different levels of nutrients on grain yield at four different locations i.e. **Kanpur (120:60:50), Lucknow (150:60:40), Navsari (120:30:0)** and **Rajendranagar (120:60:40)**. The details and data received from these locations are summarized and presented in Table 4.1(i).

Different RDF doses significantly influenced the grain yield at both locations (**Kanpur** and **Lucknow**) and maximum increase in grain yield was observed with 150% RDF (2.77 to 5.25 t/ha) respectively. Application of 150% RDF recorded higher grain yields at **Kanpur** (2.77 t/ha) and **Lucknow** (5.25 t/ha) and higher nutrient response was recorded at **Kanpur** (5.71) and **Lucknow** (4.67).

Grain yield differences among the tested cultures were found to be significant at all the location except **Kanpur**. IET 27077 recorded higher yield at **Lucknow** (5.24 t/ha), **Navsari** (6.73 t/ha) and **ARI-Rajendranagar** (5.47 t/ha). Higher nutrient response was noted with IET 27077 at **Navsari** (6.00). Interaction effects among RFD x varieties on grain yield was found to be non-significant at all locations. Mean over the locations, IET 27077 was found promising with highest grain yield (5.81 t/ha)

In this trial, 150% RDF was found to be promising and also exhibited higher nutrient recovery, IET 27077 (5.81 t/ha) was found to be promising entry and recorded higher grain yield at most of the locations over other test entries.

Table 4.1(i): Summary of data on grain yield and ancillary characters of selected NMT AL&ISTVT cultures grown under transplanted conditions at low and medium recommended fertilizer doses, kharif 2019.

F-levels	Varieties	KANPUR							LUCKNOW						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	2.22	5	277	1.36	27.65	77		4.97	6	342	3.88	24.63	104	
	V2	2.09	6	307	1.36	22.72	95		3.78	12	255	2.69	23.47	87	
	V3	-		-	-	-	-		4.78	11	294	2.90	22.97	96	
	V4	-		-	-	-	-		4.85	7	323	3.77	20.00	99	
	V5	2.04	7	280	1.39	23.99	99		4.80	10	279	3.75	17.07	95	
	V6	1.99	8	312	1.31	26.15	86		4.83	8	275	3.42	17.73	103	
F2	V1	2.91	1	284	1.51	28.19	79	5.75	5.51	1	438	3.99	22.57	104	4.32
	V2	2.66	4	313	1.59	23.87	92	4.75	4.82	9	352	4.02	19.17	86	8.32
	V3	-		-	-	-	-		5.17	5	424	3.85	19.83	93	3.12
	V4	-		-	-	-	-		5.45	2	396	3.61	21.80	97	4.80
	V5	2.73	3	280	1.69	24.44	90	5.75	5.28	3	307	3.87	18.57	91	3.84
	V6	2.78	2	319	1.63	27.45	89	6.58	5.28	3	310	3.50	21.83	106	3.60
Interation															
F at same V		NS		NS	0.04	0.14	1.62		NS		34.41	0.58	2.28	NS	
V at same F		NS		NS	0.03	0.17	1.91		NS		34.96	0.7	2.99	NS	
F1		2.09	2	294	1.36	25.13	89		4.67	2	295	3.40	20.98	97	
F2		2.77	1	299	1.61	25.99	87	5.71	5.25	1	371	3.81	20.63	96	4.67
C.D.(0.05)		0.41		3.19	0.01	0.14	1.64		0.57		19.51	NS	NS	NS	
C.V.(%)		9.72		0.61	0.41	0.32	1.06		8.07		4.09	11.44	9.22	0.91	
Mean of varieties:															
V1		2.57	1	280	1.44	27.92	78	5.75	5.24	1	390	3.94	23.60	104	4.32
V2		2.38	4	310	1.48	23.30	94	4.75	4.30	6	303	3.36	21.32	86	8.32
V3		-		-	-	-	-		4.98	5	359	3.38	21.40	95	3.12
V4		-		-	-	-	-		5.15	2	359	3.69	20.90	98	4.80
V5		2.39	2	280	1.54	24.22	94	5.75	5.04	4	293	3.81	17.82	93	3.84
V6		2.39	2	316	1.47	26.80	87	6.58	5.06	3	292	3.46	19.78	105	3.60
C.D.(0.05)		NS		3.75	0.03	0.1	1.15		0.31		24.33	0.41	1.61	2.94	
C.V. (%)		5.26		1	1.43	0.31	1.03		5.13		6.07	9.37	6.44	2.53	
Expt. Mean		**2.43**		**296**	**1.48**	**25.56**	**88**		**4.96**		**333**	**3.60**	**20.80**	**97**	

Table 4.1(i): Contd.

F-levels	Varieties	KANPUR Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	LUCKNOW Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Sandy loam							-						
pH		9.80							8.90						
N - levels (kg/ha)															
F1		120:60:60							150:60:40						
F2		180:90:90							225:90:60						
Recommended N:P:K (kg/ha)		120:60:60							150:60:40						
Varieties															
V1		IET 27077							IET 27077						
V2		CSR-10							CSR-10						
V3		-							CSR-23						
V4		-							CSR-36						
V5		Jaya							Jaya						
V6		Local Check - NDR 312							Local Check						
Available N:P:K of soil (kg/ha)		148.3:22.9: 265.1							116.32:28:336.12						

Table 4.1(i): Contd.

F-levels	Varieties	NAVSARI							Rajendranagar - ARI						Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
F1	V1	6.50	2	304	3.16	20.14	104		5.29	2	327	2.39	18.23		5.59	2
	V2	5.30	8	271	2.82	26.88	95		4.43	6	364	1.26	20.73		4.50	12
	V3	5.40	6	318	2.77	23.84	96		-		-	-	-		5.09	7
	V4	5.10	12	262	3.26	30.77	97		-		-	-	-		4.98	9
	V5	5.29	9	258	3.14	28.63	93		4.24	8	228	3.22	22.57		4.78	11
	V6	5.90	4	298	3.22	22.37	97		4.25	7	235	3.49	11.63		4.99	8
F2	V1	6.95	1	347	3.61	20.09	105	6.00	5.64	1	353	2.93	18.90	3.18	6.03	1
	V2	5.39	7	310	3.31	27.19	93	1.20	4.54	5	392	1.26	23.93	1.00	4.92	10
	V3	5.27	10	338	3.25	23.90	97	-1.73	-		-	-	-		5.22	5
	V4	5.67	5	276	3.29	30.66	95	7.60	-		-	-	-		5.56	3
	V5	5.19	11	287	3.25	28.92	95	-1.33	5.02	3	300	3.26	23.33	7.09	5.16	6
	V6	6.18	3	314	3.39	22.52	97	3.73	5.02	3	284	4.07	12.13	7.00	5.49	4
Interation																
F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS			
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS			
F1		5.58	2	285	3.06	25.44	97		4.55	2	288	2.59	18.29		4.93	2
F2		5.78	1	312	3.35	25.55	97	2.58	5.06	1	332	2.88	19.57	4.57	5.36	1
C.D.(0.05)		NS		22.37	0.28	NS	NS		NS		14.61	NS	NS			
C.V.(%)		9.58		5.22	6.02	2.82	0.45		11.14		2.68	12.6	14.26			
Mean of varieties:																
V1		6.73	1	326	3.39	20.12	105	6.00	5.47	1	340	2.66	18.57	3.18	5.81	1
V2		5.35	4	291	3.07	27.04	94	1.20	4.49	4	378	1.26	22.33	1.00	4.71	6
V3		5.34	5	328	3.01	23.87	97	-1.73	-		-	-	-		5.16	4
V4		5.39	3	269	3.28	30.72	96	7.60	-		-	-	-		5.27	2
V5		5.24	6	272	3.20	28.78	94	-1.33	4.63	3	264	3.24	22.95	7.09	4.97	5
V6		6.04	2	306	3.31	22.45	97	3.73	4.64	2	259	3.78	11.88	7.00	5.24	3
C.D.(0.05)		0.75		27.51	0.16	0.28	1.55		0.6		61.2	0.85	2.09			
C.V. (%)		10.9		7.65	4.09	0.9	1.33		10		15.68	24.76	8.76			
Expt. Mean		**5.68**		**299**	**3.21**	**25.49**	**97**		**4.80**		**310**	**2.74**	**18.93**		5.15	

Table 4.1(i): Contd.

F-levels	Varieties	NAVSARI							Rajendranagar - ARI						Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
Soil type		-							Clay loam							
pH		8.51							7.99							
N - levels (kg/ha)																
F1		120:30:0							120:60:40							
F2		180:45:90							180:90:60							
Recommended N:P:K (kg/ha)		120:30:0							120:60:40							
Varieties																
V1		IET 27077							IET 27077							
V2		CSR-10							CSR-10							
V3		CSR-23							-							
V4		CSR-36							-							
V5		Jaya							Jaya							
V6		Local Check - Dandi							Local Check - RNR 15048							
Available N:P:K of soil (kg/ha)		255:57:1184							226:109:689							

NMT 1(j) RSL

AVT-2 entry (IET 26692) was evaluated for its response to levels nutrients on grain yield at five locations i.e. **Chinsurah (80:40:40), Dhangain (120:60:40), Faizabad (80:40:40), Ghaghraghat (60:30:30) and Pusa (120:60:40)** under two levels of RDF (100% and 150% RDF). The details and data received from these locations are summarized and presented in Table 4.1(j).

RDF doses of nutrient application significantly influenced the grain yield at both the locations **Chinsurah** and **Ghaghraghat** and the maximum increase in grain yield was recorded with 150% RDF (4.73 and 3.44 t/ha respectively). Higher nutrient response at 150% RDF was recorded at both these locations (6.62 and 7.00 kg grain / kg nutrient).

Grain yield differences among the tested varieties were significant at all the locations except **Ghaghraghat**. Significantly higher mean maximum grain yield was recorded by IET 26692 at **Chinsurah** (5.20 t/ha), **Dhangain** (7.47 t/ha), **Pusa** (3.57 t/ha) and **Faizabad** (3.34 t/ha). Interaction effects among RFD x varieties was found to be non-significant at all the locations. Mean over the location, IET 26692 recorded maximum grain yield of 4.67 t/ha over other cultivars.

In this trial, 150% RDF was found to be promising and also exhibited higher nutrient recovery efficiency. IET 26692 was found to be promising in terms of grain yield and nutrient response at most of the locations.

Table 4.1.1(j): Summary of data on grain yield and ancillary characters of selected NMT RSL cultures grown under transplanted conditions at low and medium of recommended fertilizer doses, kharif 2019.

F-levels	Varieties	CHINSURAH					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.86	3	323	3.10	118	
	V2	-		-	-	-	
	V3	3.73	7	311	3.28	120	
	V4	3.46	8	298	3.07	120	
	V5	4.73	4	5	3.13	120	
F2	V1	5.54	1	343	3.64	119	8.50
	V2	-		-	-	-	
	V3	4.07	5	309	3.14	120	4.25
	V4	4.04	6	311	3.08	121	7.25
	V5	5.25	2	336	3.33	120	6.50
Interaction							
F at same V		NS		33.26	0.23	NS	
V at same F		NS		36.33	0.32	NS	
F1		4.20	2	234	3.15	120	
F2		4.73	1	325	3.30	120	6.62
C.D.(0.05)		0.15		28.08	NS	NS	
C.V.(%)		1.91		5.72	5.74	0.34	
Mean of varieties:							
V1		5.20	1	333	3.37	119	8.50
V2		-		-	-	-	
V3		3.90	3	310	3.21	120	4.25
V4		3.75	4	305	3.08	121	7.25
V5		4.99	2	170	3.23	120	6.50
C.D.(0.05)		0.44		23.52	0.16	1.03	
C.V. (%)		7.92		6.69	4	0.68	
Expt. Mean		**4.46**		**279**	**3.22**	**120**	
Soil type		Clay loam					
pH		7.85					
N - levels (kg/ha)							
F1		80:40:40					
F2		120:60:60					
Recommended N:P:K (kg/ha)		80:40:40					
Varieties							
V1		IET 26692					
V2		-					
V3		Pooja					
V4		Savithri					
V5		LC - Rajdeep					
Available N:P:K of soil (kg/ha)		530:116:364					

Table 4.1.1(j): Contd.

F-levels	Varieties	DHANGAIN Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days to 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	7.17	2	291	3.56	106	
	V2	-		-	-	-	
	V3	5.12	6	287	3.25	118	
	V4	4.98	8	283	2.55	103	
	V5	5.10	7	272	3.08	121	
F2	V1	7.77	1	302	4.38	109	5.45
	V2	-		-	-	-	
	V3	5.82	3	298	4.35	120	6.36
	V4	5.65	4	292	2.64	104	6.09
	V5	5.56	5	282	3.14	123	4.18
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
F1		5.59	2	283	3.11	112	
F2		6.20	1	294	3.63	114	5.52
C.D.(0.05)		NS		NS	NS	1.24	
C.V.(%)		6.05		6.7	18.55	0.63	
Mean of varieties:							
V1		7.47	1	297	3.97	107	5.45
V2		-		-	-	-	
V3		5.47	2	293	3.80	119	6.36
V4		5.32		288	2.60	103	6.09
V5		5.33	3	277	3.11	122	4.18
C.D.(0.05)		0.49		NS	1	0.63	
C.V. (%)		6.55		5.39	23.66	0.44	
Expt. Mean		**5.90**		**289**	**3.37**	**113**	
Soil type		Loamy					
pH		6.80					
N - levels (kg/ha)							
F1		120:60:40					
F2		180:90:60					
Recommended N:P:K (kg/ha)		120:60:40					
Varieties							
V1		IET 26692					
V2		-					
V3		Pooja					
V4		Savithri					
V5		LC - MTU 7029					
Available N:P:K of soil (kg/ha)		154:14.4:183					

Table 4.1.1(j): Contd.

		FAIZABAD						
F-levels	**Varieties**	**Grain Yield (t/ha)**	**Rank**	**Panicle/m^2 (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Days to 50% flowering**	**Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)**
F1	V1	3.19	2	254	3.47	24.47	113	
	V2	-		-	-	-	-	
	V3	2.01	8	255	2.63	20.97	113	
	V4	2.17	7	261	2.87	21.43	107	
	V5	2.90	4	257	3.10	22.17	102	
F2	V1	3.49	1	267	3.77	24.63	112	3.75
	V2	-		-	-	-	-	
	V3	2.57	5	267	2.80	21.80	110	7.00
	V4	2.54	6	266	3.03	21.60	106	4.63
	V5	2.93	3	265	3.27	23.37	106	0.38
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
F1		2.57	2	257	3.02		109	
F2		2.88	1	266	3.22		108	3.94
C.D.(0.05)		NS		8.88	0.06	0.07	NS	
C.V.(%)		6.89		1.93	1.13	0.18	2.61	
Mean of varieties:								
V1		3.34	1	260	3.62	24.55	112	3.75
V2		-		-	-	-	-	
V3		2.29	4	261	2.72	21.39	112	7.00
V4		2.36	3	264	2.95	21.52	107	4.63
V5		2.92	2	261	3.19	22.77	104	0.38
				267				
C.D.(0.05)		0.25		NS	0.13	0.37	2.35	
C.V. (%)		7.18		1.19	3.36	1.31	1.72	
Expt. Mean		**2.73**		**261**	**3.12**	**22.56**	**109**	
Soil type		Sandy loam						
pH		7.60						
N - levels (kg/ha)								
F1		80:40:40						
F2		120:60:60						
Recommended N:P:K (kg/ha)		80:40:40						
Varieties								
V1		IET 26692						
V2		-						
V3		Pooja						
V4		Savithri						
V5		LC - Narendra 8002						
Available N:P:K of soil (kg/ha)		200:24:234						

Table 4.1.1(j): Contd.

F-levels	Varieties	GHAGHRAGHAT Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	3.63	2	181	2.67	
	V2	3.00	8	172	2.70	
	V3	2.84	9	167	2.51	
	V4	2.42	10	154	2.83	
	V5	3.22	6	178	2.04	
F2	V1	3.94	1	194	2.95	5.17
	V2	3.36	4	180	2.72	6.00
	V3	3.44	3	174	2.49	10.00
	V4	3.19	7	161	3.05	12.83
	V5	3.28	5	187	2.30	1.00
Interation						
F at same V		NS		NS	NS	
V at same F		NS		NS	NS	
F1		3.02	2	171	2.55	
F2		3.44	1	179	2.70	7.00
C.D.(0.05)		0.23		NS	0.05	
C.V.(%)		4.56		6.29	1.11	
Mean of varieties:						
V1		3.79	1	188	2.81	5.17
V2		3.18	3	176	2.71	6.00
V3		3.14	4	171	2.50	10.00
V4		2.81	5	158	2.94	12.83
V5		3.25	2	183	2.17	1.00
C.D.(0.05)		NS		16.3	0.3	
C.V. (%)		19.2		7.61	9.41	
Expt. Mean		**3.23**		**175**	**2.63**	
Soil type		Sandy loam				
pH		8.06				
N - levels (kg/ha)						
F1		60:30:30				
F2		90:45:45				
Recommended N:P:K (kg/ha)		60:30:30				
Varieties						
V1		IET 26692				
V2		Dhanrasi				
V3		Pooja				
V4		Savithri				
V5		LC - Sambha Sub-1				
Available N:P:K of soil (kg/ha)		-				

Table 4.1.1(j): Contd.

F-levels	Varieties	PUSA Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Over all mean	Rank
F1	V1	3.28	2	300		4.43	2
	V2	-		-		3.00	10
	V3	2.46	8	283		3.23	8
	V4	2.64	7	290		3.13	9
	V5	2.74	6	292		3.74	5
F2	V1	3.85	1	309	5.18	4.92	1
	V2	-		-		3.36	7
	V3	2.81	5	294	3.18	3.74	4
	V4	3.07	4	297	3.91	3.70	6
	V5	3.26	3	301	4.73	4.06	3
Interation							
F at same V		NS		NS			
V at same F		NS		NS			
F1		2.78	2	291		3.63	2
F2		3.25	1	300	4.25	4.10	1
C.D.(0.05)		NS		8.15			
C.V.(%)		11.84		1.57			
Mean of varieties:							
V1		3.57	1	305	5.18	4.67	1
V2		-		-		3.18	5
V3		2.64	4	289	3.18	3.49	3
V4		2.86	3	294	3.91	3.42	4
V5		3.00	2	297	4.73	3.90	2
C.D.(0.05)		0.31		NS			
C.V. (%)		8.27		5.25			
Expt. Mean		**3.01**		**296**		3.87	
Soil type		-					
pH		-					
N - levels (kg/ha)							
F1		120:60:40					
F2		180:90:20					
Recommended N:P:K (kg/ha)		120:60:40					
Varieties							
V1		IET 26692					
V2		-					
V3		Pooja					
V4		Savithri					
V5		LC - Rajshree					
Available N:P:K of soil (kg/ha)		-					

NMT 1 (k) Basmati Trials

Basmati cultures two (IET 26995 and IET 26999) were evaluated for their response to nutrients and grain yield at twelve different locations i.e., **Chatha (30:20:10), Dhangain (120:60:40), Faizabad (60:30:30), Kanpur (90:30:30), Kaul (90:30:0), Kota (120:60:40), Ludhiana (80:0:0), Nagina (120:60:40), Navsari (100:30:0), Pantnagar (120:60:40), Raipur (60:50:50)** and **Rewa (100:60:40)** under two different RFD. The details and data received from these locations are summarized and presented in Table 4.1(k).

Different RDF doses (optimum and higher doses of NDR) significantly influenced the grain yield at five out of twelve locations (**Chatha**, **Kanpur, Pantnagar, Raipur** and **Rewa**) and the maximum increase in grain yield was observed at most the locations. Application of 150% RDF recorded higher grain yields at **Chatha** (3.59 t/ha), **Kanpur** (2.16 t/ha) **Pantnagar** (3.65 t/ha), **Raipur** (4.34 t/ha) and **Rewa** (5.37 t/ha). Higher nutrient response was recorded with 150% RFD at **Chatha** (14.53).

Grain yield differences among the tested cultures were significant at all the locations. Significantly higher mean maximum grain yield was recorded by popular varieties at most of the locations. While, Tulasi (3.10 t/ha to 3.90 t/ha) at **Chatha, Dhangain** and **Navsari** and Sugandamati (3.94 t/ha) at **Pantnagar**. Among the IET cultures, IET 26995 (3.34 t/ha) at **Faizabad** and IET 26999 (2.79 to 6.75 t/ha) at **Kanpur, Ludhian, Nagina Kaul, Raipur** and **Rewa**. Mean our the locations, IET 26999 found promising (4.16 t/ha) followed by IET 26995 (3.64 t/ha).

In this trial, application of 150% RFD followed by 100% RFD was found to be promising and also exhibited higher nutrient recovery. Cultures IET 26999 and IET 26995 were found to be promising over rest of the tested entries with better response and grain yields obtained at different locations.

Table 4.1.1(k): Summary of data on grain yield and ancillary characters of selected NMT BT cultures grown under transplanted conditions at low and medium recommended fertilizer doses, kharif 2019.

F-levels	Varieties	CHATHA						DHANGAIN					
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	3.24	6	248	1.61	19.63		2.58	7	281	2.63	68	
	V2	3.19	9	240	1.58	19.37		3.25	4	290	3.69	81	
	V3	3.24	6	257	1.55	19.37		2.10	8	275	2.52	91	
	V4	3.45	5	272	1.62	20.00		3.37	3	299	4.04	86	
	V5	2.67	10	197	1.46	18.40		-		-	-	-	
F2	V1	3.77	1	294	2.29	20.30	-104.23	3.18	5	288	3.48	69	-20.27
	V2	3.62	4	254	2.56	19.43	-102.71	3.70	2	293	4.01	83	-25.85
	V3	3.64	3	261	2.23	20.07	-104.36	2.62	6	282	2.95	94	-16.47
	V4	3.74	2	273	2.44	20.47	-111.26	4.42	1	310	4.21	87	-26.22
	V5	3.20	8	247	1.57	19.40	-85.80	-		-	-	-	
Interaction													
F at same V		NS		17.08	NS	NS		NS		NS	NS	NS	
V at same F		NS		25.08	NS	NS		NS		NS	NS	NS	
F1		3.16	2	243	1.56	19		2.83	2	286	3.22	81	
F2		3.59	1	266	2.22	20	14.53	3.48	1	293	3.66	83	5.95
C.D.(0.05)		0.19		NS	0.24	0.39		NS		NS	NS	0.72	
C.V.(%)		3.51		6.41	7.98	1.28		15.31		2.21	14.72	0.5	
Mean of varieties:													
V1		3.51	2	271	1.95	20	-104.23	2.88	3	285	3.06	69	-20.27
V2		3.41	4	247	2.07	19	-102.71	3.48	2	291	3.85	82	-25.85
V3		3.44	3	259	1.89	20	-104.36	2.36	4	279	2.74	93	-16.47
V4		3.60	1	273	2.03	20	-111.26	3.90	1	305	4.13	87	-26.22
V5		2.94	5	222	1.52	19	-85.80	-		-	-	-	
C.D.(0.05)		0.2		12.07	0.25	0.29		0.28		11.82	1.02	0.51	
C.V. (%)		4.86		3.88	10.8	1.19		7.07		3.24	23.53	0.5	
Expt. Mean		**3.38**		**254**	**1.89**	**19.64**		**3.15**		**290**	**3.44**	**82.38**	

Table 4.1.1(k): Contd.

F-levels	Varieties	CHATHA						DHANGAIN					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Clay loam						Loamy					
pH		8.03						6.80					
N - levels (kg/ha)													
F1		30:20:10						120:60:40					
F2		45:30:15						180:90:60					
Recommended N:P:K (kg/ha)		30:20:10						120:60:40					
Varieties													
V1		IET 26995						IET 26995					
V2		IET 26999						IET 26999					
V3		Sugandhamati						Sugandhamati					
V4		Tulasi						Tulasi					
V5		LC - Basmati 370						-					
Available N:P:K of soil (kg/ha)		245:14.3:146.3						154:14.4:183					

Table 4.1.1(k): Contd.

F-levels	Varieties	FAIZABAD Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	KANPUR Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	3.39	1	256	2.79	23.70	98		1.39	9	315	1.67	25.73	73	
	V2	3.19	3	258	2.49	22.37	97		2.59	3	307	1.64	23.21	73	
	V3	2.18	9	257	2.43	22.53	100		2.78	2	243	1.30	19.33	82	
	V4	1.98	10	258	1.50	21.53	96		1.97	6	281	1.50	27.16	67	
	V5	2.67	6	257	2.66	23.60	97		1.46	8	265	1.36	19.16	71	
F2	V1	3.29	2	267	2.58	24.00	97	-1.25	1.83	7	342	2.62	26.87	74	3.67
	V2	3.09	4	267	3.20	23.07	97	-1.25	2.98	1	327	2.58	24.05	72	3.25
	V3	2.30	7	265	2.27	22.83	102	1.50	2.23	5	265	1.68	20.55	83	-4.58
	V4	2.24	8	264	2.67	21.80	99	3.25	2.54	4	283	2.50	28.15	68	4.75
	V5	2.99	5	271	3.09	23.93	97	4.00	1.20	10	257	1.71	19.98	74	-2.17
Interaction															
F at same V		NS		NS	0.3	NS	1.09		0.23		7.98	0.02	0.11	NS	
V at same F		NS		NS	0.29	NS	1.42		0.23		9.79	0.02	0.13	NS	
F1		2.68	2	257	2.37	22.75	98		2.04	2	282	1.49	22.92	73	
F2		2.78	1	267	2.76	23.13	98	1.25	2.16	1	295	2.22	23.92	74	0.98
C.D.(0.05)		NS		7.89	0.13	0.13	NS		0.12		8.55	0.01	0.11	1.03	
C.V.(%)		5.82		1.92	3.31	0.36	0.85		3.52		1.89	0.49	0.29	0.89	
Mean of varieties:															
V1		3.34	1	261	2.69	23.85	98	-1.25	1.61	4	328	2.15	26.30	74	3.67
V2		3.14	2	262	2.85	22.72	97	-1.25	2.79	1	317	2.11	23.63	73	3.25
V3		2.24	4	261	2.35	22.68	101	1.50	2.51	2	254	1.49	19.94	83	-4.58
V4		2.11	5	261	2.09	21.67	97	3.25	2.26	3	282	2.00	27.66	68	4.75
V5		2.83	3	264	2.88	23.77	97	4.00	1.33	5	261	1.54	19.57	73	-2.17
C.D.(0.05)		0.25		NS	0.21	0.17	0.77		0.16		5.64	0.01	0.08	1.67	
C.V. (%)		7.34		0.95	6.77	0.62	0.64		6.42		1.6	0.62	0.27	1.85	
Expt. Mean		**2.73**		**262**	**2.57**	**22.94**	**98**		**2.10**		**288**	**1.86**	**23.42**	**74**	

Table 4.1.1(k): Contd.

F-levels	Varieties	FAIZABAD							KANPUR						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Sandy Loam							Sandy Loam						
pH		7.60							7.89						
N - levels (kg/ha)															
F1		80:40:40							120:60:60						
F2		120:60:60							180:90:90						
Recommended N:P:K (kg/ha)		80:40:40							120:60:60						
Varieties															
V1		IET 26995							IET 26995						
V2		IET 26999							IET 26999						
V3		Sugandhamati							Sugandhamati						
V4		Tulasi							Tulasi						
V5		LC - Narendra mahak							LC - Ram Raj						
Available N:P:K of soil (kg/ha)		200:24:234							237.8:18.2:172						

Table 4.1.1(k): Contd.

F-levels	Varieties	KAUL						LUDHIANA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	5.60	4	330	1.90	25.93		3.78	6	244	2.92	27.59	81	
	V2	6.59	2	265	2.76	24.67		5.22	1	213	3.54	23.63	100	
	V3	-		-	-	-		-		-	-	-	-	
	V4	-		-	-	-		-		-	-	-	-	
	V5	3.40	6	268	1.45	28.47		4.00	4	216	2.84	24.36	101	
F2	V1	6.05	3	344	1.97	26.03	6.00	3.91	5	257	2.80	27.57	81	6.50
	V2	6.90	1	280	2.79	24.77	4.13	5.04	2	222	3.45	24.04	101	-9.00
	V3	-		-	-	-		-		-	-	-	-	
	V4	-		-	-	-		-		-	-	-	-	
	V5	3.88	5	288	1.47	28.60	6.40	4.24	3	227	2.85	24.38	101	12.00
Interaction														
F at same V		NS		NS	NS	NS		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS		NS		NS	NS	NS	NS	
F1		5.20	2	288	2.04	26.36		4.33	2	224	3.10	25.19	94	
F2		5.61	1	304	2.08	26.47	5.51	4.40	1	235	3.03	25.33	94	3.17
C.D.(0.05)		NS		NS	NS	NS		NS		NS	NS	NS	NS	
C.V.(%)		9.38		7.24	8.88	4.68		7.99		5.11	8.31	2.24	0.75	
Mean of varieties:														
V1		5.83	2	337	1.94	25.98	6.00	3.85	3	251	2.86	27.58	81	6.50
V2		6.75	1	273	2.78	24.72	4.13	5.13	1	218	3.50	23.84	101	-9.00
V3		-		-	-	-		-		-	-	-	-	
V4		-		-	-	-		-		-	-	-	-	
V5		3.64	3	278	1.46	28.54	6.40	4.12	2	221	2.85	24.37	101	12.00
C.D.(0.05)		0.85		45.13	0.19	1.92		0.42		17.02	0.36	0.86	0.94	
C.V. (%)		11.81		11.46	6.79	5.46		7.29		5.56	8.72	2.56	0.75	
Expt. Mean		**5.40**		**296**	**2.06**	**26.41**		**4.37**		**230**	**3.07**	**25.26**	**94**	

Table 4.1.1(k): Contd.

F-levels	Varieties	KAUL						LUDHIANA						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Clay loam						Sandy loam						
pH		8.10						7.80						
N - levels (kg/ha)														
F1		90:30:30						40:0:0						
F2		135:45:45						60:0:0						
Recommended N:P:K (kg/ha)		90:30:30						40:0:0						
Varieties														
V1		IET 26995						IET 26995						
V2		IET 26999						IET 26999						
V3		-						-						
V4		-						-						
V5		LC - Pusa Basmati 1121						LC - Pusa Basmati 1121						
Available N:P:K of soil (kg/ha)		160:16:420						225-21.8-273						

Table 4.1.1(k): Contd.

F-levels	Varieties	NAGINA							NAVSARI						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.66	4	355	2.86	23.52	107		3.16	5	264	2.37	27.14	79	
	V2	4.79	2	374	2.84	23.48	105		3.38	4	287	2.80	24.62	93	
	V3	4.06	8	305	2.71	21.41	91		2.77	8	236	3.01	20.81	93	
	V4	4.16	7	312	2.67	23.70	83		3.58	2	174	4.15	32.12	77	
	V5	-		-	-	-	-		-		-	-	-	-	
F2	V1	4.74	3	361	2.88	23.54	108	0.73	3.01	7	275	2.40	27.57	80	-2.31
	V2	4.8	1	373	2.87	23.49	106	0.09	3.13	6	278	3.00	25.87	92	-3.85
	V3	4.23	6	318	2.73	21.46	94	1.55	3.43	3	287	3.13	21.83	94	10.15
	V4	4.29	5	326	2.73	23.71	84	1.18	4.08	1	179	4.10	32.14	83	7.69
	V5	-		-	-	-	-		-		-	-	-	-	
Interaction															
F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	1.53	
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	1.57	
F1		4.42	2	336	2.77	23.03	97		3.22	2	240	3.08	26.17	86	
F2		4.52	1	345	2.80	23.05	98	0.89	3.41	1	255	3.16	26.85	87	2.92
C.D.(0.05)		NS		NS	0	NS	NS		NS		NS	NS	NS	1.08	
C.V.(%)		2.45		3.34	0.07	0.06	0.76		10.36		4.01	6.84	3.68	0.71	
Mean of varieties:															
V1		4.70	2	358	2.87	23.53	108	0.73	3.09	4	269	2.39	27.36	80	-2.31
V2		4.80	1	373	2.86	23.49	106	0.09	3.26	2	282	2.90	25.25	93	-3.85
V3		4.15	4	312	2.72	21.44	93	1.55	3.10	3	261	3.07	21.32	94	10.15
V4		4.23	3	319	2.70	23.71	84	1.18	3.83	1	176	4.13	32.13	80	7.69
V5		-		-	-	-	-		-		-	-	-	-	
C.D.(0.05)		0.11		13.15	0.02	0.03	1.24		0.47		20.92	0.39	1.98	1.08	
C.V. (%)		1.89		3.07	0.46	0.09	1.01		11.33		6.73	9.97	5.94	0.99	
Expt. Mean		**4.47**		**341**	**2.79**	**23.04**	**97**		**3.32**		**247**	**3.12**	**26.51**	**86**	

Table 4.1.1(k): Contd.

F-levels	Varieties	NAGINA Grain Yield (t/ha)	NAGINA Rank	NAGINA Panicle/m² (No.)	NAGINA Panicle wt (g)	NAGINA Test wt (g)	NAGINA Days 50% flowering	NAGINA Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	NAVSARI Grain Yield (t/ha)	NAVSARI Rank	NAVSARI Panicle/m² (No.)	NAVSARI Panicle wt (g)	NAVSARI Test wt (g)	NAVSARI Days 50% flowering	NAVSARI Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		-							Clayey						
pH		7.70							7.85						
N - levels (kg/ha)															
F1		120:60:40							100:30:0						
F2		180:90:60							150:45:0						
Recommended N:P:K (kg/ha)		120:60:40							100:30:0						
Varieties															
V1		IET 26995							IET 26995						
V2		IET 26999							IET 26999						
V3		Sugandhamati							Sugandhamati						
V4		Tulasi							Tulasi						
V5		-							-						
Available N:P:K of soil (kg/ha)		21:18.33:209							21:18.33:209						

Table 4.1.1(k): Contd.

F-levels	Varieties	PANTNAGAR							RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	3.15	8	226	1.68	27.88	87		2.85	8	217	2.23	31.57	75	
	V2	3.17	7	229	1.60	20.94	97		4.65	3	212	3.52	25.20	87	
	V3	3.87	2	242	1.84	21.41	94		3.41	6	170	3.44	24.60	92	
	V4	3.56	4	233	1.76	26.96	92		4.49	4	188	3.45	34.43	90	
	V5	-		-	-	-	-		-		-	-	-	-	
F2	V1	3.43	6	248	1.99	27.55	87	2.55	3.40	7	247	2.28	31.80	75	6.88
	V2	3.53	5	246	2.00	21.14	95	3.27	4.73	2	228	3.68	25.10	87	1.00
	V3	4.00	1	239	2.03	21.84	90	1.18	3.60	5	210	3.51	24.70	92	2.38
	V4	3.63	3	245	1.74	27.02	90	0.64	5.64	1	218	3.59	34.90	90	14.38
	V5	-		-	-	-	-		-		-	-	-	-	
Interaction															
F at same V		NS		NS	NS	NS	NS		0.41		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS		0.47		NS	NS	NS	NS	
F1		3.44	2	232	1.72	24.30	93		3.85	2	197	3.16	28.95	86	
F2		3.65	1	245	1.94	24.39	91	1.91	4.34	1	226	3.27	29.13	86	6.16
C.D.(0.05)		0.18		NS	0.22	NS	1.29		0.39		20.79	NS	NS	NS	
C.V.(%)		2.89		7.83	6.81	3.96	0.8		5.41		5.6	3.46	2.65	0.63	
Mean of varieties:															
V1		3.29	4	237	1.84	27.72	87	2.55	3.13	4	232	2	32	75	6.88
V2		3.35	3	238	1.80	21.04	96	3.27	4.69	2	220	4	25	87	1.00
V3		3.94	1	241	1.94	21.63	92	1.18	3.51	3	190	3	25	92	2.38
V4		3.60	2	239	1.75	26.99	91	0.64	5.07	1	203	4	35	90	14.38
V5		-		-	-	-	-		-		-	-	-	-	
C.D.(0.05)		0.25		NS	0.12	0.6	1.26		0.29		17.72	0.22	0.88	0.96	
C.V. (%)		5.69		5.32	5.04	1.95	1.09		5.68		6.67	5.51	2.42	0.89	
Expt. Mean		**3.54**		**238**	**1.83**	**24.34**	**92**		**4.10**		**211**	**3.21**	**29.04**	**86**	

Table 4.1.1(k): Contd.

F-levels	Varieties	PANTNAGAR							RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Soil type		Silt loan							Clay loam						
pH		7.60							7.20						
N - levels (kg/ha)															
F1		120:60:40							60:50:50						
F2		180:90:60							90:75:75						
Recommended N:P:K (kg/ha)		120:60:40							60:50:50						
Varieties															
V1		IET 26995							IET 26995						
V2		IET 26999							IET 26999						
V3		Sugandhamati							Sugandhamati						
V4		Tulasi							Tulasi						
V5		-							-						
Available N:P:K of soil (kg/ha)		230:22.01:215							172.4:23.4:452.7						

Table 4.1.1(k): Contd.

F-levels	Varieties	REWA Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Over all mean	Rank
F1	V1	4.50	5	263	3.07	25.00	81		3.48	6
	V2	4.50	5	300	3.03	26.03	83		4.05	2
	V3	-		-	-	-	-		3.05	10
	V4	-		-	-	-	-		3.32	7
	V5	4.83	4	287	3.13	26.27	79		3.17	9
F2	V1	5.23	3	301	3.60	24.63	86	7.30	3.80	4
	V2	5.47	1	309	3.50	25.90	86	9.70	4.27	1
	V3	-		-	-	-	-		3.26	8
	V4	-		-	-	-	-		3.82	3
	V5	5.40	2	297	3.27	26.50	85	5.70	3.49	5
Interaction										
F at same V		NS		NS	NS	NS	NS			
V at same F		NS		NS	NS	NS	NS			
F1		4.61	2	283	3.08	25.77	81		3.62	2
F2		5.37	1	303	3.46	25.68	86	7.57	3.94	1
C.D.(0.05)		0.13		NS	0.31	NS	0.48			
C.V.(%)		1.25		7.3	4.73	1.08	0.28			
Mean of varieties:										
V1		4.87	3	282	3.34	24.82	84	7.30	3.64	2
V2		4.99	2	305	3.27	25.97	85	9.70	4.16	1
V3		-		-	-	-	-		3.15	5
V4		-		-	-	-	-		3.57	3
V5		5.12	1	292	3.20	26.39	82	5.70	3.33	4
C.D.(0.05)		NS		NS	NS	0.74	NS			
C.V. (%)		4.32		6.57	3.23	2.17	2.88			
Expt. Mean		**4.99**		**293**	**3.27**	**25.72**	**83**		3.78	

Table 4.1.1(k): Contd.

F-levels	Varieties	REWA Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Over all mean	Rank
Soil type		-								
pH		6.2								
N - levels (kg/ha)										
F1		100:60:40								
F2		150:90:60								
Recommended N:P:K (kg/ha)		100:60:40								
Varieties										
V1		IET 26995								
V2		IET 26999								
V3										
V4										
V5		LC - IR 64								
Available N:P:K of soil (kg/ha)		302:19.8:416								

NMT 1(l) Biofortified

AVT-2 entry (IET 27179) was evaluated for its response to different levels of nutrients (100% and 150% RDF) on grain yield from thirteen locations viz., **Chinsurah (80:40:40), Coimbatore (150:60:40), IIRR (120:60:40), Kaul (150:60:60), Mandya (100:50:50), Nagina (120:60:40), Nawagam (100:25:0), Pantnagar (120:60:40), Raipur (100:60:40), Rajendranagar (120:60:40), Rewa (120:60:40) Maruteru (90:60:60) and Varanasi (120:60:60).** The details and data received from these locations are summarized and presented in Table 4.1(l).

Application of different nutrient levels registered significantly higher grain yield at **Chinsurah, Mandya, Nawagam, Raipur, Rajendranagar** and **Rewa**. Application of 150% RDF recorded significantly higher grain yields at **Chinsurah** (4.65 t/ha), **Mandya** (5.43 t/ha), **Nawagam** (5.55 t/ha), **Raipur** (4.35 t/ha), **Rajendranagar** (3.83 t/ha) ,**Rewa** (5.55 t/ha) and Varanasi(2.61 t/ha) . Higher nutrient response was recorded with 150% RDF over 100% RDF at **Chinsurah** (8.83), **Mandya** (4.68), **Nawagam** (15.60), **Raipur** (8.50), **Rajendranagar** (4.85) , **Rewa** (5.88) and **Varanasi** (2.28) indicating higher nutrient application for better yields.

Grain yield differences among the tested cultures were found to be significant at all the locations except at **Rajendranagar** and **Maruteru**. Highest grain yield was recorded by IET 27179 at **Chinsurah** (4.93 t/ha), **Coimbatore** (5.50 t/ha), **Mandya** (7.09 t/ha), **Nagina** (4.11 t/ha) **Raipur** (5.57 t/ha) and **Varanasi** (3.81 t/ha) . Mean over the locations, IET 27179 (4.70 t/ha) performed better and was found superior over local check - Kalanamak (3.43 t/ha)). Interaction effects among RDF x varieties was found to be non-significant at all the locations except at **Pantnagar** and **Raipur** where significant interaction was noted. Application of 150% RDF with cultivar IET 27179 and BPT 5204 found promising in recording better yields.

In this trial, mean over the locations nutrient management with 150% had higher grain yield. IET 27179 and BPT 5204 were found to be promising and recorded higher mean grain yield over the locations.

Table 4.1(l): Summary of data on grain yield and ancillary characters of selected NMT Bio-fortifed cultures grown under transplanted conditions at medium & high levels of recommended fertilizer doses, kharif 2019.

		CHINSURAH						COIMBATORE						
F-levels	Varieties	Grain Yield (t/ha)	Rank	Panicle /m^2 (No.)	Panicle wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/ m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.56	5	293	3.55	89		5.41	3	346	3.97	23.2	101	
	V2	3.75	8	270	3.64	95		5.28	4	339	2.84	14.5	98	
	V3	3.92	7	316	2.72	108		3.90	8	365	1.34	15.5	98	
	V4	4.64	4	275	3.25	84		4.51	6	344	2.18	23.4	88	
	V5	2.85	10	284	2.78	98		3.64	9	335	1.93	21.3	108	
F2	V1	5.30	1	309	4.83	90	-51.70	5.58	1	351	4.06	23.4	102	-37.70
	V2	4.83	3	313	3.97	95	-42.05	5.53	2	343	2.88	14.7	99	-36.71
	V3	4.18	6	327	3.22	110	-44.82	4.01	7	377	1.79	15.6	98	-27.19
	V4	5.22	2	280	3.42	84	-52.78	4.67	5	355	2.55	23.6	88	-31.41
	V5	3.71	9	230	3.00	98	-31.92	3.62	10	348	1.86	21.4	108	-25.50
Interaction														
F at same V		NS		NS	NS	NS		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS		NS		NS	NS	NS	NS	
F1		3.94	2	288	3.19	95		4.55	2	346	2.45	19.6	99	
F2		4.65	1	292	3.69	95	8.80	4.68	1	355	2.63	19.7	99	1.07
C.D.(0.05)		0.51		NS	0.12	NS		NS		NS	NS	NS	NS	
C.V.(%)		7.51		5.01	2.26	0.51		1.91		4.95	10.55	0.67	0.18	
Mean of varieties:														
V1		4.93	1	301	4.19	90	-51.70	5.50	1	349	4.02	23.3	102	-37.70
V2		4.29	3	292	3.81	95	-42.05	5.41	2	341	2.86	14.6	99	-36.71
V3		4.05	4	321	2.97	109	-44.82	3.96	4	371	1.57	15.6	98	-27.19
V4		4.93	1	278	3.34	84	-52.78	4.59	3	349	2.37	23.5	88	-31.41
V5		3.28	5	257	2.89	98	-31.92	3.63	5	341	1.90	21.4	108	-25.50
C.D.(0.05)		0.36		26.21	0.43	0.84		0.26		18.48	0.34	0.25	0.54	
C.V. (%)		6.78		7.39	10.26	0.72		4.58		4.31	10.81	1.04	0.44	
Expt. Mean		**4.30**		**290**	**3.44**	**95.20**		**4.62**		**350**	**2.54**	**19.7**	**98.93**	
Soil type		Clay loam						Clay loam						
pH		7.87						8.02						
N - levels (kg/ha)														
F1		80:40:40						150:50:50						
F2		120:60:60						225:75:75						
Recommended N:P:K (kg/ha)		80:40:40						150:50:50						
Varieties														
V1		IET 27179						IET 27179						
V2		BPT 5204						BPT 5204						
V3		Chittimuthyalu						Chittimuthyalu						
V4		IR 64						IR 64						
V5		Kalanamak						Kalanamak						
Available N:P:K of soil (kg/ha)		560:54:307						193:30:616						

Table 4.1(l): Cntd….

F-levels	Varieties	IIRR Grain Yield (t/ha)	IIRR Rank	IIRR Panicle /m² (No.)	IIRR Panicle wt (g)	IIRR Test wt (g)	IIRR Days 50% flowering	IIRR Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	KAUL Grain Yield (t/ha)	KAUL Rank	KAUL Panicle/m² (No.)	KAUL Panicle wt (g)	KAUL Test wt (g)	KAUL Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	3.51	8	235	4.07	22.4	106		5.51	6	266	2.31	25.43	
	V2	3.64	6	334	2.17	18.1	112		6.57	4	309	2.37	25.77	
	V3	3.72	4	286	2.14	17.1	109		4.14	8	308	1.50	14.10	
	V4	3.79	3	287	3.24	22.7	96		7.23	2	304	2.69	28.20	
	V5	3.04	10	257	2.51	20.5	93		3.09	9	293	1.17	14.80	
F2	V1	3.61	7	232	4.33	21.3	108	0.91	5.69	5	268	2.37	25.63	1.33
	V2	3.65	5	351	2.62	18.1	114	0.09	6.77	3	315	2.40	26.03	1.48
	V3	4.01	1	323	2.13	18.1	111	2.64	4.2	7	313	1.51	14.23	0.44
	V4	3.87	2	326	3.68	17.7	103	0.73	7.25	1	313	2.68	28.10	0.15
	V5	3.05	9	281	2.80	20.1	97	0.09	3.09	9	288	1.19	14.83	0.00
Interaction														
F at same V		NS		NS	0.16	2.01	NS		NS		NS	NS	NS	
V at same F		NS		NS	0.15	1.82	NS		NS		NS	NS	NS	
F1		3.54	2	280	2.83	20.2	103		5.31	2	296	2.01	21.66	
F2		3.64	1	303	3.11	19.0	107	0.89	5.40	1	299	2.03	21.76	0.68
C.D.(0.05)		NS		15.96	0.08	0.35	1.31		NS		NS	NS	NS	
C.V.(%)		2.65		3.49	1.61	1.14	0.8		5.39		5.96	1.28	11.53	
Mean of varieties:														
V1		3.56	4	234	4.20	21.8	107	0.91	5.60	3	267	2.34	25.53	1.33
V2		3.65	3	343	2.40	18.1	113	0.09	6.67	2	312	2.39	25.90	1.48
V3		3.87	1	304	2.14	17.6	110	2.64	4.17	4	310	1.51	14.17	0.44
V4		3.83	2	307	3.46	20.2	100	0.73	7.24	1	308	2.69	28.15	0.15
V5		3.05	5	269	2.66	20.3	95	0.09	3.09	5	290	1.18	14.82	0.00
C.D.(0.05)		0.18		11.61	0.11	1.42	2.57		0.45		30.35	0.16	2.01	
C.V. (%)		4.05		3.26	3.11	5.93	2.01		6.83		8.33	6.46	7.57	
Expt. Mean		**3.59**		**291**	**2.97**	**19.6**	**105**		**5.35**		**298**	**2.02**	**21.71**	
Soil type		Black clay							Clay loam					
pH		7.56							8.10					
N - levels (kg/ha)														
F1		120:60:40							150:60:60					
F2		180:90:60							225:90:90					
Recommended N:P:K (kg/ha)		120:60:40							150:60:60					
Varieties														
V1		IET 27179							IET 27179					
V2		BPT 5204							BPT 5204					
V3		Chittimuthyalu							Chittimuthyalu					
V4		IR 64							IR 64					
V5		Kalanamak							Kalanamak					
Available N:P:K of soil (kg/ha)		-							160:16:420					

Table 4.1(I): Cntd….

F-levels	Varieties	MANDYA Grain Yield (t/ha)	Rank	Panicle/ m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	NAGINA Grain Yield (t/ha)	Rank	Panicle/ m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	6.74	4	327	3.87	27.5	95		4.02	2	258	2.16	23.9	99	
	V2	4.70	7	377	2.33	15.9	107		-		-	-	-	-	
	V3	2.00	10	406	1.66	13.3	78		3.41	4	265	2.48	24.9	109	
	V4	6.84	3	358	3.23	25.2	90		-		-	-	-	-	
	V5	4.53	8	321	2.00	16.0	78		3.15	6	244	2.45	17.7	115	
F2	V1	7.43	1	340	4.09	28.0	95	26.60	4.20	1	270	2.16	23.2	99	1.64
	V2	5.19	5	385	2.45	16.1	108	20.00	-		-	-	-	-	
	V3	2.23	9	422	1.79	13.3	78	23.30	3.49	3	255	2.50	24.9	109	0.73
	V4	7.31	2	377	3.44	25.7	91	76.60	-		-	-	-	-	
	V5	4.99	6	340	2.10	16.2	78	43.30	3.28	5	270	2.45	17.8	117	1.18
Interaction															
F at same V		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS	
F1		4.96	2	358	2.62	19.6	90		3.53	2	256	2.36	22.2	108	
F2		5.43	1	373	2.77	19.9	90	4.68	3.66	1	265	2.37	22.0	108	1.18
C.D.(0.05)		0.1		10.06	0.08	0.15	NS		NS		NS	NS	NS	NS	
C.V.(%)		1.21		1.75	1.85	0.47	0.89		1.92		1.96	0.36	2.12	0.38	
Mean of varieties:															
V1		7.09	1	334	3.98	27.8	95	26.60	4.11	1	264	2.16	23.5	99	1.64
V2		4.95	3	381	2.39	16.0	108	20.00	-		-	-	-	-	
V3		2.12	5	414	1.73	13.3	78	23.30	3.45	2	260	2.49	24.9	109	0.73
V4		7.08	2	367	3.34	-	-	76.60	-		-	-	-	-	
V5		4.76	4	330	2.05	16.1	78	43.30	3.22	3	257	2.45	17.7	116	1.18
C.D.(0.05)		0.6		43.85	0.39	2.48	0.74		0.19		NS	0.02	0.87	1.09	
C.V. (%)		9.38		9.81	11.76	10.26	0.68		4.06		6.09	0.62	2.97	0.76	
Expt. Mean		**5.20**		**365**	**2.70**	**18.3**	**89**		**3.59**		**260**	**2.37**	**22.1**	**108**	
Soil type		Red sandy loam							-						
pH		6.98							7.70						
N - levels (kg/ha)															
F1		100:50:50							120:60:40						
F2		150:75:75							180:90:60						
Recommended N:P:K (kg/ha)		100:50:50							120:60:40						
Varieties															
V1		IET 27179							IET 27179						
V2		BPT 5204													
V3		Chittimuthyalu							Chittimuthyalu						
V4		IR 64													
V5		Kalanamak							Kalanamak						
Available N:P:K of soil (kg/ha)		356:89:256							21:18.:209						

Table 4.1(l): Cntd….

F-levels	Varieties	PANTNAGAR							RAIPUR						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	2.57	8	233	1.42	22.4	100		5.07	2	223	4.04	26.1	90	
	V2	4.00	3	269	1.77	21.3	110		-		-	-	-	-	
	V3	2.20	9	226	1.12	23.8	113		2.85	5	236	2.15	12.4	110	
	V4	3.73	4	238	1.76	25.2	87		-		-	-	-	-	
	V5	2.83	6	240	1.42	25.0	111		2.57	6	247	2.70	14.6	99	
F2	V1	2.86	5	193	2.00	22.5	99	2.64	6.06	1	262	4.58	26.4	90	9.90
	V2	5.30	1	298	2.48	22.6	110	11.82	-		-	-	-	-	
	V3	2.17	10	294	0.89	23.6	113	-0.27	3.23	4	293	2.60	12.3	111	3.80
	V4	4.60	2	231	2.48	25.6	87	7.91							
	V5	2.59	7	201	1.73	22.4	109	-2.18	3.75	3	309	3.30	14.4	100	11.80
Interaction															
F at same V		0.5		44.65	NS	0.74	NS		0.28		NS	NS	NS	NS	
V at same F		0.6		62.99	NS	1.01	NS		0.41		NS	NS	NS	NS	
F1		3.07	2	241	1.50	23.5	104		3.50	2	236	2.96	17.7	100	
F2		3.50	1	244	1.92	23.3	103	3.98	4.35	1	288	3.49	17.7	100	8.50
C.D.(0.05)		NS		NS	0.35	NS	NS		0.43		17.11	0.52	NS	NS	
C.V.(%)		9.92		16.43	13.18	2.66	1.68		5.46		3.22	7.88	5.02	0.71	
Mean of varieties:															
V1		2.72	3	213	1.71	22.4	99	2.64	5.57	1	243	4.31	26.3	90	9.90
V2		4.65	1	284	2.13	21.9	110	11.82	-		-	-	-	-	
V3		2.19	5	260	1.01	23.7	113	-0.27	3.04	3	265	2.38	12.4	110	3.80
V4		4.17	2	235	2.12	25.4	87	7.91	-		-	-	-	-	
V5		2.71	4	221	1.58	23.7	110	-2.18	3.16	2	278	3.00	14.5	100	11.80
C.D.(0.05)		0.35		31.57	0.5	0.52	2.26		0.2		16.22	0.26	0.9	0.59	
C.V. (%)		8.8		10.64	23.82	1.82	1.78		3.85		4.65	6.01	3.83	0.44	
Expt. Mean		**3.29**		**242**	**1.71**	**23.4**	**104**		**3.92**		**262**	**3.23**	**17.7**	**100**	
Soil type		Silt loan							Clay loam						
pH		7.60							7.20						
N - levels (kg/ha)															
F1		120:60:40							100:60:40						
F2		180:90:60							150:90:60						
Recommended N:P:K (kg/ha)		120:60:40							100:60:40						
Varieties															
V1		IET 27179							IET 27179						
V2		BPT 5204							-						
V3		Chittimuthyalu							Chittimuthyalu						
V4		IR 64							-						
V5		Kalanamak							Kalanamak						
Available N:P:K of soil (kg/ha)		230:22:215							172:23:452						

Table 4.1(l): Cntd….

F-levels	Varieties	RAJENDRANAGAR - ARI Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	3.50	5	234	4.37	22.93	111	
	V2	3.50	5	335	2.14	12.97	115	
	V3	3.39	8	300	2.09	10.67	113	
	V4	3.43	7	255	3.13	25.77	98	
	V5	2.79	10	278	2.34	15.50	98	
F2	V1	4.46	1	239	4.02	24.00	111	-27.36
	V2	4.11	2	371	2.53	14.83	115	-27.71
	V3	3.72	3	318	2.77	11.23	113	-27.10
	V4	3.37	9	315	3.40	26.07	108	-27.81
	V5	3.62	4	290	2.73	15.63	98	-21.74
Interaction								
F at same V		NS		NS	NS	NS	0.61	
V at same F		NS		NS	NS	NS	0.87	
F1		3.32	2	280	2.81	17.57	107	
F2		3.86	1	307	3.09	18.35	109	4.85
C.D.(0.05)		0.24		NS	NS	NS	0.86	
C.V.(%)		4.17		10.47	14.74	5.7	0.51	
Mean of varieties:								
V1		3.98	1	236	4.20	23.47	111	-27.36
V2		3.81	2	353	2.34	13.90	115	-27.71
V3		3.56	3	309	2.43	10.95	113	-27.10
V4		3.40		285	3.27	25.92	103	-27.81
V5		3.21	5	284	2.54	15.57	98	-21.74
C.D.(0.05)		NS		29.33	0.46	1.65	0.43	
C.V. (%)		15.59		8.16	12.74	7.49	0.33	
Expt. Mean		**3.59**		**294**	**2.95**	**17.96**	**108**	
Soil type		Clay loam						
pH		7.99						
N - levels (kg/ha)								
F1		120:60:40						
F2		180:90:60						
Recommended N:P:K (kg/ha)		120:60:40						
Varieties								
V1		IET 27179						
V2		BPT 5204						
V3		Chittimuthyalu						
V4		IR 64						
V5		Kalanamak						
Available N:P:K of soil (kg/ha)		226:109:689						

Table 4.1(I): Cntd….

F-levels	Varieties	REWA Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
	V1	4.8	9	296	3.33	23.13	79	
	V2	4.97	8	303	3.13	25	82	
	V3	5.1	7	302	2.93	26.03	80	
	V4	5.23	6	296	3.17	24.83	79	
F1	V5	4.7	10	286	3.07	26.03	82	
	V1	5.37	5	301	3.4	24.47	83	5.7
	V2	5.43	4	308	3.53	25.43	85	4.6
	V3	5.77	1	308	3.67	26.23	87	6.7
	V4	5.7	2	304	3.6	26.73	87	4.7
F2	V5	5.47	3	306	3.5	25.17	84	7.7
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
F1		4.96	2	297	3.13	25	80	
F2		5.55	1	305	3.54	25.61	85	5.88
C.D.(0.05)		0.55		NS	0.1	0.52	2.91	
C.V.(%)		6.71		2.34	1.97	1.32	2.24	
Mean of varieties:								
V1		5.09	4	299	3.37	23.8	81	5.7
V2		5.2	3	306	3.33	25.22	84	4.6
V3		5.44	2	305	3.3	26.13	83	6.7
V4		5.47	1	300	3.39	25.78	83	4.7
V5		5.09	4	296	3.29	25.6	83	7.7
C.D.(0.05)		0.26		NS	NS	1	NS	
C.V. (%)		3.99		2.11	7.91	3.23	4.77	
Expt. Mean		**5.25**		**301**	**3.33**	**25.31**	**83**	
Soil type		-						
pH		6.7						
N - levels (kg/ha)								
F1		100:60:40						
F2		150:90:60						
Recommended N:P:K (kg/ha)		100:60:40						
Varieties								
V1		IET 27179						
V2		BPT 5204						
V3		Chittimuthyalu						
V4		IR 64						
V5		Kalanamak						
Available N:P:K of soil (kg/ha)		20:02.2						

Table 4.1(l): Cntd….

F-levels	Varieties	MARUTERU					
		Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	4.65	1	297	2.98	18.85	
	V2						
	V3	4.42	2	292	2.86	15.13	
	V4						
	V5	4.26	3	291	2.66	17.85	
F2	V1	4.18	4	292	2.97	18.88	-40.11
	V2						
	V3	4.16	5	271	2.78	15.15	-37.94
	V4						
	V5	4.01	6	260	2.69	17.84	-36.56
Interaction							
F at same V		NS		NS	NS	NS	
V at same F		NS		NS	NS	NS	
F1		4.44	1	293	2.83	17.28	
F2		4.12	2	274	2.81	17.29	-3.11
C.D.(0.05)		0.25		15.34	NS	NS	
C.V.(%)		2.88		2.66	3.18	1.15	
Mean of varieties:							
V1		4.42	1	295	2.98	18.87	-40.11
V2							
V3		4.29	2	282	2.82	15.14	-37.94
V4							
V5		4.14	3	276	2.68	17.85	-36.56
C.D.(0.05)		NS		NS	NS	0.63	
C.V. (%)		6.57		9.11	12.27	2.72	
Expt. Mean		**4.28**		**284**	**2.82**	**17.28**	
Soil type		Delta alluvial					
pH		7.16					
N - levels (kg/ha)							
F1		90:60:60					
F2		135:90:90					
Recommended N:P:K (kg/ha)		90:60:60					
Varieties							
V1		IET 27179					
V2		-					
V3		Chittimuthyalu					
V4		-					
V5		Kalanamak					
Available N:P:K of soil (kg/ha)		151:36:257					

Table 4.1(l): Cntd….

F-levels	Varieties	VARANASI							Over all mean	Rank
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
F1	V1	3.70	2	236	2.35	24.72	89		4.50	6
	V2								4.55	5
	V3	1.65	5	235	0.66	10.70	105		3.39	9
	V4								4.93	3
	V5	1.63	6	208	1.08	11.94	107		3.26	10
F2	V1	3.91	1	226	2.47	25.44	91	-26.92	4.89	4
	V2								5.10	2
	V3	1.76	4	284	0.83	10.36	105	-11.99	3.58	8
	V4								5.25	1
	V5	2.13	3	231	1.40	12.10	106	-11.45	3.61	7
Interaction										
F at same V		NS		18.84	NS	NS	NS			
V at same F		NS		18.66	NS	NS	NS			
F1		2.33	2	226	1.36	15.79	100		3.95	2
F2		2.60	1	247	1.57	15.97	101	2.28	4.29	1
C.D.(0.05)		0.20		13.28	NS	NS	NS			
C.V.(%)		4.07		2.77	10.15	2.84	0.62			
Mean of varieties:										
V1		3.81	1	231	2.41	25.08	90	-26.92	4.70	3
V2									4.83	2
V3		1.71	3	259	0.75	10.53	105	-11.99	3.48	4
V4									5.09	1
V5		1.88	2	220	1.24	12.02	106	-11.45	3.43	5
C.D.(0.05)		0.21		13.32	0.25	1.61	0.99			
C.V. (%)		6.35		4.23	12.61	7.60	0.74			
Expt. Mean		**2.46**		**237**	**1.47**	**15.88**	**100**		4.12	
Soil type		Sandy loam								
pH		7.32								
N - levels (kg/ha)										
F1		60:30:30								
F2		120:60:60								
Recommended N:P:K (kg/ha)		60:30:30								
Varieties										
V1		IET 27179								
V2		-								
V3		Chittimuthyalu								
V4		-								
V5		Kalanamak								
Available N:P:K of soil (kg/ha)		241:18:190								

Table 4.1(l): Cntd….

F-levels	Varieties	NAWAGAM						
		Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days 50% flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	5.30	5	202	3.84	22.13	102	
	V2	5.43	4	197	3.50	17.60	103	
	V3	4.19	6	189	3.27	16.93	102	
	V4	3.39	8	190	3.24	17.73	105	
	V5	-	-	-	-	-	-	
	V6							
F2	V1	6.22	2	245	4.23	22.20	104	-78.58
	V2	6.42	1	280	3.94	18.13	105	-80.46
	V3	5.56	3	251	3.69	15.33	106	-61.48
	V4	4.01	7	217	3.35	19.60	105	-50.23
	V5	-	-	-	-	-	-	
	V6							
Interaction								
F at same V		NS		NS	NS	NS	NS	
V at same F		NS		NS	NS	NS	NS	
F1		4.58	2	194	3.46	18.60	103	
F2		5.55	1	248	3.80	18.82	105	15.60
C.D.(0.05)		0.95		39.68	NS	NS	0.72	
C.V.(%)		10.68		10.21	11.07	9.33	0.39	
Mean of varieties:								
V1		5.76	2	224	4.04	22.17	103	-78.58
V2		5.93	1	238	3.72	17.87	104	-80.46
V3		4.88	3	220	3.48	16.13	104	-61.48
V4		3.70		203	3.30	18.67	105	-50.23
V5		-	-	-	-	-	-	
C.D.(0.05)		0.63		21.92	0.41	1.38	NS	
C.V. (%)		9.95		7.87	8.89	5.87	1.68	
Expt. Mean		**5.07**		**221**	**3.63**	**18.71**	**104**	
Soil type		Clay loam						
pH		7.63						
N - levels (kg/ha)								
F1		100:25:0						
F2		150:37.5:0						
Recommended N:P:K (kg/ha)		100:25:0						
Varieties								
V1		IET 27179						
V2		GAR 14						
V3		GAR 13						
V4		GR 101						
V5		-						
V6		-						
Available N:P:K of soil (kg/ha)		0.035:39.8						

NMT 1m(i) NIL – BL, BLB

Evaluation of five AVT-2 NIL lines (IET 27285, IET 27294, IET 27280, IET 27286 and IET 28014) for blast resistance, a trial was conducted at four locations *viz.,* **IIRR**, **Jagdalpur, Pantnagar** and **Nellore.** The selected AVT-2 cultures were compared with high yielding cultivars (Swarna, BPT 5204 and RP Bio-226) and along with a local check of respective locations under two recommended doses RDF *i.e.,* 100 & 150%. The data received from these locations are summarized and presented in **Table 4.1 (m-i).**

Grain yields of the test cultures differed significantly at all the locations. Culture IET 27280 found promising and recorded higher grain yield at **IIRR** (6.97 t/ha) and **Jagdalpur** (6.41 t/ha), while IET 27285 (6.18 t/ha) found promising and next best culture at **IIRR** and **Pantnagar** (5.43 t/ha and 5.96 t/ha respectively), while IET 27286 (4.78 t/ha) found as second best culture at Nellore.

Mean over the locations, higher grain yield were obtained with IET 27280 (5.88 t/ha) followed by IET 27285 (4.97 t/ha). Significant responses to graded dose of nitrogen (RDN) application were observed at both the locations. Application of 150 % of RDF was promising at **Pantnagar** (4.42 t/ha) as compared to 100% RDF. Interaction effect of IET cultures and nitrogen levels were significant at **IIRR** where the performance of cultures was promising at 150% RDF (IET 27280 at 150% of RDF).

Three NIL Blast cultures were evaluated and the results revealed that the mean maximum grain yield was recorded by IET 27280 (5.29 t/ha) followed by IET 27285 (4.97 t/ha) which were found promising at higher nutrient level.

Table 4.1(m(i)): Summary of data on grain yield and ancillary characters of selected AVT-2 NIL BL, BLB cultures grown under transplanted conditions at low, medium & high levels of recommended N fertilizer doses, kharif 2019.

N-levels	Varieties	IIRR							JAGADALPUR						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
F1	V1	5.48	*3*	552	1.85	23.2	96		5.76	*7*	481	2.15	21.1	78	
	V2	5.07	*5*	372	2.41	19.0	84		5.66	*9*	413	2.37	16.9	76	
	V3	6.67	*2*	356	2.54	21.4	82		6.55	*1*	348	2.79	20.1	62	
	V4	4.34	*12*	455	2.56	21.5	99		5.13	*13*	458	2.49	21.8	82	
	V5	4.11	*14*	368	2.42	19.7	93		4.17	*16*	396	2.24	17.3	85	
	V6	4.73	*8*	482	1.56	21.6	85		5.64	*10*	482	1.76	20.6	80	
	V7	3.2	*16*	382	2.32	17.0	114		5.34	*12*	375	2.59	19.9	85	
	V8	4.55	*9*	428	2.26	19.1	85		4.67	*15*	378	2.03	18.0	80	
	V9	-		-	-	-	-		6.2	*3*	323	3.22	22.1	68	
F2	V1	5.37	*4*	533	1.85	22.4	93	-1.00	6.16	*4*	476	2.41	20.2	79	4.00
	V2	4.89	*6*	393	2.4	20.2	81	-1.64	5.7	*8*	471	2.36	17.5	76	0.40
	V3	7.27	*1*	372	2.64	20.9	77	5.45	6.27	*2*	349	3.05	23.9	61	-2.80
	V4	4.24	*13*	446	2.85	20.9	99	-0.91	5.58	*11*	477	2.4	22.0	82	4.50
	V5	4.38	*11*	384	2.75	19.2	92	2.45	3.93	*17*	343	2	17.5	86	-2.40
	V6	4.44	*10*	473	2.2	22.0	86	-2.64	5.9	*6*	475	2.14	19.5	81	2.60
	V7	3.26	*15*	404	1.57	17.4	113	0.55	5.99	*5*	380	2.18	19.5	85	6.50
	V8	4.74	*7*	422	2.26	20.9	84	1.73	4.69	*14*	368	2.67	18.9	81	0.20
	V9	-		-	-	-	-		5.66	*9*	312	3.36	20.7	69	-5.40
Interaction															
N at same V		0.23		12.86	0.19	NS	NS		NS		NS	NS	NS	NS	
V at same N		0.25		16.54	0.2	NS	NS		NS		NS	NS	NS	NS	
F1		4.77	*2*	424	2.24	20.31	92		5.46	*2*	406	2.40	19.75	77	
F2		4.82	*1*	428	2.32	20.50	91	0.50	5.54	*1*	406	2.51	19.97	78	1.90
C.D.(0.05)		NS		NS	NS	NS	NS		NS		NS	NS	NS	NS	
C.V.(%)		2.82		2.75	4.4	1.56	1.82		13.93		4.66	20.92	8.9	0.8	

Table 4.1(m(i)): Cntd…

N-levels	Varieties	IIRR							JAGADALPUR						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)
Mean of varieties:															
V1		5.43	*2*	543	1.85	22.8	94	-1.00	5.96	*2*	478	2.28	20.6	79	4.00
V2		4.98	*3*	382	2.41	19.6	83	-1.64	5.68	*5*	442	2.37	17.2	76	0.40
V3		6.97	*1*	364	2.59	21.1	80	5.45	6.41	*1*	349	2.92	22.0	62	-2.80
V4		4.29	*6*	451	2.71	21.2	99	-0.91	5.36	*7*	468	2.45	21.9	82	4.50
V5		4.25	*7*	376	2.59	19.5	93	2.45	4.05	*9*	370	2.12	17.4	86	-2.40
V6		4.59	*5*	478	1.88	21.8	86	-2.64	5.77	*4*	478	1.95	20.0	81	2.60
V7		3.23	*8*	393	1.95	17.2	113	0.55	5.67	*6*	378	2.39	19.7	85	6.50
V8		4.65	*4*	425	2.26	20.0	84	1.73	4.68	*8*	373	2.35	18.5	81	0.20
V9		-		-	-	-	-		5.93	*3*	318	3.29	21.4	69	-5.40
C.D.(0.05)		0.16		9.09	0.13	1.52	2.32		0.76		52.18	0.44	2.44	0.69	
C.V.(%)		2.88		1.8	4.95	6.29	2.14		11.85		11.02	15.34	10.55	0.76	
Expt. Mean		**4.80**		**426**	**2.28**	**20.41**	**91**		**5.50**		**406**	**2.46**	**19.86**	**78**	
Soil type		Black clay							Vertisols						
pH		7.6							6.6						
N - levels (kg/ha)															
F1		120:60:40							100:60:40						
F2		180:90:60							150:90:60						
Recommended NPK (kg/ha)		120:60:40							100:60:40						
Varieties															
V1		IET 27285							IET 27285						
V2		IET 27294							IET 27294						
V3		IET 27280							IET 27280						
V4		IET 27286							IET 27286						
V5		IET 28014							IET 28014						
V6		BPT 5204							BPT 5204						
V7		Swarna							Swarna						
V8		RP Bio 226							RP Bio 226						
V9		-							LC - Samleswari						
Availabe NPK of soil (kg/ha)		-							260:15:321						

Table 4.1(m(i)): Cntd…

N-levels	Varieties	PANTNAGAR							NELLORE					Over all mean	*Rank*
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle Weight (g)	Test weight (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
F1	V1	4.06	*8*	226	2.23	22.4	90		4.26	*7*	378	28.6		4.89	*7*
	V2	2.84	*15*	212	1.69	22.39	110		3.95	*11*	344	19.7		4.38	*13*
	V3	3.84	*10*	218	2.1	22.54	82		3.78	*13*	379	35.2		5.21	*4*
	V4	3.24	*13*	214	1.73	27.59	110		4.95	*1*	322	29.8		4.42	*11*
	V5	3.82	*11*	216	2.06	23.15	100		4.05	*10*	322	22.2		4.04	*17*
	V6	4	*9*	233	1.94	21.26	110		4.73	*4*	389	30.7		4.78	*8*
	V7	4.07	*7*	243	1.97	21.8	93		4.83	*3*	355	25.5		4.36	*14*
	V8	2.77	*16*	226	1.71	22.32	102		3.47	*15*	333	20.0		3.87	*18*
	V9	-		-	-	-	-		-		-	-		6.20	*1*
F2	V1	4.59	*5*	229	2.36	22.67	92	4.82	4.07	*9*	356	29.8	-2.11	5.05	*5*
	V2	3.17	*14*	234	1.69	23.09	110	3.00	3.86	*12*	400	21.2	-1.00	4.41	*12*
	V3	4.67	*4*	236	2.29	23.49	82	7.55	3.27	*16*	367	39.5	-5.67	5.37	*3*
	V4	4.1	*6*	245	2.07	27.71	110	7.82	4.6	*5*	356	30.4	-3.89	4.63	*10*
	V5	4.82	*2*	249	2.27	20.97	104	9.09	4.12	*8*	356	22.9	0.78	4.31	*15*
	V6	5.47	*1*	270	2.36	22.95	110	13.36	4.38	*6*	400	30.6	-3.89	5.05	*5*
	V7	4.78	*3*	264	2.11	22.56	94	6.45	4.84	*2*	378	28.2	0.11	4.72	*9*
	V8	3.74	*12*	249	1.92	21.55	100	8.82	3.7	*14*	378	23.3	2.56	4.22	*16*
	V9	-		-	-	-	-		-		-	-		5.66	*2*
Interaction															
N at same V		NS		NS	NS	1.06	0.82		NS		NS	NS			
V at same N		NS		NS	NS	1.34	1.19		NS		NS	NS			
F1		3.58	*2*	223	1.93	22.93	100		4.25	*1*	353	26.46		4.51	*2*
F2		4.42	*1*	247	2.13	23.12	100	7.61	4.11	*2*	374	28.24	-1.64	4.72	*1*
C.D.(0.05)		0.27		4.37	0.17	NS	NS		0.14		NS	1.51			
C.V.(%)		5.52		1.5	6.61	4.01	0.95		2.6		17.84	4.44			

Table 4.1(m(i)): Cntd…

N-levels	Varieties	PANTNAGAR							NELLORE					Over all mean	*Rank*
		Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle Weight (g)	Test weight (g)	Days for 50% Flowering	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)	Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Test weight (g)	Nutri. res. (kg grain/kg Nutri.) (Base level 100% RDF)		
Mean of varieties:															
V1		4.33	*3*	228	2.30	22.5	91	4.82	4.17	*4*	367	29.2	-2.11	4.97	*3*
V2		3.01	*8*	223	1.69	22.7	110	3.00	3.91	*6*	372	20.4	-1.00	4.39	*7*
V3		4.26	*5*	227	2.20	23.0	82	7.55	3.53	*8*	373	37.4	-5.67	5.29	*2*
V4		3.67	*6*	229	1.90	27.7	110	7.82	4.78	*2*	339	30.1	-3.89	4.52	*6*
V5		4.32	*4*	232	2.17	22.1	102	9.09	4.09	*5*	339	22.5	0.78	4.18	*8*
V6		4.74	*1*	251	2.15	22.1	110	13.36	4.56	*3*	395	30.7	-3.89	4.91	*4*
V7		4.43	*2*	253	2.04	22.2	94	6.45	4.84	*1*	367	26.9	0.11	4.54	*5*
V8		3.26	*7*	237	1.82	21.9	101	8.82	3.59	*7*	355	21.7	2.56	4.04	*9*
V9		-		-	-	-	-		-		-	-		5.93	*1*
C.D.(0.05)		0.56		20.6	0.27	0.75	0.58		0.25		33.66	1.7			
C.V.(%)		11.88		7.41	11.08	2.76	0.49		5.04		7.84	5.26			
Expt. Mean		**4.00**		**235**	**2.03**	**23.03**	**100**		**4.18**		**363**	**27.35**		4.62	
Soil type		Silt loam							Sandy clay loam						
pH		7.6							7.5						
N - levels (kg/ha)															
F1		120:60:40							80:60:40						
F2		180:90:60							120:90:60						
Recommended NPK (kg/ha)		120:60:40							80:60:40						
Varieties															
V1		IET 27285							IET 27285						
V2		IET 27294							IET 27294						
V3		IET 27280							IET 27280						
V4		IET 27286							IET 27286						
V5		IET 28014							IET 28014						
V6		BPT 5204							BPT 5204						
V7		Swarna							Swarna						
V8		RP Bio 226							RP Bio 226						
V9		-							-						
Availabe NPK of soil (kg/ha)		230:22.01;215							138:50:401						

NMT 1m(ii) NIL – HT (Herbicide Tolerant Genotypes)

Rice crop suffers more from weed competition unlike other cereal crops. Efficient cultures will reduce the weed competition and enhance the productivity with reduced input. The present investigation to study the herbicide tolerance in elite genotypes for their efficacy in Basmati growing areas of the country was taken up at six locations viz., **ICAR-IARI, ICAR-IIRR, Kaul, Ludhiana, Nagina** and **Pantnagar** during kharif 2019. The trial was conducted in replicated split plot design with weed control treatments (T1–Imazethapyr 10%SL post-emergence application; T2–Pendimethelin 30% EC pre-emergence application followed by Bispyribacsodium 10% SC post-emergence application; T3–Weed free check)in main plots and genotypes (G1–IET 28812, G2–IET 28813, G3–IET 28814, G4-IET 28815, G5–Pusa Basmati 1121, G6– Pusa Basmatia1509) in sub plots. The data on cop growth parameters, yield attributes, yield and weed parameters were recorded in the crop season and results are presented in **Tables 4.1m(ii)**

The mean grain yield ranged from 1.76 t/ha at **Ludhiana** to 4.07 t/ha at **Panatnagar**. At all the test locations, irrespective of the genotypes, weed free check has resulted is significantly higher plant growth and yield attributes viz., no of panicles, panicle weight, test weight, filled grain percentage, grain yield and straw yield. The standard herbicide application of pre-emergence Pendimethalin and post-emergence Bispyribacsodium resulted in significantly higher crop growth, yield attributes and grain yield compared to Imazethapyr application. Among the three weed management treatments, application of Imazethapyr resulted in lowest grain yield and significantly inferior to others. At four locations, Pusa Basmati 1121& Pusa Basmati 1509 exhibited high phytotoxicity of Imazethapyr, and at one location **Kaul** showed little recovery resulting in very low yields of Pusa Basmati 1509 (1.18 t/ha) and Pusa Basmati 1121 (0.17 t/ha). Similar trend was observed in the result of straw yield data also. Among the test genotypes, at **ICAR-IARI, ICAR-IIRR, Kaul**, IET 28812 and IET 28813 recorded significantly higher grain yield and comparable. At **Nagina** and **Ludhiana**, IET 28814 and IET 28815 recorded significantly higher grain yield and were comparable. At **Pantnagar**, four genotypes viz., IET 28812, 28813, 28815 recorded significantly higher grain yields and comparable with each other. Similar trend was observed in crop growth, yield attributes and straw yield also. The mean grain yield of 3.84 t/ha was recorded with IET 28812 followed by IET 28813(3.67 t/ha) and IET 28815 (3.66 t/ha). The genotype IET 28814 recorded lowest grain yield of 3.53 t/ha among the IET group of genotypes. The recurring parents Pusa Basmati 1121 & 1509 recorded significantly low mean yields. (**Tables 4.1m(ii))**

The results of data on weed population and weed biomass was reported by all the test locations. The stages of observation were 15, 30, 45 and 60 DAHA by one location, 15, 30 & 60 by one locations; 15&30 DAHA by one location; 45& 60 DAHA by one location; 30 & 60 DAHA at one location and 60 DAHA at one location.

In sandy loam soils of **ICAR-IARI**, the dominant weed group was BLW followed by sedges. Grasses group was the least competent group in the study period. The weed species reported were *Trianthema portulocastrum, portulaca oleraceae, Eclipta prostrata* among

BLW; *Cyperus rotundus* among sedges; *Echinochloa crusgalli* among grasses. The results of data on weed population indicate that at 15 days after herbicide application (DAHA), no grass weeds infestation was noticed. From 30 DAHA to 60 DAHA grass weed infestation was present. The group-wise weed population as well as total weed population was lowest at 30 DAHA. AT 45 DAHA, the weed population was highest and decreased at 60 DAHA. At 15 and 30 DAHA, application of standard pre-emergence application of Pendimethain and post-emergence application of Bispyribacsodium recorded significantly low total weed population. At 45 and 60 DAHA, application of Imazethapyr recorded significantly low total weed population. Among the genotypes, no significant difference was reported by weeds group wise, except Broad leaf weeds at 45 DAHA. The test genotypes IET 28812, 28813 & 28814 reported lowest BLW population and comparable. The interaction effects of weed management and genotypes was found non significant.

At **ICAR – IIRR**, the weed population at 15 DAHA was dominated by grasses. The BLW group was lowest throughout the crop season. At 30 and 60 DAHA, sedges were dominant group followed by grasses. Among the grasses *Echinochloa crusgalli*; among the sedges *Cyperus rotundus, Cyperus iria*; among the BLW *Alternanthera spp*, *Trianthema portulacastrum*, *Corchorus spp*, etc., were prevalent in the experimental plot. The weed population was highest at 30 DAHA and lowest at 60 DAHA. At 15 DAHA, the sedges were in second position where as at 30 & 60 DAHA, sedges population was dominant. Among the weed management treatments, application of Imazethapyr recorded highest weed population of all groups and significantly inferior to standard herbicides application and weed free check. Among the test genotypes, at 15 DAHA there was no significant difference in sedges & BLW population; at 30 DAHA in case of BLWs; at 60 DAHA in case of in sedges was observed. At all the stages of observation, genotypes IET 28812 and IET 28814 recorded lowest total weed population.

In clay loam soils of **Kaul**, only at 60 DAHA, group-wise weed data was reported. Grasses were dominant and sedges, BLW were prevalent in equal proportion. The weed management treatments showed that, weed free check was without weeds and application of Imazthepyr recorded significantly lower weed population of grasses & BLW. Among the genotypes, IET 28812 and IET 28813 recorded lower total weed population and comparable.

At **Nagina**, at all stages of observation, weed population was stable. Grasses, sedges and BLW were present in equal proportion. At all stages of observation, apart from weed free check, application of Imazethapyr recorded lowest weed population. Among the genotypes, at 15 DAHA no significant difference was observed. At 30 DAHA & 45 DAHA, genotype 28815, Pusa Basmati 1121 & Pusa Basmati 1509 recorded significantly lower weed population and at 60 DAHA, Pusa Basmati 1121 recorded lowest weed population.

At **Ludhiana**, weedy check was maintained instead of weed-free check. Grasses were dominant group followed by sedges and BLW. Among the weed management treatments, application of Imazethapyr recorded lower weed population and weedy check recorded ten times higher weed population than herbicide applied plots. The genotypes did not show any significant difference in weed population at both 30 & 60 DAHA.

At **Pantnagar** also, the weed free check treatment was not maintained. At both 15 and 30 DAHA, the treatment of Imazethapyr application recorded lowest weed population. No significant difference was recorded at 15& 30 DAHA, among weed groups or total weed population by test genotypes & recurring parents.

The data on weed biomass recorded and reported till 60 DAHA at five locations showed that the weed biomass was lower with application of Imaethapyr. At these locations, after 60 DAHA also, another weed flush might had appeared and resulted in lower crop growth, and grain yield etc. in the treatment of Imazethaypr application. At **ICAR–IIRR**, the weed biomass was lowest with standard pre and post emergence herbicides application.

The results of data on crop phytotoxicity observations indicate that at all the test locations, the genotypes IET 28812, 28813, 28814 and 28815 showed no or low visual phytotoxicity of herbicide Imazethapyr application. But the recurring parents Pusa Basmati 1121 and Pusa Basmati 1509 showed complete mortality when exposed to Imazethapyr herbicide spray at **ICAR-IARI, ICAR IIRR, Ludhiana, Nagina** and **Pantnagar** . Only at **Kaul**, the genotype Pusa Basmati 1121 showed 81-90% crop injury and genotype Pusa Basmati 1509 showed 51-60% crop injury, resulting in poor recovery, poor crop growth and yield.

The results of one season study of HT genotypes showed that at all the locations, irrespective of genotypes tested, weed free check has resulted is significantly high crop growth, yield attributes and grain yield. The herbicide treatment of standard pre and post-emergence application of Pendimethalin and Bispyribacsodium resulted in higher yield, yield attributes and growth parameters. Till 60 days after herbicide application, application of Imazethapyr resulted in lower weed parameters at five out of six locations. At these locations, after 60 DAHA also, another weed flush might had appeared and resulted in lower crop growth, and grain yield etc. in the treatment of Imazethaypr application. Among the test genotypes, IET 28812 and 28813 were superior at three locations; IET 28814 and 28815 at two locations ; IET 28812, 28813, 28814 and 28815 were comparable at one location. At majority of the test locations, weed population and biomass at 30, 45 & 60 days after herbicide application were lower with IET 28812 and 28813. The genotypes IET 28812 and IET28813 with no or low phytotoxicity to Imazethapyr have contributed to higher crop growth and grain yield with standard pre and post-emergence application of Pendimethalin, Bispyribacsodium.

Table 1m(ii): Summary of data on grain yield, yield attributes, weed population and weed biomass of AVT-2 NIL Herbicide Tolerant genotypes grown under direct seeded condition, kharif 2019.

Main plot	Genotypes	IARI-NEW DELHI							
		Plant height at max. vegetative stage	Plant height at panicle initiation stage	Panicle no /m^2	Panicle wt (g)	Test wt (g)	Filled grain %	Grain yield t/ha	Straw yield t/ha
T1	G1	38.00	89.00	494	1.25	26.05	90.28	4.58	7.37
	G2	38.50	87.67	495	1.19	24.86	90.71	4.43	7.03
	G3	28.67	61.17	446	1.28	28.48	88.79	4.21	5.53
	G4	28.17	60.67	461	1.26	30.37	89.79	4.27	5.13
	G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2	G1	37.17	85.83	417	1.24	26.23	88.50	4.08	6.77
	G2	38.67	86.67	390	1.27	24.09	86.27	3.55	7.00
	G3	29.00	59.33	279	1.30	28.72	77.87	2.54	4.37
	G4	28.00	60.50	350	1.03	30.39	82.62	3.04	5.07
	G5	37.83	86.17	337	1.23	25.32	84.93	3.09	6.40
	G6	27.83	59.50	261	1.26	30.46	74.97	2.42	4.30
T3	G1	36.67	85.83	474	1.19	25.90	90.43	4.38	7.27
	G2	38.33	87.83	439	1.29	24.38	88.43	4.05	6.57
	G3	28.33	60.67	329	1.17	28.68	84.39	2.81	4.23
	G4	28.50	60.00	395	1.30	30.15	88.11	3.67	5.30
	G5	37.00	88.50	378	1.22	25.39	84.69	3.43	6.03
	G6	27.67	61.00	278	1.18	30.64	78.23	2.58	3.57
Interaction									
M and T		1.33	2.21	75.36	0.22	0.45	4.82	0.76	1.69
T and M		1.23	2.05	76.75	0.20	0.43	4.64	0.73	1.59
Mean of Factor-1									
1		22.22	49.75	316	0.83	18.29	59.93	2.91	4.18
2		33.08	73.00	339	1.22	27.54	82.53	3.12	5.65
3		32.75	73.97	382	1.23	27.52	85.71	3.49	5.49
CD(0.05)		0.39	0.57	NS	0.06	0.21	2.42	NS	0.67
Mean of Factor-2									
1		37.28	86.89	462	1.23	26.06	89.73	4.35	7.13
2		38.50	87.39	441	1.25	24.44	88.47	4.01	6.87
3		28.67	60.39	352	1.25	28.63	83.68	3.19	4.71
4		28.22	60.39	402	1.20	30.30	86.84	3.66	5.17
5		24.94	58.22	238	0.82	16.90	56.54	2.17	4.14
6		18.50	40.17	180	0.81	20.37	51.07	1.67	2.62
CD(0.05)		0.77	1.28	43.51	0.13	0.26	2.78	0.44	0.97
Experimental Mean		**29.35**	**65.57**	**345.65**	**1.09**	**24.45**	**76.06**	**3.17**	**5.11**
Soil type		Sandy Loam							
pH		8.19							
Recommended N:P:K (kg/ha)		80:15:20							
Available N:P:K of soil (kg/ha)		0.46-0.61							

T1: Imazethapyr
T2: Pendimethalin fb bispyribacsodium
T3: Weed free check

G1 - IET 28812
G2 - IET 28813
G3 - IET 28814
G4 - IET 28815
G5 - Pusa Basmati 1121 (RP)
G6 - Pusa Basmati 1509 (RP)

Table 1m(ii): Contd.

Main plot	Genotypes	ICAR-IIRR									
		Plant height(cm)		Tillers/m2		Panicle no /m^2	Test wt (g)	Panicle wt (g)	Filled grain %	Grain yield (t/ha)	Straw yield t/ha
		Max vegetative stage	Panicle initiation stage	Max vegetative stage	Panicle initiation stage						
T1	G1	39.54	58.67	290	340	313	20.80	0.45	72.76	2.22	2.82
	G2	37.31	56.78	215	301	271	23.57	0.34	77.66	2.10	2.79
	G3	36.14	52.34	215	262	236	23.86	0.35	71.90	1.86	2.96
	G4	38.39	45.98	185	263	228	17.66	0.25	76.50	2.04	2.45
	G5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
	G6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
T2	G1	36.02	64.48	326	395	380	27.93	1.18	75.29	2.87	3.80
	G2	37.89	58.26	311	410	401	27.72	1.36	80.04	2.75	3.98
	G3	36.72	61.31	277	460	431	29.56	1.27	77.14	2.51	3.35
	G4	36.81	58.4	272	444	409	28.45	1.02	78.35	2.13	3.45
	G5	39.6	60.37	319	429	392	28.47	1.11	72.78	2.69	3.49
	G6	36.21	64.81	258	450	413	29.08	1.17	76.73	2.10	3.56
T3	G1	46.41	70.73	439	487	476	28.81	1.52	87.24	4.53	5.62
	G2	46.42	68.51	395	556	505	28.47	1.31	85.11	4.24	5.35
	G3	38.48	64.79	426	497	487	29.87	1.21	88.09	3.13	3.91
	G4	46.26	61.77	454	500	491	29.25	1.26	79.77	3.20	4.10
	G5	42.11	59.16	397	466	445	29.82	1.11	75.60	3.52	4.39
	G6	40.9	61.39	391	464	417	28.61	1.27	85.53	3.53	4.41
Interaction											
M and T		3.58	2.78	25.6	22.74	32.01	2.48	0.08	7.88	0.30	0.59
T and M		3.33	2.74	24.43	21.71	29.77	2.31	0.08	7.24	0.27	0.55
Mean of Factor-1											
1		25.23	35.63	151	194	175	14.31	0.23	49.80	1.37	1.84
2		37.21	61.27	294	431	404	28.54	1.18	76.72	2.51	3.60
3		43.43	64.39	417	495	470	29.14	1.28	83.56	3.69	4.63
CD(0.05)		1.06	1.64	11.8	10.5	9.69	0.81	0.07	1.35	0.03	0.15
Mean of Factor-2											
1		40.66	64.63	352	407	389	25.85	1.05	78.43	3.20	4.08
2		40.54	61.18	307	422	392	26.59	1.00	80.93	3.03	4.04
3		37.11	59.48	306	406	384	27.76	0.94	79.04	2.50	3.41
4		40.49	55.38	304	402	376	25.12	0.85	78.21	2.45	3.33
5		27.24	39.84	239	298	279	19.43	0.74	49.46	2.07	2.63
6		25.7	42.07	216	305	277	19.23	0.81	54.09	1.88	2.66
CD(0.05)		2.07	1.61	14.78	13.13	18.48	1.43	0.04	4.55	0.17	0.34
Experimental Mean		**35.29**	**53.76**	**287**	**374**	**350**	**24.00**	**0.90**	**70.03**	**2.52**	**3.36**
Soil type		Black clay									
pH		7.6									
Recommended N:P:K (kg/ha)		120:60:40									
Available N:P:K of soil (kg/ha)		-									

T1: Imazethapyr
T2: Pendimethalin fb bispyribacsodium
T3: Weed free check
G1 - IET 28812
G2 - IET 28813
G3 - IET 28814
G4 - IET 28815
G5 - Pusa Basmati 1121 (RP)
G6 - Pusa Basmati 1509 (RP)

Table 1m(ii): Contd.

Main plot	Genotypes	KAUL				
		No of tillers/m^2 at panicle initiation stage	Panicle no /m^2	Panicle wt (g)	Test wt (g)	Grain yield t/ha
T1	G1	384	382	1.47	30.40	4.85
	G2	391	390	1.35	26.50	4.61
	G3	374	372	1.23	28.40	3.93
	G4	367	367	1.21	28.20	3.86
	G5	22	21	0.89	22.20	0.17
	G6	116	115	1.33	31.50	1.18
T2	G1	361	359	1.48	30.23	4.74
	G2	356	355	1.34	27.67	4.20
	G3	298	296	1.23	27.33	3.25
	G4	305	303	1.19	28.40	3.19
	G5	395	393	1.04	25.40	3.65
	G6	351	351	1.33	31.53	4.12
T3	G1	393	392	1.45	30.63	4.97
	G2	422	420	1.39	28.90	4.95
	G3	374	373	1.24	27.67	4.04
	G4	376	375	1.17	27.70	4.11
	G5	409	407	1.01	24.87	3.79
	G6	354	353	1.30	31.77	4.12
Interaction						
M and T		39.88	37.88	NS	NS	0.50
T and M		37.95	36.16	NS	NS	0.46
Mean of Factor-1						
1		276	274	1.25	27.87	3.10
2		344	343	1.27	28.43	3.86
3		388	387	1.26	28.59	4.33
CD(0.05)		17.82	17.51	NS	NS	0.14
Mean of Factor-2						
1		379	378	1.47	30.42	4.85
2		390	388	1.36	27.69	4.59
3		349	347	1.23	27.80	3.74
4		349	348	1.19	28.10	3.72
5		275	274	0.98	24.16	2.53
6		274	273	1.32	31.60	3.14
CD(0.05)		23.02	21.87	0.07	2.41	0.29
Experimental Mean		**336**	**334.65**	**1.26**	**28.29**	**3.76**
Soil type		Clay loam				
pH		8.1				
Recommended N:P:K (kg/ha)		110				
Available N:P:K of soil (kg/ha)		160:16:420				

T1: Imazethapyr
T2: Pendimethalin fb bispyribacsodium
T3: Weed free check

G1 - IET 28812
G2 - IET 28813
G3 - IET 28814
G4 - IET 28815
G5 - Pusa Basmati 1121 (RP)
G6 - Pusa Basmati 1509 (RP)

Table 1m(ii): Contd.

Main plot	Genotypes	NAGINA						
		Plant height(cm) at Max-tillering stage	Plant height(cm) at panicle initiation stage	No of tillers/m² at Max vegetative stage	Panicle no /m²	Panicle wt (g)	Test wt (g)	Grain yield t/ha
T1	G1	70.17	105.10	310	305	2.72	23.92	4.43
	G2	70.03	104.83	315	312	2.69	23.93	4.53
	G3	66.87	100.97	320	315	2.72	24.13	4.67
	G4	68.27	100.37	323	314	2.70	24.12	4.72
	G5	0.00	0.00	0	0	0.00	0.00	0.00
	G6	0.00	0.00	0	0	0.00	0.00	0.00
T2	G1	70.13	104.60	307	304	2.71	23.95	4.47
	G2	69.97	104.80	315	311	2.69	23.94	4.35
	G3	66.83	101.17	318	315	2.73	24.14	4.58
	G4	68.23	100.37	315	310	2.72	24.13	4.61
	G5	68.83	103.37	321	304	2.67	24.12	4.43
	G6	67.13	101.67	315	310	2.70	23.99	4.52
T3	G1	70.20	104.60	309	306	2.71	23.96	4.51
	G2	70.03	104.93	320	313	2.70	23.96	4.50
	G3	66.90	99.87	323	318	2.72	24.15	4.65
	G4	68.23	99.33	317	316	2.71	24.14	4.71
	G5	68.87	103.60	310	307	2.69	24.14	4.55
	G6	67.17	100.67	318	311	2.69	24.00	4.59
Interaction								
M and T		0.12	1.08	14.54	15.28	0.02	0.03	0.13
T and M		0.11	1.00	14.02	14.04	0.01	0.02	0.12
Mean of Factor-1								
1		45.89	68.54	211	208	1.80	16.02	3.06
2		68.52	102.66	315	309	2.70	24.05	4.50
3		68.57	102.17	316	312	2.70	24.06	4.59
CD(0.05)		0.04	0.20	7.36	2.79	0.00	0.01	0.03
Mean of Factor-2								
1		70.17	104.77	309	305	2.71	23.95	4.47
2		70.01	104.86	317	312	2.69	23.94	4.46
3		66.87	100.67	320	316	2.73	24.14	4.63
4		68.24	100.02	318	313	2.71	24.13	4.68
5		45.90	68.99	210	203	1.79	16.09	3.00
6		44.77	67.44	211	207	1.80	16.00	3.04
CD(0.05)		0.07	0.63	8.40	8.82	0.01	0.01	0.07
Experimental Mean		**60.99**	**91.12**	**280.93**	**276.13**	**2.40**	**21.37**	**4.05**
Soil type		-						
pH		7.7						
Recommended N:P:K (kg/ha)		120:60:40						
Available N:P:K of soil (kg/ha)		21:18.33;209						

T1: Imazethapyr
T2: Pendimethalin fb bispyribacsodium
T3: Weed free check

G1 - IET 28812
G2 - IET 28813
G3 - IET 28814
G4 - IET 28815
G5 - Pusa Basmati 1121 (RP)
G6 - Pusa Basmati 1509 (RP)

Table 1m(ii): Contd.

Main plot	Genotypes	PANTNAGAR								
		Plant height(cm) at Mid-tillering stage	Plant height(cm) at panicle initiation stage	No of tillers/m^2 at Mid tillering stage	No of tillers/m^2 at panicle initiation stage	Panicle no /m^2	Panicle wt (g)	Test wt (g)	Grain yield t/ha	Straw yield t/ha
T1	G1	90.67	101.33	144	391	373	1.34	25.58	4.38	4.89
	G2	90.00	99.33	146	371	380	1.45	26.21	4.65	5.31
	G3	87.67	104.00	153	398	385	1.46	28.65	4.77	4.84
	G4	93.00	101.67	160	396	375	1.31	29.17	4.40	5.03
	G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2	G1	86.00	100.00	141	348	343	1.49	27.57	4.40	5.02
	G2	89.00	97.33	165	381	360	1.41	26.77	4.58	4.90
	G3	90.67	102.00	188	393	364	1.48	27.67	4.25	5.13
	G4	96.33	102.33	181	392	388	1.43	27.62	4.69	5.08
	G5	78.33	101.33	178	378	338	1.48	26.88	4.21	4.69
	G6	90.67	102.00	124	393	383	1.49	27.81	4.79	4.99
T3	G1	85.67	99.33	146	404	403	1.27	26.94	4.77	5.04
	G2	87.33	101.33	148	392	388	1.45	27.94	4.75	5.08
	G3	89.67	102.67	128	397	395	1.39	28.85	4.48	4.99
	G4	90.67	100.67	148	397	391	1.60	26.67	4.84	4.92
	G5	90.00	100.67	141	388	373	1.64	25.11	4.54	5.19
	G6	89.00	103.33	128	403	395	1.49	28.82	4.85	4.92
Interaction										
M and T		3.69	3.22	9.83	19.20	73.77	0.32	2.26	0.41	0.62
T and M		3.45	3.02	10.28	17.64	71.29	0.30	2.20	0.38	0.58
Mean of Factor-1										
1		60.22	67.72	100	259	252	0.93	18.27	3.03	3.34
2		88.50	100.83	163	381	363	1.46	27.39	4.49	4.97
3		88.72	101.33	140	397	391	1.47	27.39	4.71	5.02
CD(0.05)		1.29	1.20	7.83	3.46	38.27	0.11	1.23	0.16	0.23
Mean of Factor-2										
1		87.44	100.22	144	381	373	1.37	26.70	4.51	4.99
2		88.78	99.33	153	381	376	1.44	26.97	4.66	5.10
3		89.33	102.89	156	396	381	1.45	28.39	4.50	4.98
4		93.33	101.56	163	395	385	1.45	27.82	4.64	5.01
5		56.11	67.33	106	256	237	1.04	17.33	2.92	3.29
6		59.89	68.44	84	266	259	0.99	18.88	3.22	3.30
CD(0.05)		2.13	1.86	5.68	11.08	42.59	0.18	1.31	0.24	0.36
Experimental Mean		**79.15**	**89.96**	**134.40**	**345.56**	**335.09**	**1.29**	**24.35**	**4.07**	**4.45**
Soil type		Silt loam								
pH		7.8								
Recommended N:P:K (kg/ha)		120:60:40								
Available N:P:K of soil (kg/ha)		235:21.7;212								

T1: Imazethapyr
T2: Pendimethalin fb bispyribacsodium
T3: Weed free check

G1 - IET 28812
G2 - IET 28813
G3 - IET 28814
G4 - IET 28815
G5 - Pusa Basmati 1121 (RP)
G6 - Pusa Basmati 1509 (RP)

Table 1m(ii): Contd.

Main plot	Genotypes	LUDHIANA							
		Plant height(cm) at panicle initiation stage	No of tillers/m² at panicle initiation stage	Panicle no /m²	Panicle wt (g)	Test wt (g)	Filled grain	Grain yield t/ha	Straw yield t/ha
T1	G1	83.40	225	208	0.93	28.69	59.29	1.89	7.33
	G2	74.93	255	242	1.02	27.62	59.80	1.00	7.02
	G3	88.07	345	315	1.56	31.89	71.26	3.51	7.88
	G4	87.27	322	305	1.54	31.03	75.18	3.63	8.57
	G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2	G1	90.67	328	300	1.36	30.20	66.68	2.75	6.74
	G2	81.80	308	275	1.16	30.32	48.28	2.53	6.28
	G3	87.60	370	338	1.47	31.75	71.65	3.68	7.55
	G4	89.40	353	337	1.52	31.28	73.36	3.86	7.73
	G5	85.80	335	317	0.98	30.15	55.14	2.08	7.29
	G6	83.20	338	298	1.66	30.02	70.15	3.63	7.13
T3	G1	72.27	120	110	0.54	27.89	43.16	0.37	0.97
	G2	66.33	140	127	0.58	26.43	47.08	0.24	0.42
	G3	68.40	178	152	0.65	30.83	55.56	0.68	2.04
	G4	77.60	183	153	0.69	30.37	57.14	0.86	2.99
	G5	79.43	182	130	0.46	29.17	38.67	0.18	1.88
	G6	72.73	185	160	0.70	27.23	50.85	0.73	2.80
Interaction									
M and T		6.39	21.47	21.30	0.21	1.58	12.13	0.34	0.90
T and M		5.90	20.39	19.52	0.19	1.46	11.77	0.32	0.84
Mean of Factor-1									
1		55.61	191	178	0.84	19.87	44.25	1.67	5.13
2		86.41	339	311	1.36	30.62	64.21	3.09	7.12
3		72.79	165	139	0.60	28.65	48.74	0.51	1.85
CD(0.05)		1.60	9.36	2.90	0.07	0.38	6.52	0.09	0.24
Mean of Factor-2									
1		82.11	224	206	0.94	28.93	56.38	1.67	5.01
2		74.36	234	214	0.92	28.12	51.72	1.26	4.57
3		81.36	298	268	1.23	31.49	66.16	2.62	5.83
4		84.76	286	265	1.25	30.89	68.56	2.78	6.43
5		55.08	172	149	0.48	19.77	31.27	0.76	3.06
6		51.98	174	153	0.79	19.09	40.33	1.45	3.31
CD(0.05)		3.69	12.40	12.30	0.12	0.91	7.00	0.20	0.52
Experimental Mean		**71.61**	**231.57**	**209.26**	**0.94**	**26.38**	**52.4**	**1.76**	**4.7**
Soil type		Sandy loam							
pH		7.8							
Recommended N:P:K (kg/ha)		150							
Available N:P:K of soil (kg/ha)		220:22.0;289							

T1: Imazethapyr
T2: Pendimethalin fb bispyribacsodium
T3: Weed free check

G1 - IET 28812
G2 - IET 28813
G3 - IET 28814
G4 - IET 28815
G5 - Pusa Basmati 1121 (RP)
G6 - Pusa Basmati 1509 (RP)

Table 1m(ii): Contd.

Main plot	Genotypes	IARI-NEW DELHI									
		1 DBHA			15 DAHA			30 DAHA			
		Groupwise weed population no/m²			Groupwise weed population no/m²			Groupwise Weed population no/m²			
		Sedges	BLW	Total	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	50.67(7.14)	398.67(19.85)	449.33(21.08)	18.67(4.37)	337.33(18.30)	356.00(18.80)	0.00(0.71)	9.33(3.06)	281.33(16.76)	290.67(17.04)
	G2	40.00(6.34)	506.67(22.51)	546.67(23.38)	20.00(4.51)	388.00(19.68)	408.00(20.18)	0.00(0.71)	8.00(2.86)	345.33(18.58)	353.33(18.80)
	G3	37.33(6.05)	572.00(23.67)	609.33(24.49)	14.67(3.84)	400.00(20.01)	414.67(20.37)	0.00(0.71)	4.00(2.12)	341.33(18.49)	345.33(18.59)
	G4	137.33(9.45)	606.67(24.46)	744.00(26.72)	72.00(6.61)	530.67(22.93)	602.67(24.25)	0.00(0.71)	22.67(4.01)	400.00(20.01)	422.67(20.54)
	G5	64.00(8.00)	686.67(25.88)	750.67(27.10)	18.67(4.37)	469.33(21.60)	488.00(22.03)	0.00(0.71)	13.33(3.71)	368.00(19.17)	381.33(19.52)
	G6	44.00(6.61)	546.67(23.29)	590.67(24.20)	20.00(4.53)	420.00(20.45)	440.00(20.94)	0.00(0.71)	4.00(2.12)	293.33(17.07)	297.33(17.19)
T2	G1	1.33(1.18)	1.33(1.18)	2.67(1.65)	34.67(5.73)	66.67(8.08)	101.33(10.01)	8.00(2.86)	105.33(10.12)	142.67(11.80)	256.00(15.99)
	G2	0.00(0.71)	12.00(3.39)	12.00(3.39)	32.00(5.65)	52.00(6.95)	84.00(9.09)	5.33(2.39)	113.33(10.14)	130.67(11.22)	249.33(15.37)
	G3	0.00(0.71)	10.67(3.33)	10.67(3.33)	24.00(4.88)	70.67(8.37)	94.67(9.74)	13.33(3.25)	80.00(8.80)	158.67(12.52)	252.00(15.88)
	G4	6.67(2.65)	2.67(1.44)	9.33(3.03)	30.67(5.30)	96.00(9.81)	126.67(11.24)	17.33(4.22)	78.67(8.85)	200.00(14.15)	296.00(17.21)
	G5	2.67(1.65)	1.33(1.18)	4.00(1.91)	30.67(5.53)	74.67(8.34)	105.33(10.14)	10.67(3.24)	166.67(12.45)	168.00(12.77)	345.33(18.49)
	G6	0.00(0.71)	0.00(0.71)	0.00(0.71)	24.00(4.81)	73.33(8.56)	97.33(9.84)	12.00(3.39)	38.67(6.14)	165.33(12.84)	216.00(14.67)
T3	G1	-	-	-	-	-	-	-	-	-	-
	G2	-	-	-	-	-	-	-	-	-	-
	G3	-	-	-	-	-	-	-	-	-	-
	G4	-	-	-	-	-	-	-	-	-	-
	G5	-	-	-	-	-	-	-	-	-	-
	G6	-	-	-	-	-	-	-	-	-	-
Interaction											
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-1											
1		62.22(7.27)	552.89(23.27)	615.11(24.50)	27.33(4.70)	424.22(20.49)	451.56(21.09)	0.00(0.71)	10.22(2.98)	338.22(18.35)	348.44(18.61)
2		1.78(1.27)	4.67(1.87)	6.44(2.34)	29.33(5.32)	72.22(8.35)	101.56(10.01)	11.11(3.22)	97.11(9.42)	160.89(12.55)	269.11(16.27)
3		-	-	-	-	-	-	-	-	-	-
CD(0.05)		4.58	4.52	4.82	NS	1.06	3.43	1	1.62	1.38	1.86
Mean of Factor-2											
1		26.00(4.16)	200.00(10.51)	226.00(11.37)	26.67(5.05)	202.00(13.19)	228.67(14.40)	4.00(1.78)	57.33(6.59)	212.00(14.28)	273.33(16.52)
2		20.00(3.53)	259.33(12.95)	279.33(13.39)	26.00(5.08)	220.00(13.32)	246.00(14.64)	2.67(1.55)	60.67(6.50)	238.00(14.90)	301.33(17.09)
3		18.67(3.38)	291.33(13.50)	310.00(13.91)	19.33(4.36)	235.33(14.19)	254.67(15.06)	6.67(1.98)	42.00(5.46)	250.00(15.50)	298.67(17.24)
4		72.00(6.05)	304.67(12.95)	376.67(14.88)	51.33(5.95)	313.33(16.37)	364.67(17.74)	8.67(2.46)	50.67(6.43)	300.00(17.08)	359.33(18.88)
5		33.33(4.82)	344.00(13.53)	377.33(14.51)	24.67(4.95)	272.00(14.97)	296.67(16.08)	5.33(1.97)	90.00(8.08)	268.00(15.97)	363.33(19.00)
6		22.00(3.66)	273.33(12.00)	295.33(12.46)	22.00(4.67)	246.67(14.51)	268.67(15.39)	6.00(2.05)	21.33(4.13)	229.33(14.96)	256.67(15.93)
CD(0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	2.23
Experimental Mean		**4.27**	**12.57**	**13.42**	**5.01**	**14.42**	**15.55**	**1.97**	**6.2**	**15.45**	**17.44**

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	IARI-NEW DELHI							
		45 DAHA				60 DAHA			
		Groupwise Weed population no/m^2				Groupwise Weed population no/m^2			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	0.00(0.71)	0.00(0.71)	213.33(14.62)	213.33(14.62)	0.00(0.71)	0.00(0.71)	173.33(13.09)	173.33(13.09)
	G2	0.00(0.71)	0.00(0.71)	253.33(15.92)	253.33(15.92)	0.00(0.71)	0.00(0.71)	220.00(14.81)	220.00(14.81)
	G3	0.00(0.71)	0.00(0.71)	220.00(14.84)	220.00(14.84)	0.00(0.71)	0.00(0.71)	220.00(14.84)	220.00(14.84)
	G4	0.00(0.71)	0.00(0.71)	253.33(15.92)	253.33(15.92)	0.00(0.71)	0.00(0.71)	221.33(14.88)	221.33(14.88)
	G5	0.00(0.71)	0.00(0.71)	273.33(16.55)	273.33(16.55)	0.00(0.71)	0.00(0.71)	226.67(15.02)	226.67(15.02)
	G6	0.00(0.71)	0.00(0.71)	180.00(13.33)	180.00(13.33)	0.00(0.71)	0.00(0.71)	173.33(13.10)	173.33(13.10)
T2	G1	20.00(4.51)	186.67(13.66)	248.00(15.68)	454.67(21.31)	14.67(3.87)	166.67(12.92)	261.33(16.17)	442.67(21.05)
	G2	13.33(3.71)	280.00(16.56)	202.67(14.16)	496.00(22.15)	12.00(3.45)	306.67(17.30)	250.67(15.83)	569.33(23.80)
	G3	16.00(3.87)	266.67(16.31)	241.33(15.46)	524.00(22.89)	13.33(3.57)	246.67(15.72)	264.00(16.18)	524.00(22.86)
	G4	22.67(4.76)	240.00(15.47)	312.00(17.67)	574.67(23.96)	22.67(4.76)	213.33(14.61)	324.00(18.01)	560.00(23.67)
	G5	12.00(3.50)	320.00(17.72)	317.33(17.79)	649.33(25.43)	17.33(4.11)	253.33(15.61)	329.33(18.07)	600.00(24.28)
	G6	13.33(3.57)	180.00(12.90)	298.67(17.30)	492.00(22.08)	12.00(3.39)	173.33(12.71)	301.33(17.36)	486.67(22.03)
T3	G1	-	-	-	-	-	-	-	-
	G2	-	-	-	-	-	-	-	-
	G3	-	-	-	-	-	-	-	-
	G4	-	-	-	-	-	-	-	-
	G5	-	-	-	-	-	-	-	-
	G6	-	-	-	-	-	-	-	-
Interaction									
M and T		NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-1									
1		0.00(0.71)	0.00(0.71)	232.22(15.20)	232.22(15.20)	0.00(0.71)	0.00(0.71)	205.78(14.29)	205.78(14.29)
2		16.22(3.99)	245.56(15.44)	270.00(16.34)	531.78(22.97)	15.33(3.86)	226.67(14.81)	288.44(16.94)	530.44(22.95)
3		-	-	-	-	-	-	-	-
CD(0.05)		1.84	3.57	NS	4.06	0.69	4.17	2.4	5.1
Mean of Factor-2									
1		10.00(2.61)	93.33(7.18)	230.67(15.15)	334.00(17.97)	7.33(2.29)	83.33(6.82)	217.33(14.63)	308.00(17.07)
2		6.67(2.21)	140.00(8.63)	228.00(15.04)	374.67(19.04)	6.00(2.08)	153.33(9.00)	235.33(15.32)	394.67(19.30)
3		8.00(2.29)	133.33(8.51)	230.67(15.15)	372.00(18.87)	6.67(2.14)	123.33(8.21)	242.00(15.51)	372.00(18.85)
4		11.33(2.74)	120.00(8.09)	282.67(16.80)	414.00(19.94)	11.33(2.74)	106.67(7.66)	272.67(16.45)	390.67(19.28)
5		6.00(2.11)	160.00(9.21)	295.33(17.17)	461.33(20.99)	8.67(2.41)	126.67(8.16)	278.00(16.55)	413.33(19.65)
6		6.67(2.14)	90.00(6.80)	239.33(15.31)	336.00(17.70)	6.00(2.05)	86.67(6.71)	237.33(15.23)	330.00(17.56)
CD(0.05)		NS	NS	1.58	1.79	NS	NS	NS	1.84
Experimental Mean		**2.35**	**8.07**	**15.77**	**19.08**	**2.28**	**7.76**	**15.61**	**18.62**

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	ICAR-IIRR										
		1 DBHA			15 DAHA				30 DAHA			
		Weed population no/m^2			Weed population no/m^2				Weed population no/m^2			
		Grasses	**Sedges**	**Total**	**Grasses**	**Sedges**	**BLWs**	**Total**	**Grasses**	**Sedges**	**BLWs**	**Total**
T1	G1	1.67(1.46)	18.00(4.30)	19.67(4.49)	60.67(7.78)	5.33(2.39)	4.67(2.26)	70.67(8.40)	122.00(11.05)	14.67(3.89)	8.67(2.97)	145.33(12.06)
	G2	3.00(1.81)	15.33(3.97)	18.33(4.31)	91.00(9.56)	6.67(2.39)	7.67(2.81)	105.33(10.28)	142.00(11.93)	18.00(4.30)	10.00(3.21)	170.00(13.05)
	G3	2.00(1.47)	13.00(3.66)	15.00(3.94)	98.00(9.92)	2.67(1.65)	2.33(1.54)	103.00(10.17)	174.00(13.20)	3.67(1.87)	11.33(3.41)	189.00(13.75)
	G4	3.00(1.82)	14.67(3.88)	17.67(4.24)	100.00(10.02)	2.67(1.65)	5.33(2.39)	108.00(10.42)	156.00(12.51)	13.33(3.68)	10.67(3.29)	180.00(13.43)
	G5	4.67(2.26)	19.67(4.48)	24.33(4.98)	65.67(8.11)	18.67(4.34)	6.67(2.59)	91.00(9.55)	117.00(10.84)	21.00(4.63)	12.67(3.56)	150.67(12.29)
	G6	3.33(1.93)	17.00(4.17)	20.33(4.56)	114.67(10.66)	9.33(3.13)	4.67(2.02)	128.67(11.29)	169.00(13.01)	10.33(3.28)	8.67(2.87)	188.00(13.73)
T2	G1	0.00(0.71)	22.33(4.77)	22.33(4.77)	0.00(0.71)	15.67(3.97)	0.00(0.71)	15.67(3.97)	0.00(0.71)	80.00(8.94)	4.00(1.91)	84.00(9.15)
	G2	0.00(0.71)	34.00(5.87)	34.00(5.87)	0.00(0.71)	40.67(6.36)	0.00(0.71)	40.67(6.36)	0.00(0.71)	149.33(12.23)	0.00(0.71)	149.33(12.23)
	G3	0.00(0.71)	18.67(4.36)	18.67(4.36)	0.00(0.71)	34.00(5.87)	0.00(0.71)	34.00(5.87)	0.00(0.71)	53.33(7.28)	4.00(1.91)	57.33(7.57)
	G4	0.00(0.71)	21.00(4.59)	21.00(4.59)	0.00(0.71)	38.00(6.18)	0.00(0.71)	38.00(6.18)	0.00(0.71)	76.00(8.73)	1.33(1.18)	77.33(8.81)
	G5	0.00(0.71)	37.00(6.11)	37.00(6.11)	0.00(0.71)	30.33(5.41)	0.00(0.71)	30.33(5.41)	0.00(0.71)	101.33(10.09)	0.00(0.71)	101.33(10.09)
	G6	0.00(0.71)	23.67(4.91)	23.67(4.91)	0.00(0.71)	33.00(5.63)	0.00(0.71)	33.00(5.63)	0.00(0.71)	101.33(10.09)	0.00(0.71)	101.33(10.09)
T3	G1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G4	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G5	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Interaction												
M and T		NS	0.6	0.61	0.83	1.25	NS	NS	0.51	0.7	NS	0.68
T and M		NS	0.57	0.57	0.76	1.22	NS	NS	0.47	0.73	NS	0.68
Mean of Factor-1												
1		2.94(1.79)	16.28(4.08)	19.22(4.42)	88.33(9.34)	7.56(2.59)	5.22(2.27)	101.11(10.02)	146.67(12.09)	13.50(3.61)	10.33(3.22)	170.50(13.05)
2		0.00(0.71)	26.11(5.10)	26.11(5.10)	0.00(0.71)	31.94(5.57)	0.00(0.71)	31.94(5.57)	0.00(0.71)	93.56(9.56)	1.56(1.19)	95.11(9.66)
3		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		0.25	0.24	0.17	0.05	0.68	0.24	0.57	0.11	0.55	0.43	0.45
Mean of Factor-2												
1		0.56(0.96)	13.44(3.26)	14.00(3.32)	20.22(3.07)	7.00(2.36)	1.56(1.23)	28.78(4.36)	40.67(4.16)	31.56(4.51)	4.22(1.86)	76.44(7.31)
2		1.00(1.08)	16.44(3.51)	17.44(3.63)	30.33(3.66)	15.78(3.15)	2.56(1.41)	48.67(5.78)	47.33(4.45)	55.78(5.75)	3.33(1.54)	106.44(8.66)
3		0.67(0.96)	10.56(2.91)	11.22(3.00)	32.67(3.78)	12.22(2.74)	0.78(0.99)	45.67(5.58)	58.00(4.87)	19.00(3.29)	5.11(2.01)	82.11(7.34)
4		1.00(1.08)	11.89(3.06)	12.89(3.18)	33.33(3.81)	13.56(2.84)	1.78(1.27)	48.67(5.77)	52.00(4.64)	29.78(4.37)	4.00(1.73)	85.78(7.65)
5		1.56(1.22)	18.89(3.76)	20.44(3.93)	21.89(3.18)	16.33(3.48)	2.22(1.34)	40.44(5.22)	39.00(4.08)	40.78(5.14)	4.22(1.66)	84.00(7.70)
6		1.11(1.12)	13.56(3.26)	14.67(3.39)	38.22(4.03)	14.11(3.16)	1.56(1.15)	53.89(5.88)	56.33(4.81)	37.22(4.69)	2.89(1.43)	96.44(8.17)
CD(0.05)		NS	0.35	0.35	0.48	NS	NS	0.73	0.29	0.41	NS	0.39
Experimental Mean		**1.07**	**3.29**	**3.41**	**3.59**	**2.96**	**1.23**	**5.43**	**4.5**	**4.62**	**1.7**	**7.8**

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	ICAR-IIRR				KAUL			
		60 DAHA				60 DAHA			
		Weed population no/m²				Groupwise weed population no/m²			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLW	Total
T1	G1	21.67(4.71)	6.33(2.34)	9.33(3.11)	37.33(6.14)	1.80(1.52)	1.10(1.26)	1.10(1.26)	4.00(2.12)
	G2	50.00(7.11)	5.00(2.12)	5.00(2.34)	60.00(7.77)	1.73(1.49)	0.63(1.06)	1.20(1.30)	3.57(2.02)
	G3	25.00(4.34)	4.00(1.91)	4.00(2.03)	33.00(5.31)	2.33(1.68)	1.00(1.22)	1.03(1.24)	4.37(2.21)
	G4	54.00(7.38)	7.67(2.54)	6.67(2.65)	68.33(8.29)	2.27(1.66)	1.37(1.36)	1.03(1.24)	4.67(2.27)
	G5	74.00(8.63)	17.67(4.24)	7.33(2.79)	99.00(9.97)	7.83(2.89)	4.70(2.28)	3.10(1.90)	15.63(4.02)
	G6	57.00(7.57)	0.67(1.05)	8.33(2.92)	66.00(8.14)	5.47(2.44)	3.40(1.97)	2.13(1.62)	11.00(3.39)
T2	G1	0.33(0.88)	48.00(6.96)	6.00(2.47)	54.33(7.40)	4.20(2.17)	1.90(1.55)	1.93(1.56)	8.03(2.92)
	G2	2.00(1.48)	68.00(8.27)	2.00(1.56)	72.00(8.51)	4.47(2.23)	1.53(1.42)	1.97(1.57)	7.97(2.91)
	G3	0.67(1.00)	54.00(7.38)	5.33(2.41)	60.00(7.78)	4.90(2.32)	1.70(1.48)	1.93(1.56)	8.53(3.01)
	G4	0.00(0.71)	42.33(6.51)	11.00(3.34)	53.33(7.32)	4.80(2.30)	1.90(1.55)	1.77(1.50)	8.47(2.99)
	G5	2.67(1.64)	57.00(7.58)	6.33(2.56)	66.00(8.15)	5.87(2.52)	2.37(1.69)	2.50(1.73)	10.73(3.35)
	G6	0.33(0.88)	75.00(8.68)	9.00(3.05)	84.33(9.20)	5.30(2.41)	2.13(1.62)	1.90(1.55)	9.33(3.14)
T3	G1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G4	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G5	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Interaction									
M and T		1.38	1.25	NS	1.27	0.14	0.08	0.11	0.09
T and M		1.3	1.15	NS	1.18	0.13	0.08	0.1	0.08
Mean of Factor-1									
1		46.94(6.62)	6.89(2.37)	6.78(2.64)	60.61(7.60)	3.57(1.95)	2.03(1.53)	1.60(1.43)	7.21(2.67)
2		1.00(1.10)	57.39(7.56)	6.61(2.57)	65.00(8.06)	4.92(2.32)	1.92(1.55)	2.00(1.58)	8.84(3.05)
3		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		0.55	0.26	0.17	0.38	0.02	0.05	0.02	0.03
Mean of Factor-2									
1		7.33(2.10)	18.11(3.34)	5.11(2.09)	30.56(4.75)	2.00(1.46)	1.00(1.17)	1.01(1.18)	4.01(1.92)
2		17.33(3.10)	24.33(3.70)	2.33(1.53)	44.00(5.66)	2.07(1.48)	0.72(1.07)	1.06(1.19)	3.84(1.88)
3		8.56(2.02)	19.33(3.33)	3.11(1.71)	31.00(4.60)	2.41(1.57)	0.90(1.14)	0.99(1.17)	4.30(1.97)
4		18.00(2.93)	16.67(3.25)	5.89(2.23)	40.56(5.44)	2.36(1.56)	1.09(1.21)	0.93(1.15)	4.38(1.99)
5		25.56(3.66)	24.89(4.18)	4.56(2.02)	55.00(6.28)	4.57(2.04)	2.36(1.56)	1.87(1.44)	8.79(2.69)
6		19.11(3.05)	25.22(3.48)	5.78(2.23)	50.11(6.02)	3.59(1.85)	1.84(1.43)	1.34(1.29)	6.78(2.41)
CD(0.05)		0.8	NS	0.45	0.74	0.08	0.05	0.06	0.05
Experimental Mean		**2.81**	**3.55**	**1.97**	**5.46**	**1.66**	**1.26**	**1.24**	**2.14**

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	NAGINA											
		1 DBHA				15 DAHA				30 DAHA			
		Groupwise weed population no/m^2				Groupwise weed population no/m^2				Groupwise weed population no/m2			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	3.25(1.92)	2.27(1.64)	3.84(2.08)	9.36(3.13)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G2	3.07(1.88)	2.55(1.74)	3.19(1.92)	8.81(3.05)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G3	3.21(1.92)	2.07(1.60)	3.08(1.89)	8.37(2.97)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G4	3.12(1.89)	2.76(1.79)	3.59(2.02)	9.47(3.15)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G5	2.52(1.73)	2.97(1.86)	2.85(1.82)	8.34(2.97)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G6	2.21(1.65)	2.97(1.86)	2.55(1.74)	7.73(2.87)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
T2	G1	2.76(1.80)	2.88(1.83)	3.58(2.00)	9.22(3.11)	2.74(1.79)	3.48(1.98)	2.96(1.86)	9.18(3.10)	3.20(1.91)	2.96(1.84)	3.50(2.00)	9.66(3.18)
	G2	2.42(1.69)	2.90(1.83)	3.11(1.89)	8.43(2.99)	2.87(1.84)	2.34(1.68)	2.75(1.80)	7.96(2.91)	3.28(1.94)	3.34(1.95)	3.27(1.94)	9.90(3.22)
	G3	3.22(1.91)	3.06(1.87)	4.38(2.21)	10.66(3.34)	3.16(1.91)	2.50(1.71)	2.64(1.77)	8.31(2.96)	4.28(2.17)	5.86(2.52)	4.04(2.13)	14.18(3.83)
	G4	3.55(2.00)	4.02(2.12)	3.31(1.95)	10.88(3.37)	2.98(1.86)	2.86(1.82)	3.03(1.87)	8.86(3.05)	3.71(2.05)	2.79(1.81)	3.22(1.93)	9.72(3.20)
	G5	2.89(1.84)	3.64(2.03)	3.18(1.92)	9.72(3.19)	2.33(1.68)	2.46(1.72)	2.65(1.77)	7.44(2.82)	2.67(1.75)	2.89(1.84)	3.00(1.87)	8.56(3.00)
	G6	2.74(1.79)	2.49(1.72)	3.62(2.03)	8.86(3.06)	2.22(1.64)	2.54(1.74)	2.78(1.80)	7.54(2.83)	3.18(1.90)	3.22(1.90)	2.96(1.84)	9.36(3.13)
T3	G1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G4	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G5	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	0.24	NS	0.16
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	0.23	NS	0.16
Mean of Factor-1													
1		2.90(1.83)	2.60(1.75)	3.18(1.91)	8.68(3.02)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
2		2.93(1.84)	3.17(1.90)	3.53(2.00)	9.62(3.17)	2.72(1.79)	2.70(1.77)	2.80(1.81)	8.21(2.94)	3.39(1.95)	3.51(1.98)	3.33(1.95)	10.23(3.26)
3		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		0.09	0.05	0.08	0.05	0.03	0.08	0.06	0.09	0.15	0.1	0.03	0.12
Mean of Factor-2													
1		2.00(1.48)	1.71(1.39)	2.47(1.59)	6.19(2.32)	0.91(1.07)	1.16(1.13)	0.99(1.09)	3.06(1.51)	1.07(1.11)	0.99(1.08)	1.17(1.14)	3.22(1.53)
2		1.83(1.43)	1.82(1.43)	2.10(1.51)	5.75(2.25)	0.96(1.08)	0.78(1.03)	0.92(1.07)	2.65(1.44)	1.09(1.12)	1.11(1.12)	1.09(1.12)	3.30(1.55)
3		2.14(1.51)	1.71(1.39)	2.49(1.60)	6.34(2.34)	1.05(1.11)	0.83(1.04)	0.88(1.06)	2.77(1.46)	1.43(1.20)	1.95(1.31)	1.35(1.18)	4.73(1.75)
4		2.22(1.53)	2.26(1.54)	2.30(1.56)	6.78(2.41)	0.99(1.09)	0.95(1.08)	1.01(1.09)	2.95(1.49)	1.24(1.15)	0.93(1.08)	1.07(1.11)	3.24(1.54)
5		1.80(1.43)	2.21(1.53)	2.01(1.48)	6.02(2.29)	0.78(1.03)	0.82(1.04)	0.88(1.06)	2.48(1.41)	0.89(1.05)	0.96(1.08)	1.00(1.09)	2.85(1.47)
6		1.65(1.38)	1.82(1.43)	2.06(1.49)	5.53(2.21)	0.74(1.02)	0.85(1.05)	0.93(1.07)	2.51(1.41)	1.06(1.11)	1.07(1.10)	0.99(1.08)	3.12(1.52)
CD(0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	0.14	NS	0.09
Experimental Mean		**1.46**	**1.45**	**1.54**	**2.3**	**1.07**	**1.06**	**1.08**	**1.45**	**1.12**	**1.13**	**1.12**	**1.56**

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	NAGINA							
		45 DAHA				60 DAHA			
		Groupwise weed population no/m²				Groupwise weed population no/m²			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G4	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G5	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
T2	G1	3.53(2.01)	4.08(2.11)	3.80(2.07)	11.41(3.44)	3.77(2.06)	4.67(2.27)	3.28(1.94)	11.72(3.49)
	G2	3.95(2.10)	3.71(2.05)	3.27(1.94)	10.93(3.38)	3.75(2.05)	4.00(2.12)	3.04(1.88)	10.80(3.36)
	G3	4.28(2.17)	3.60(2.02)	3.86(2.09)	11.74(3.50)	3.16(1.91)	4.42(2.22)	3.11(1.90)	10.69(3.35)
	G4	3.71(2.05)	2.98(1.86)	3.22(1.93)	9.90(3.23)	3.47(1.99)	4.67(2.27)	3.25(1.93)	11.39(3.45)
	G5	2.67(1.75)	2.89(1.84)	3.00(1.87)	8.56(3.00)	2.14(1.62)	2.82(1.82)	2.83(1.82)	7.78(2.88)
	G6	2.69(1.77)	3.25(1.93)	3.22(1.93)	9.16(3.11)	3.50(1.99)	3.63(2.00)	3.27(1.93)	10.40(3.30)
T3	G1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G4	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G5	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	G6	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
Interaction									
M and T		0.16	NS	NS	NS	0.16	NS	NS	0.09
T and M		0.19	NS	NS	NS	0.16	NS	NS	0.09
Mean of Factor-1									
1		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
2		3.47(1.98)	3.42(1.97)	3.39(1.97)	10.28(3.27)	3.30(1.94)	4.03(2.12)	3.13(1.90)	10.46(3.30)
3		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
CD(0.05)		0.17	0.12	0.04	0.09	0.1	0.1	0.03	0.05
Mean of Factor-2									
1		1.18(1.14)	1.36(1.17)	1.27(1.16)	3.80(1.62)	1.26(1.16)	1.56(1.23)	1.09(1.12)	3.91(1.64)
2		1.32(1.17)	1.24(1.16)	1.09(1.12)	3.64(1.60)	1.25(1.16)	1.33(1.18)	1.01(1.10)	3.60(1.59)
3		1.43(1.20)	1.20(1.15)	1.29(1.17)	3.91(1.64)	1.05(1.11)	1.47(1.21)	1.04(1.10)	3.56(1.59)
4		1.24(1.15)	0.99(1.09)	1.07(1.11)	3.30(1.55)	1.16(1.13)	1.56(1.23)	1.08(1.12)	3.80(1.62)
5		0.89(1.05)	0.96(1.08)	1.00(1.09)	2.85(1.47)	0.71(1.01)	0.94(1.08)	0.94(1.08)	2.59(1.43)
6		0.90(1.06)	1.08(1.11)	1.07(1.11)	3.05(1.51)	1.17(1.13)	1.21(1.14)	1.09(1.12)	3.47(1.57)
CD(0.05)		0.09	NS	NS	0.11	0.09	NS	NS	0.05
Experimental Mean		**1.13**	**1.13**	**1.13**	**1.56**	**1.12**	**1.18**	**1.11**	**1.57**

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	PANTNAGAR											
		1 DBHA				15 DAHA				30 DAHA			
		Groupwise weed population no/m^2				Groupwise weed population no/m^2				Groupwise Weed population no/m^2			
		Grasses	**Sedges**	**BLW**	**Total**	**Grasses**	**Sedges**	**BLW**	**Total**	**Grasses**	**Sedges**	**BLW**	**Total**
T1	G1	8.00(2.56)	22.67(4.65)	4.00(1.65)	34.67(5.81)	2.00(1.32)	6.00(2.53)	4.67(2.26)	12.67(3.56)	7.33(2.79)	7.33(2.79)	7.33(2.79)	22.00(4.74)
	G2	2.67(1.44)	29.33(5.41)	0.00(0.71)	32.00(5.61)	4.67(2.21)	3.33(1.79)	4.67(2.06)	12.67(3.56)	6.00(2.53)	7.33(2.79)	4.67(2.06)	18.00(4.27)
	G3	4.00(1.91)	28.00(5.33)	0.00(0.71)	32.00(5.68)	2.67(1.65)	4.67(2.26)	4.67(2.06)	12.00(3.41)	4.00(1.91)	7.33(2.79)	5.33(2.18)	16.67(4.06)
	G4	4.00(1.91)	13.33(3.68)	2.67(1.44)	20.00(4.40)	5.33(2.41)	5.33(2.41)	5.33(2.18)	16.00(4.05)	6.00(2.53)	6.67(2.67)	6.67(2.65)	19.33(4.45)
	G5	4.00(1.91)	44.00(6.64)	6.67(2.65)	54.67(7.39)	6.00(2.55)	6.67(2.67)	2.00(1.32)	14.67(3.88)	7.33(2.79)	8.00(2.92)	4.00(1.91)	19.33(4.44)
	G6	4.00(1.65)	22.67(4.65)	8.00(2.56)	34.67(5.67)	5.33(2.39)	4.00(2.12)	2.67(1.65)	12.00(3.50)	7.33(2.79)	6.67(2.65)	6.00(2.53)	20.00(4.52)
T2	G1	12.00(3.33)	17.33(4.13)	1.33(1.18)	30.67(5.48)	13.33(3.68)	22.67(4.58)	9.33(3.06)	45.33(6.70)	16.00(3.49)	48.00(6.69)	13.33(3.59)	77.33(8.58)
	G2	4.00(1.91)	26.67(5.13)	6.67(2.39)	37.33(6.11)	5.33(2.39)	25.33(5.02)	6.67(2.39)	37.33(6.05)	8.00(2.56)	38.67(6.01)	16.00(3.98)	62.67(7.64)
	G3	4.00(1.91)	26.67(5.13)	1.33(1.18)	32.00(5.65)	8.00(2.77)	22.67(4.70)	14.67(3.89)	45.33(6.76)	5.33(2.39)	41.33(6.31)	30.67(5.56)	77.33(8.78)
	G4	6.67(2.39)	40.00(6.34)	5.33(1.83)	52.00(7.24)	10.67(2.86)	34.67(5.85)	12.00(3.50)	57.33(7.60)	21.33(3.91)	61.33(7.80)	24.00(4.90)	106.67(10.35)
	G5	4.00(1.91)	32.00(5.64)	0.00(0.71)	36.00(5.99)	10.67(3.24)	28.00(5.10)	10.67(2.86)	49.33(7.01)	14.67(3.80)	56.00(7.18)	25.33(4.85)	96.00(9.73)
	G6	4.00(1.91)	34.67(5.90)	5.33(2.12)	44.00(6.66)	18.67(4.01)	18.67(4.16)	6.67(2.39)	44.00(6.61)	18.67(3.53)	36.00(5.76)	13.33(3.24)	68.00(8.08)
T3	G1	-	-	-	-	-	-	-	-	-	-	-	-
	G2	-	-	-	-	-	-	-	-	-	-	-	-
	G3	-	-	-	-	-	-	-	-	-	-	-	-
	G4	-	-	-	-	-	-	-	-	-	-	-	-
	G5	-	-	-	-	-	-	-	-	-	-	-	-
	G6	-	-	-	-	-	-	-	-	-	-	-	-
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-1													
1		4.44(1.90)	26.67(5.06)	3.56(1.62)	34.67(5.76)	4.33(2.09)	5.00(2.30)	4.00(1.92)	13.33(3.66)	6.33(2.56)	7.22(2.77)	5.67(2.35)	19.22(4.41)
2		5.78(2.23)	29.56(5.38)	3.33(1.57)	38.67(6.19)	11.11(3.16)	25.33(4.90)	10.00(3.01)	46.44(6.79)	14.00(3.28)	46.89(6.62)	20.44(4.36)	81.33(8.86)
3		-	-	-	-	-	-	-	-	-	-	-	-
CD(0.05)		NS	NS	NS	NS	NS	2.19	0.9	0.47	NS	2.71	0.7	2.22
Mean of Factor-2													
1		10.00(2.95)	20.00(4.39)	2.67(1.41)	32.67(5.64)	7.67(2.50)	14.33(3.55)	7.00(2.66)	29.00(5.13)	11.67(3.14)	27.67(4.74)	10.33(3.19)	49.67(6.66)
2		3.33(1.68)	28.00(5.27)	3.33(1.55)	34.67(5.86)	5.00(2.30)	14.33(3.41)	5.67(2.22)	25.00(4.80)	7.00(2.55)	23.00(4.40)	10.33(3.02)	40.33(5.95)
3		4.00(1.91)	27.33(5.23)	0.67(0.94)	32.00(5.67)	5.33(2.21)	13.67(3.48)	9.67(2.97)	28.67(5.09)	4.67(2.15)	24.33(4.55)	18.00(3.87)	47.00(6.42)
4		5.33(2.15)	26.67(5.01)	4.00(1.63)	36.00(5.82)	8.00(2.63)	20.00(4.13)	8.67(2.84)	36.67(5.82)	13.67(3.22)	34.00(5.23)	15.33(3.78)	63.00(7.40)
5		4.00(1.91)	38.00(6.14)	3.33(1.68)	45.33(6.69)	8.33(2.89)	17.33(3.89)	6.33(2.09)	32.00(5.45)	11.00(3.30)	32.00(5.05)	14.67(3.38)	57.67(7.09)
6		4.00(1.78)	28.67(5.28)	6.67(2.34)	39.33(6.16)	12.00(3.20)	11.33(3.14)	4.67(2.02)	28.00(5.06)	13.00(3.16)	21.33(4.21)	9.67(2.88)	44.00(6.30)
CD(0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		2.06	5.22	1.59	5.97	2.62	3.6	2.47	5.22	2.92	4.7	3.35	6.64

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	LUDHIANA											
		1 DBHA				30 DAHA				60 DAHA			
		Groupwise weed population no/m^2				Groupwise weed population no/m^2				Groupwise Weed population no/m^2			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	52.33(7.26)	12.67(3.60)	14.67(3.85)	79.67(8.94)	2.67(1.77)	4.00(2.08)	2.67(1.74)	9.33(3.10)	3.67(1.87)	4.67(2.16)	4.00(2.09)	12.33(3.53)
	G2	52.00(7.20)	11.67(3.46)	14.33(3.83)	78.00(8.84)	2.33(1.66)	3.00(1.81)	2.00(1.56)	7.33(2.76)	3.33(1.80)	4.00(2.00)	4.00(2.08)	11.33(3.42)
	G3	47.67(6.88)	9.00(3.03)	14.00(3.77)	70.67(8.41)	4.67(2.26)	3.00(1.86)	2.67(1.77)	10.33(3.28)	6.33(2.61)	5.00(2.27)	4.33(2.18)	15.67(4.00)
	G4	48.00(6.96)	11.00(3.36)	13.00(3.63)	72.00(8.49)	2.00(1.56)	3.67(1.94)	2.00(1.56)	7.67(2.80)	3.33(1.90)	4.67(2.26)	3.33(1.85)	11.33(3.41)
	G5	46.67(6.82)	8.33(2.93)	13.00(3.67)	68.00(8.24)	2.33(1.64)	3.00(1.81)	1.67(1.46)	7.00(2.71)	3.33(1.77)	4.00(1.91)	3.33(1.93)	10.67(3.27)
	G6	46.33(6.77)	8.67(3.02)	13.33(3.69)	68.33(8.24)	5.00(2.34)	3.67(2.02)	3.00(1.86)	11.67(3.47)	5.67(2.46)	5.33(2.40)	5.00(2.34)	16.00(4.05)
T2	G1	5.33(2.40)	14.67(3.89)	13.00(3.65)	33.00(5.78)	4.00(2.11)	4.33(2.18)	3.67(2.02)	12.00(3.52)	5.33(2.39)	5.67(2.41)	5.00(2.30)	16.00(4.03)
	G2	5.33(2.39)	12.33(3.54)	13.33(3.71)	31.00(5.61)	3.67(2.00)	4.00(2.08)	3.33(1.93)	11.00(3.38)	5.00(2.35)	5.33(2.34)	5.00(2.30)	15.33(3.93)
	G3	4.33(2.16)	8.33(2.95)	13.00(3.64)	25.67(5.11)	3.67(2.02)	4.00(2.04)	3.67(1.97)	11.33(3.44)	4.67(2.22)	5.33(2.38)	4.67(2.18)	14.67(3.85)
	G4	3.67(1.97)	8.00(2.86)	13.33(3.71)	25.00(5.01)	3.33(1.94)	4.33(2.18)	3.67(1.94)	11.33(3.39)	4.33(2.15)	5.67(2.41)	4.67(2.11)	14.67(3.86)
	G5	4.00(2.11)	9.33(3.13)	12.33(3.54)	25.67(5.09)	4.00(2.11)	4.33(2.16)	3.33(1.93)	11.67(3.48)	5.00(2.29)	5.67(2.41)	4.33(1.99)	15.00(3.92)
	G6	4.00(2.11)	6.67(2.67)	13.33(3.71)	24.00(4.94)	3.33(1.93)	4.00(2.11)	3.67(1.97)	11.00(3.33)	4.00(2.11)	5.33(2.34)	4.00(2.06)	13.33(3.69)
T3	G1	-	-	-	-	-	-	-	-	-	-	-	-
	G2	-	-	-	-	-	-	-	-	-	-	-	-
	G3	-	-	-	-	-	-	-	-	-	-	-	-
	G4	-	-	-	-	-	-	-	-	-	-	-	-
	G5	-	-	-	-	-	-	-	-	-	-	-	-
	G6	-	-	-	-	-	-	-	-	-	-	-	-
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-1													
1		48.83(6.98)	10.22(3.23)	13.72(3.74)	72.78(8.53)	3.17(1.87)	3.39(1.92)	2.33(1.66)	8.89(3.02)	4.28(2.07)	4.61(2.17)	4.00(2.08)	12.89(3.61)
2		4.44(2.19)	9.89(3.17)	13.06(3.66)	27.39(5.26)	3.67(2.02)	4.17(2.13)	3.56(1.96)	11.39(3.42)	4.72(2.25)	5.50(2.38)	4.61(2.16)	14.83(3.88)
3		-	-	-	-	-	-	-	-	-	-	-	-
CD(0.05)		0.99	NS	NS	1.12	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-2													
1		28.83(4.83)	13.67(3.74)	13.83(3.75)	56.33(7.36)	3.33(1.94)	4.17(2.13)	3.17(1.88)	10.67(3.31)	4.50(2.13)	5.17(2.29)	4.50(2.20)	14.17(3.78)
2		28.67(4.79)	12.00(3.50)	13.83(3.77)	54.50(7.23)	3.00(1.83)	3.50(1.95)	2.67(1.75)	9.17(3.07)	4.17(2.07)	4.67(2.17)	4.50(2.19)	13.33(3.68)
3		26.17(4.56)	9.67(3.15)	13.00(3.64)	48.83(6.80)	2.83(1.79)	3.83(1.99)	2.83(1.76)	9.50(3.12)	4.00(2.06)	5.00(2.32)	4.00(2.01)	13.00(3.63)
4		25.17(4.39)	8.17(2.89)	13.17(3.69)	46.50(6.63)	2.83(1.79)	3.67(2.00)	2.67(1.70)	9.17(3.05)	3.83(1.96)	4.83(2.16)	4.00(2.02)	12.67(3.57)
5		25.83(4.50)	9.17(3.08)	13.17(3.65)	48.17(6.75)	4.33(2.18)	3.67(2.01)	3.00(1.85)	11.00(3.38)	5.67(2.45)	5.33(2.34)	4.33(2.08)	15.33(3.96)
6		25.17(4.44)	7.67(2.84)	13.33(3.70)	46.17(6.59)	4.17(2.14)	3.83(2.06)	3.33(1.91)	11.33(3.40)	4.83(2.29)	5.33(2.37)	4.50(2.20)	14.67(3.87)
CD(0.05)		NS	0.61	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		4.59	3.2	3.7	6.89	1.94	2.02	1.81	3.22	2.16	2.27	2.12	3.75

(Values in parentheses are transformed figures)

Table 1m(ii): Contd.

Main plot	Genotypes	IARI-NEW DELHI																	
		1 DBHA			15 DAHA			30 DAHA				45 DAHA				60 DAHA			
		Groupwise weed biomass g/m^2			Groupwise weed biomass g/m^2			Groupwise weed biomass g/m^2				Groupwise weed biomass g/m^2				Groupwise weed biomass g/m^2			
		Sedges	BLW	Total	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	36.00	358.67	394.67	13.33	572.00	585.33	0.00	4.67	459.33	464.00	0.00	0.00	164.00	164.00	0.00	0.00	100.00	100.00
	G2	34.67	412.00	446.67	12.67	612.00	624.67	0.00	4.00	525.33	529.33	0.00	0.00	236.67	236.67	0.00	0.00	103.33	103.33
	G3	28.00	444.67	472.67	13.33	633.33	646.67	0.00	1.33	491.33	492.67	0.00	0.00	154.67	154.67	0.00	0.00	106.67	106.67
	G4	73.33	513.33	586.67	32.67	726.00	758.67	0.00	7.33	541.33	548.67	0.00	0.00	212.67	212.67	0.00	0.00	108.67	108.67
	G5	50.00	500.67	550.67	13.33	697.33	710.67	0.00	6.67	523.33	530.00	0.00	0.00	240.00	240.00	0.00	0.00	105.33	105.33
	G6	28.67	461.33	490.00	14.00	664.00	678.00	0.00	2.00	457.33	459.33	0.00	0.00	148.00	148.00	0.00	0.00	91.33	91.33
T2	G1	2.67	4.00	6.67	32.67	80.00	112.67	19.33	92.67	144.53	256.53	44.00	260.00	295.33	599.33	90.00	263.33	316.67	670.00
	G2	0.00	13.33	13.33	31.33	54.00	85.33	21.33	78.67	138.00	238.00	49.33	370.67	218.00	638.00	68.00	325.33	309.33	702.67
	G3	0.00	14.00	14.00	24.00	89.33	113.33	24.67	66.67	190.00	281.33	56.67	432.00	213.33	702.00	94.67	293.33	306.67	694.67
	G4	6.67	4.00	10.67	28.00	120.00	148.00	42.67	59.33	218.67	320.67	55.33	361.33	362.00	778.67	138.00	284.67	430.00	852.67
	G5	4.67	2.00	6.67	32.67	92.67	125.33	22.00	117.33	181.07	320.40	36.67	486.67	346.00	869.33	100.00	388.00	369.33	857.33
	G6	0.00	0.00	0.00	20.67	89.07	109.73	32.67	34.67	193.33	260.67	37.33	224.67	403.33	665.33	75.33	230.00	380.00	685.33
T3	G1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interaction																			
M and T		NS	53.45	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	81.64	NS	NS	NS	NS	NS
T and M		NS	117.88	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	76.18	NS	NS	NS	NS	NS
Mean of Factor-1																			
1		41.78	448.44	490.22	16.56	650.78	667.33	0.00	4.33	499.67	504.00	0.00	0.00	192.67	192.67	0.00	0.00	102.56	102.56
2		2.33	6.22	8.56	28.22	87.51	115.73	27.11	74.89	177.60	279.60	46.56	355.89	306.33	708.78	94.33	297.44	352.00	743.78
3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CD(0.05)		NS	142.32	179.63	NS	59.08	101.16	8.62	47.20	36.75	75.11	26.19	123.63	20.10	110.34	27.08	144.53	48.50	199.19
Mean of Factor-2																			
1		19.33	181.33	200.67	23.00	326.00	349.00	9.67	48.67	301.93	360.27	22.00	130.00	229.67	381.67	45.00	131.67	208.33	385.00
2		17.33	212.67	230.00	22.00	333.00	355.00	10.67	41.33	331.67	383.67	24.67	185.33	227.33	437.33	34.00	162.67	206.33	403.00
3		14.00	229.33	243.33	18.67	361.33	380.00	12.33	34.00	340.67	387.00	28.33	216.00	184.00	428.33	47.33	146.67	206.67	400.67
4		40.00	258.67	298.67	30.33	423.00	453.33	21.33	33.33	380.00	434.67	27.67	180.67	287.33	495.67	69.00	142.33	269.33	480.67
5		27.33	251.33	278.67	23.00	395.00	418.00	11.00	62.00	352.20	425.20	18.33	243.33	293.00	554.67	50.00	194.00	237.33	481.33
6		14.33	230.67	245.00	17.33	376.53	393.87	16.33	18.33	325.33	360.00	18.67	112.33	275.67	406.67	37.67	115.00	235.67	388.33
CD(0.05)		NS	37.80	57.43	NS	62.00	68.71	NS	NS	NS	NS	NS	NS	57.73	NS	NS	NS	NS	NS
Experimental Mean		**22.06**	**227.33**	**249.39**	**22.39**	**369.14**	**391.53**	**13.56**	**39.61**	**338.63**	**391.80**	**23.28**	**177.94**	**249.50**	**450.72**	**47.17**	**148.72**	**227.28**	**423.17**

Table 1m(ii): Contd.

Main plot	Genotypes	ICAR-IIRR														
		1 DBHA			15 DAHA				30 DAHA				60 DAHA			
		Weed biomass g/m²			Groupwise weed biomass g/m²				Weed biomass g/m²				Weed biomass g/m²			
		Grasses	Sedges	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
T1	G1	0.30	2.51	2.81	13.86	2.09	3.74	19.68	64.23	7.66	23.35	95.23	44.39	3.61	42.79	90.79
	G2	0.75	2.42	3.17	14.82	2.88	4.47	22.17	76.23	10.33	21.81	108.38	93.84	2.29	20.12	116.24
	G3	0.25	0.88	1.13	15.60	1.79	5.93	23.32	85.11	2.09	14.54	101.75	66.06	6.42	17.80	90.29
	G4	0.57	0.98	1.56	15.29	0.64	4.45	20.38	72.88	4.76	12.44	90.08	74.83	12.04	35.53	122.40
	G5	0.91	2.57	3.49	10.07	4.35	4.75	19.17	56.77	13.64	33.96	104.36	183.48	11.74	29.71	224.93
	G6	0.62	2.09	2.71	22.04	5.16	5.78	32.99	81.93	9.62	14.96	106.52	84.94	1.21	45.09	131.25
T2	G1	0.00	2.48	2.48	0.00	13.99	0.00	13.99	0.00	19.67	0.69	20.36	0.17	40.64	9.24	50.05
	G2	0.00	2.77	2.77	0.00	10.56	0.00	10.56	0.00	33.35	0.00	33.35	3.42	71.67	8.45	83.53
	G3	0.00	2.65	2.65	0.00	6.33	0.00	6.33	0.00	25.92	0.31	26.23	0.50	51.33	16.89	68.72
	G4	0.00	2.09	2.09	0.00	7.05	0.00	7.05	0.00	27.18	0.24	27.42	0.00	74.33	9.09	83.42
	G5	0.00	3.00	3.00	0.00	4.95	0.00	4.95	0.00	22.88	0.00	22.88	2.64	59.11	26.65	88.40
	G6	0.00	2.79	2.79	0.00	5.62	0.00	5.62	0.00	31.34	0.00	31.34	0.44	37.46	18.70	56.60
T3	G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interaction																
M and T		0.13	NS	NS	2.92	3.05	NS	4.41	8.56	NS	NS	NS	27.66	11.38	NS	37.40
T and M		0.14	NS	NS	2.67	2.92	NS	4.11	8.89	NS	NS	NS	26.73	10.97	NS	34.96
Mean of Factor-1																
1		0.57	1.91	2.48	15.28	2.82	4.85	22.95	72.86	8.02	20.18	101.05	91.26	6.22	31.84	129.32
2		0.00	2.63	2.63	0.00	8.09	0.00	8.09	0.00	26.72	0.21	26.93	1.19	55.76	14.84	71.79
3		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CD(0.05)		0.12	0.53	0.49	0.33	1.47	0.53	1.40	6.64	8.86	2.64	14.14	14.34	5.77	2.85	12.78
Mean of Factor-2																
1		0.10	1.66	1.76	4.62	5.36	1.25	11.22	21.41	9.11	8.01	38.53	14.85	14.75	17.35	46.95
2		0.25	1.73	1.98	4.94	4.48	1.49	10.91	25.41	14.56	7.27	47.24	32.42	24.65	9.52	66.59
3		0.08	1.18	1.26	5.20	2.71	1.98	9.89	28.37	9.34	4.95	42.66	22.19	19.25	11.57	53.00
4		0.19	1.02	1.22	5.10	2.56	1.48	9.14	24.29	10.65	4.23	39.17	24.94	28.79	14.87	68.61
5		0.30	1.86	2.16	3.36	3.10	1.58	8.04	18.92	12.17	11.32	42.42	62.04	23.62	18.79	104.44
6		0.21	1.63	1.83	7.35	3.59	1.93	12.87	27.31	13.65	4.99	45.95	28.46	12.89	21.27	62.61
CD(0.05)		0.08	NS	NS	1.68	1.76	NS	2.55	4.94	NS	4.60	NS	15.97	6.57	NS	21.59
Experimental Mean		**0.19**	**1.51**	**1.70**	**5.09**	**3.63**	**1.62**	**10.35**	**24.29**	**11.58**	**6.79**	**42.66**	**30.82**	**20.66**	**15.56**	**67.03**

Table 1m(ii): Contd.

Main plot	Genotypes	KAUL				NAGINA											
		60 DAHA				1 DBHA				15 DAHA				30 DAHA			
		Wweed biomassat g/m^2				Groupwise weed biomass g/m^2				Groupwise weed biomass g/m^2				Groupwise weed biomass g/m^2			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	9.50	8.20	7.90	25.60	2.91	2.86	2.65	8.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G2	7.53	8.03	6.70	22.27	2.71	2.48	2.46	7.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G3	41.70	24.30	16.70	82.70	2.71	2.65	2.77	8.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G4	9.87	8.27	6.30	24.43	2.70	2.48	2.70	7.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G5	9.63	8.50	7.20	25.33	2.94	2.67	2.47	8.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G6	24.67	16.77	13.03	54.47	2.68	2.43	2.31	7.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2	G1	15.50	10.77	10.20	36.47	3.55	2.90	2.66	9.12	2.11	2.23	1.92	6.26	2.62	2.93	2.66	8.21
	G2	23.43	10.83	11.13	45.40	3.06	2.95	3.31	9.32	2.11	2.18	2.09	6.39	2.71	2.55	2.34	7.61
	G3	26.30	12.00	13.50	51.80	2.20	2.37	2.70	7.26	1.81	2.03	2.09	5.93	2.71	2.71	2.59	8.01
	G4	24.70	11.00	10.70	46.40	2.98	3.18	2.83	8.99	2.06	2.13	2.17	6.36	2.70	2.53	2.33	7.57
	G5	21.83	11.93	11.57	45.33	2.83	2.78	3.06	8.68	1.99	1.96	2.11	6.06	2.94	2.75	2.56	8.25
	G6	23.30	13.20	11.90	48.40	2.89	3.17	3.31	9.36	2.19	2.52	2.66	7.36	2.94	2.71	2.38	8.04
T3	G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interaction																	
M and T		2.94	1.52	1.30	3.47	0.35	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		2.72	1.43	1.20	3.23	0.36	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-1																	
1		17.15	12.34	9.64	39.13	2.78	2.60	2.56	7.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2		22.51	11.62	11.50	45.63	2.92	2.89	2.98	8.79	2.04	2.18	2.17	6.39	2.77	2.70	2.48	7.95
3		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CD(0.05)		0.68	0.56	0.29	1.14	0.27	0.26	0.63	1.05	0.03	0.10	0.10	0.19	0.21	0.19	0.11	0.33
Mean of Factor-2																	
1		8.33	6.32	6.03	20.69	2.16	1.92	1.77	5.85	0.70	0.74	0.64	2.09	0.87	0.98	0.89	2.74
2		10.32	6.29	5.94	22.56	1.92	1.81	1.92	5.66	0.70	0.73	0.70	2.13	0.90	0.85	0.78	2.54
3		22.67	12.10	10.07	44.83	1.64	1.67	1.82	5.13	0.60	0.68	0.70	1.98	0.90	0.90	0.86	2.67
4		11.52	6.42	5.67	23.61	1.89	1.89	1.85	5.63	0.69	0.71	0.72	2.12	0.90	0.84	0.78	2.52
5		10.49	6.81	6.26	23.56	1.93	1.82	1.84	5.59	0.66	0.65	0.70	2.02	0.98	0.92	0.85	2.75
6		15.99	9.99	8.31	34.29	1.86	1.87	1.87	5.60	0.73	0.84	0.89	2.45	0.98	0.90	0.79	2.68
CD(0.05)		1.70	0.88	0.75	2.00	0.20	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		**13.22**	**7.99**	**7.05**	**28.26**	**1.90**	**1.83**	**1.85**	**5.57**	**0.68**	**0.73**	**0.72**	**2.13**	**0.92**	**0.90**	**0.83**	**2.65**

Table 1m(ii): Contd.

Main plot	Genotypes	NAGINA								PANTNAGAR		
		45 DAHA				60 DAHA				Total		
		Groupwise weed biomass g/m^2				Groupwise weed biomass g/m^2				Groupwise weed biomass 1 DBHA g/m^2	Groupwise weed biomass at 15 DAHA g/m^2	Groupwise weed biomass at 30 DAHA g/m^2
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total			
T1	G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.40	1.41	4.73
	G2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89	1.12	5.89
	G3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	1.61	4.73
	G4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.55	1.43	4.60
	G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	1.59	6.20
	G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	1.11	5.25
T2	G1	2.62	2.93	2.66	8.21	2.24	2.78	2.46	7.48	0.63	7.47	50.40
	G2	2.71	2.55	2.34	7.61	2.84	2.25	2.22	7.32	0.92	4.84	42.48
	G3	2.71	2.71	2.59	8.01	2.66	2.36	2.28	7.30	1.59	6.27	46.35
	G4	2.70	2.53	2.33	7.57	2.66	2.60	2.23	7.49	0.63	9.49	41.47
	G5	2.94	2.75	2.56	8.25	2.77	2.35	2.24	7.36	1.17	5.45	46.40
	G6	2.83	2.66	2.76	8.25	2.80	2.46	2.63	7.90	0.79	8.83	54.00
T3	G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-
	G2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-
	G3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-
	G4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-
	G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-
	G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-
Interaction												
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-1												
1		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.48	1.38	5.24
2		2.75	2.69	2.54	7.98	2.66	2.47	2.34	7.47	0.95	7.06	46.85
3		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
CD(0.05)		0.19	0.17	0.16	0.36	0.07	0.19	0.08	0.18	NS	0.32	4.36
Mean of Factor-2												
1		0.87	0.98	0.89	2.74	0.75	0.93	0.82	2.49	1.51	4.44	27.57
2		0.90	0.85	0.78	2.54	0.95	0.75	0.74	2.44	1.41	2.98	24.19
3		0.90	0.90	0.86	2.67	0.89	0.79	0.76	2.43	1.36	3.94	25.54
4		0.90	0.84	0.78	2.52	0.89	0.87	0.74	2.50	1.09	5.46	23.03
5		0.98	0.92	0.85	2.75	0.92	0.78	0.75	2.45	0.99	3.52	26.30
6		0.94	0.89	0.92	2.75	0.93	0.82	0.88	2.63	0.95	4.97	29.63
CD(0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		**0.92**	**0.90**	**0.85**	**2.66**	**0.89**	**0.82**	**0.78**	**2.49**	1.22	4.22	26.04

Table 1m(ii): Contd.

Main plot	Genotypes	LUDHIANA											
		1 DBHA				30 DAHA				60 DAHA			
		Groupwise weed biomass g/m^2				Groupwise weed biomass g/m^2				Groupwise weed biomass g/m^2			
		Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T1	G1	75.23	10.04	42.08	127.34	6.20	3.50	3.48	13.18	8.82	4.88	4.37	18.07
	G2	82.30	9.54	42.29	134.13	5.05	2.78	2.57	10.40	7.68	4.12	4.41	16.21
	G3	80.92	8.11	41.88	130.91	7.56	2.40	2.87	12.83	12.83	5.38	4.89	23.11
	G4	79.56	8.23	39.35	127.14	4.76	3.38	2.63	10.76	8.68	4.82	3.66	17.16
	G5	79.67	8.13	39.10	126.89	5.19	2.78	2.25	10.22	8.67	3.74	3.86	16.28
	G6	79.27	8.29	39.02	126.58	6.60	2.81	2.55	11.97	13.78	5.24	5.09	24.11
T2	G1	18.80	10.02	41.27	70.10	10.67	3.78	4.24	18.69	16.70	5.33	5.55	27.58
	G2	18.58	9.68	40.96	69.22	10.02	3.60	4.33	17.95	16.38	5.10	5.46	26.94
	G3	17.44	7.68	41.25	66.37	9.42	3.85	4.75	18.02	15.49	5.19	5.38	26.07
	G4	16.72	7.80	40.66	65.19	8.02	3.74	4.56	16.32	15.28	5.10	4.91	25.30
	G5	18.10	8.78	40.28	67.16	8.97	3.72	4.16	16.85	16.49	5.59	4.64	26.72
	G6	17.05	7.76	39.61	64.41	8.99	3.54	4.45	16.97	15.33	5.14	4.78	25.25
T3	G1	-	-	-	-	-	-	-	-	-	-	-	-
	G2	-	-	-	-	-	-	-	-	-	-	-	-
	G3	-	-	-	-	-	-	-	-	-	-	-	-
	G4	-	-	-	-	-	-	-	-	-	-	-	-
	G5	-	-	-	-	-	-	-	-	-	-	-	-
	G6	-	-	-	-	-	-	-	-	-	-	-	-
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Factor-1													
1		79.49	8.72	40.62	128.83	5.89	2.94	2.72	11.56	10.08	4.70	4.38	19.16
2		17.78	8.62	40.67	67.07	9.35	3.70	4.41	17.47	15.95	5.24	5.12	26.31
3		-	-	-	-	-	-	-	-	-	-	-	-
CD(0.05)		7.35	NS	NS	7.06	NS	NS	1.27	5.87	NS	NS	NS	NS
Mean of Factor-2													
1		47.01	10.03	41.67	98.72	8.43	3.64	3.86	15.93	12.76	5.10	4.96	22.83
2		50.44	9.61	41.63	101.67	7.54	3.19	3.45	14.18	12.03	4.61	4.94	21.58
3		48.50	7.95	40.30	96.76	7.09	3.61	3.69	14.39	12.09	5.00	4.52	21.62
4		48.20	7.96	39.88	96.04	6.60	3.26	3.40	13.27	11.98	4.42	4.38	20.79
5		49.51	8.44	41.08	99.04	8.26	3.06	3.52	14.84	14.66	5.49	4.77	24.92
6		48.16	8.03	39.32	95.50	7.80	3.17	3.50	14.47	14.56	5.19	4.94	24.68
CD(0.05)		NS	1.52	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		48.64	8.67	40.65	97.95	7.62	3.32	3.57	14.51	13.01	4.97	4.75	22.73

Table 1m(ii): Contd.

Main plot	Genotypes	Phytotoxicity %														
		ICAR-IIRR														
		7 DAHA			14 DAHA			21 DAHA			28 DAHA			35 DAHA		
		Tip burning	Scorching	Yellowing	Tip burning	Scorching	Yellowing	Tip burning	Scorching	Yellowing	Tip burning	Scorching	Yellowing	Tip burning	Scorching	Yellowing
T1	G1	1.5	1	0.7	1.7	1.1	1	2	1.4	1	2	1.4	1	1.4	0	0
	G2	1.5	1	0.7	1.6	1.5	0.8	1.9	1.5	1	1.6	1.2	1	1.6	1	0
	G3	1.3	1	0.7	1.8	1.3	0.9	2	1.3	1	1.9	1	1	1.8	1	0
	G4	1.5	0.9	0.9	1.8	1.2	1	2	1.5	1	1.7	1.1	1	1	1	0
	G5	9	9	7	9	9	9	9	9	9	10	10	10	10	10	10
	G6	9	9	7	9	9	9	9	9	9	10	10	10	10	10	10
T2	G1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T3	G1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

***DAHA - Days after herbicide application**

Table 1m(ii): Contd.

Main plot	Genotypes	Phytotoxicity %												
		IARI-NEW DELHI					KAUL						PANTNAGAR	LUDHIANA
		7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	Chlorisis	Necrosis	Wilting	Scorching	Hyponasty	Epinasty	Wilting	
T1	G1	0	0	0	0	0	0	0	0	0	0	0	1.33	No visual phytotoxicity of herbicide Imazethpypr was observed in genontypes 1,2,4,5 but genotypes 3 and 6 showed compete mortality when exposed to imazethpyr herbicide
	G2	0	0	0	0	0	0	0	0	0	0	0	1.67	
	G3	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G4	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G5	6	9	10	10	10	9	9	9	9	9	9	10.00	
	G6	6	9	10	10	10	6	6	6	6	6	6	10.00	
T2	G1	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G2	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G3	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G4	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G5	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G6	0	0	0	0	0	0	0	0	0	0	0	2.00	
T3	G1	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G2	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G3	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G4	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G5	0	0	0	0	0	0	0	0	0	0	0	2.00	
	G6	0	0	0	0	0	0	0	0	0	0	0	2.00	

***DAS - Days after spraying**

Reference:

Crop response / crop injury	Rating
0	**0**
1-10 %	**1**
11-20 %	**2**
21-30 %	**3**
31-40 %	**4**
41-50 %	**5**
51-60 %	**6**
61-70 %	**7**
71-80 %	**8**
81-90 %	**9**
91-100 %	**10**

NMT 1m(iii) Evaluation of identified cultures and cultivars for enhancing nitrogen use efficiency in irrigated rice

The productivity of rice is very low due to imbalanced and excessive use of nitrogen fertilizers by the farmers. It has been reported that the apparent recovery efficiency of applied nitrogen is approximately about 30-33%. The remaining amount of N is either lost through surface runoff, leaching, volatilization or denitrification and further adds to increased cost of production and environmental degradation. The use of efficient and economical rates of nitrogen fertilizer is important for enhancing crop productivity and maintaining environmental sustainability. To achieve this, it is imperative to identify high nitrogen utilizing cultivars which can minimize the losses. Large numbers of rice cultivars have been released in India so far, but the question is that whether these cultivars are capable to utilizing the nitrogen efficiently. Inter varietal differences for nitrogen use efficiency has been reported by many researchers. Therefore, there is a need to identify the cultivars which can efficiently utilize the nitrogen and to develop a sustainable nitrogen rate recommendation for these cultivars which can further give enhanced yield and resource use efficiency. Hence the present trial is constituted to evaluate the identified cultures and cultivars with the following objective: 1) To study the comparative performance of elite lines and cultivars under different levels of nitrogen. The trial was conducted at 4 locations (**ICAR-IIRR, Ludhiana, Ranchi and Maruteru**). Split plot design was adopted with 3 main plots of nitrogen levels (N_1- No nitrogen, N_2: 50 % of recommended N dose (P and K is constant) and M_3: 100 % of recommended dose of N (P and K constant). Sub plots consists of 25 advanced cultures. The results were summarized and presented in **Table 4.1. m(iii)** and the salient findings are as followed.

Interaction effect of nitrogen level and advanced cultures on grain yield was found significant at **ICAR-IIRR** and **Maruteru** only. However, our interest is to find out suitable and efficient cultivars under 0%, 50% and 100% RDN, we will limit our discussion to these three RDN levels.

The recommended nitrogen dose of black clay soils of **ICAR-IIRR** research plot is 120 kg N/ha (100% recommended dose of nitrogen). There are four fixed nitrogen plots (0, 60, 120 and 180 kg N/ha) are maintained at Rajendranagar farm of ICAR-IIRR since last three years. So 60 and 120 kg N/ha corresponds to 50 and 100% of recommended dose of nitrogen, respectively. Every season the above mentioned nitrogen dose is applied keeping other nutrients dose (P_2O_5 and K_2O) constant. The recommended phosphorus and potassium doses are 60 and 40 kg/ha, respectively. For a better comparison among the locations and valid conclusion we have taken three nitrogen level (0, 60 and 120 kg N/ha) for in depth discussion.

At black clay soils of **ICAR-IIRR** all cultures performed better under 150% of RDN than under 100% RDN. At 150% of RDN, IET 28827 resulted the highest grain yield (8.75 t/ha) followed by IET 28084 (8.03 t/ha), IET 28088 (7.99 t/ha), IET 28080 (7.55 t/ha) and IET 27730 (7.49 t/ha). Similarly, at 100% RDN IET 28080 resulted the highest grain yield (7.31 t/ha) closely followed by IET 28084 (7.29 t/ha), IET 27730 (7.29 t/ha), IET 28088 (7.24 t/ha). Similarly, at 50% of RDN the highest grain yield was recorded in IET 28087 (5.81 t/ha) closely followed by IET 27730 (5.26 t/ha), IET 28080 (5.03 t/ha), IET 28831

(4.47 t/ha), IET 28081 (4.38 t/ha) and IET 28830 (4.37 t/ha). In without nitrogen (0 kg/ha) applied plots IET 27730 (3.32 t/ha) resulted the highest grain yield, followed by IET 28081 (3.07 t/ha), IET 28830 (2.95 t/ha), IET 28080 (2.94 t/ha) and IET 28084 (2.93 t/ha). The highest agronomic efficiency of N was recorded in IET 28088 (43.83%) followed by Tella Hamsa (41.33%) at 100% RDN. Similarly, at 50% RDN the highest agronomic efficiency of N was recorded in IET 28831 (39.33%) followed by IET 28080 (35.0%). Among nitrogen levels 150% RDN resulted significantly highest grain yield (6.45 t/ha) than 100% (6.05 t/ha), 50% (3.70 t/ha), without nitrogen (2.2 t/ha). Among advanced cultures IET 27730 (5.84 t/ha) resulted the highest grain yield followed by IET 28080 (5.82 t/ha), IET 28087 (5.75 t/ha), IET 28086 (5.52 t/ha).

The recommended **N: P_2O_5: K_2O/ha** at sandy loam soils of **Ludhiana** is **105:30:30 kg/ha.** Two nitrogen levels (52.5 and 105 kg N/ha) were adopted in the trial which corresponds to 50 and 100% of RDN, respectively. The above mentioned nitrogen doses are applied keeping other recommended nutrients dose (P_2O_5 and K_2O) constant. Entries/Cultivars not taken up/grown for the trial were (IET 28083, IET 27730, IET 28079, BPT 5204 and Swarna). At 100% RDN, IET 28087 resulted the highest grain yield (5.93 t/ha) closely followed by IET 28827 (5.51 t/ha), Varadhan (5.48 t/ha), IET 28826 (5.37 t/ha). Similarly, at 50% of RDN the highest grain yield was recorded in IET 28087 (4.99 t/ha) closely followed by IET 28827 (4.98 t/ha), IET 28084 (4.98 t/ha), IET 28088 (4.84 t/ha), IET 28828 (4.81 t/ha), IET 28086 (4.78 t/ha) and Varadhan (4.71 t/ha). At 100% RDN the highest agronomic efficiency of N was recorded in IET 28081 (11.33%) followed by IET 28829 (10.67%). Effect of main plots nitrogen levels were non-significant on grain yields. Among advanced cultures IET 28087 (5.46 t/ha) resulted the highest grain yield followed by IET 28827 (5.25 t/ha), Varadhan (5.10 t/ha), IET 28084 (4.96 t/ha), IET 28826 (4.93 t/ha) and IET 28086 (4.89).

The recommended **N: P_2O_5: K_2O/ha** of **Ranchi** soils is **120:60:40 kg/ha.** Three nitrogen levels (0, 60 and 120 kg N/ha) were adopted in the trial which corresponds to 0, 50 and 100% of RDN, respectively. The above mentioned nitrogen doses are applied keeping other recommended nutrients dose (P_2O_5 and K_2O) constant. The interaction effect of nitrogen level and advanced cultures on grain yield was statistically non-significant. At 100% RDN, IET 27730 resulted the highest grain yield (4.82 t/ha) followed by IET 28831 (4.62 t/ha), Rasi (4.61 t/ha), IET 28827 (4.56 t/ha) and BPT 5204 (4.55 t/ha). At 50% RDN, the highest grain yield was recorded in IET 28828 (4.05 t/ha) followed by BPT 5204 (4.02 t/ha), IET 28831 (3.96 t/ha), IET 27730 (3.94 t/ha) and Tella Hamsa (3.92 t/ha). In without nitrogen (0 kg/ha) applied plots IET 28828 (2.33 t/ha) given the highest grain yield followed by IET 28088 (2.3 t/ha), IET 28832 (2.24 t/ha), IET 28084 (2.23 t/ha) and Rasi (2.22 t/ha). Among advanced cultures IET 28828 (3.63 t/ha) resulted the highest grain yield followed by Rasi (3.58 t/ha), IET 27730 (3.58 t/ha), IET 28831 (3.57 t/ha) and Tella Hamsa (3.53 t/ha).

The recommended **N: P_2O_5: K_2O/ha** at **Maruteru** is **90:60:60 kg/ha.** Three nitrogen levels (0, 45 and 90 kg N/ha) were adopted in the trial which corresponds to 0, 50 and 100% of RDN, respectively. The above mentioned nitrogen doses are applied keeping other recommended nutrients dose (P_2O_5 and K_2O) constant. In delta alluvial soils of **Maruteru** IET 27730 at 100% RDN resulted the highest grain yield (6.96 t/ha) closely followed by IET 28831 (6.52 t/ha), Improved Samba Mahsuri (6.25 t/ha). At 50% RDN, the highest grain yield recorded in IET 28831 (6.52 t/ha), IET 28828 (5.87 t/ha), Improved Samba Mahsuri (5.53 t/ha), IET 28079 (5.52 t/ha) and IET 28086 (5.43 t/ha). The highest agronomic efficiency of N was recorded in IET 28831 (78.22%) at 50% RDN. In without nitrogen (0 kg/ha) applied plots the highest grain yield recorded in IET 28831 (3.0 t/ha) followed by IET 28828 (2.83 t/ha), IET 28832 (2.71 t/ha), IET 28079 (2.68 t/ha) and IET 28086 (2.58 t/ha). Among nitrogen levels 100% RDN resulted significantly highest grain yield (4.87 t/ha) followed by 50% (4.74 t/ha) and without nitrogen (2.37 t/ha). Among advanced cultures IET 28831 (4.94 t/ha) resulted the highest grain yield followed by Improved Samba Mahsuri (4.8 t/ha), IET 28828 (4.69 t/ha), IET 27730 (4.59 t/ha) and IET 28826 (4.49 t/ha).

Trials conducted at 4 locations revealed that the following cultivars/entries to be high grain yielding and nitrogen use efficient

Location	High grain yielding entries/cultivars (descending order) under without application of nitrogen (0 kh/ha)	High grain yielding entries/cultivars (descending order) under 50% of recommended nitrogen dose	High grain yielding entries/cultivars (descending order) under 100% of recommended nitrogen dose	High grain yielding entries/cultivars (descending order) under 150% of recommended nitrogen dose
ICAR-IIRR	**IET 27730 (3.32 t/ha),** IET 28081 (3.07 t/ha), **IET 28830 (2.95 t/ha),** **IET 28080 (2.94 t/ha)** and **IET 28084 (2.93 t/ha)** *The highest grain yield recorded among checks is under Swarna (2.59 t/ha)	**IET 28087 (5.81 t/ha),** **IET 27730 (5.26 t/ha),** **IET 28080 (5.03 t/ha),** **IET 28831 (4.47 t/ha),** IET 28081 (4.38 t/ha) and **IET 28830 (4.37 t/ha)** *The highest grain yield recorded among checks is under Swarna (4.15 t/ha)	**IET 28080 (7.31 t/ha),** IET 28084 (7.29 t/ha), **IET 27730 (7.29 t/ha)** and IET 28088 (7.24 t/ha) *The highest grain yield recorded among checks is under Tella Hamsa (7.03 t/ha)	IET 28827 (8.75 t/ha), IET 28084 (8.03 t/ha), IET 28088 (7.99 t/ha), **IET 28080 (7.55 t/ha)** and IET 27730 (7.49 t/ha) *The highest grain yield recorded among checks is under Tella Hamsa (7.28 t/ha)
PAU, Ludhiana		**IET 28087 (4.99 t/ha),** IET 28827 (4.98 t/ha), **IET 28084 (4.98 t/ha),** **IET 28088 (4.84 t/ha),** **IET 28828 (4.81 t/ha),** and IET 28086 (4.78 t/ha) *The highest grain yield recorded among checks is under Varadhan (4.71 t/ha)	IET 28087 (5.93 t/ha), IET 28827 (5.51 t/ha), Varadhan (5.48 t/ha) and IET 28826 (5.37 t/ha) *The highest grain yield recorded among checks is under Varadhan (5.48 t/ha)	
Ranchi	IET 28828 (2.33 t/ha), **IET 28088 (2.30 t/ha),** IET 28832 (2.24 t/ha), **IET 28084 (2.23 t/ha)** and *The highest grain yield recorded among checks is under Rasi (2.22 t/ha)	IET 28828 (4.05 t/ha), BPT 5204 (4.02 t/ha), **IET 28831 (3.96 t/ha),** **IET 27730 (3.94 t/ha)** and Tella Hamsa (3.92 t/ha) *The highest grain yield recorded among checks is under BPT 5204 (4.02 t/ha)	**IET 27730 (4.82 t/ha),** IET 28831 (4.62 t/ha), Rasi (4.61 t/ha), IET 28827 (4.56 t/ha) and BPT 5204 (4.55 t/ha) *The highest grain yield recorded among checks is under Rasi (4.61 t/ha)	
Maruteru	**IET 28831 (3.0 t/ha)** **IET 28828 (2.83 t/ha),** IET 28832 (2.71 t/ha), IET 28079 (2.68 t/ha) and IET 28086 (2.58 t/ha) *The highest grain yield recorded among checks is under Improved Samba Mahsuri (2.63 t/ha)	**IET 28831 (6.52 t/ha),** **IET 28828 (5.87 t/ha),** Improved Samba Mahsuri (5.53 t/ha), IET 28079 (5.52 t/ha) and IET 28086 (5.43 t/ha)	**IET 27730 (6.96 t/ha),** **IET 28831 (6.52 t/ha),** *The highest grain yield recorded among checks is under Improved Samba Mahsuri (6.25 t/ha)	

High grain yielding entries/cultivars irrespective of nitrogen levels

ICAR-IIRR	**IET 27730 (5.84 t/ha), IET 28080 (5.82 t/ha), IET 28087 (5.75 t/ha)** and IET 28086 (5.52 t/ha)
PAU, Ludhiana	**IET 28087 (5.46 t/ha),** IET 28827 (5.25 t/ha), Varadhan (5.10 t/ha), IET 28084 (4.96 t/ha), IET 28826 (4.93 t/ha) and IET 28086 (4.89).
Ranchi	**IET 28828 (3.63 t/ha),** Rasi (3.58 t/ha), **IET 27730 (3.58 t/ha), IET 28831 (3.57 t/ha)** and Tella Hamsa (3.53 t/ha)
Maruteru	**IET 28831 (4.94 t/ha),** Improved Samba Mahsuri (4.8 t/ha), **IET 28828 (4.69 t/ha), IET 27730 (4.59 t/ha)** and IET 28826 (4.49 t/ha)

Table 4.1(m(iii)): Summary of data on grain yield and ancillary characters of selected IVT NIL LNT cultures grown under transplanted conditions at low, medium & high levels of recommended N fertilizer doses, kharif 2019.

N-levels	Varieties	ICAR-IIRR						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	No of grains/panicle	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
F1	V1	3.07	*73*	143	1.70	16.83	123	
	V2	2.94	*77*	153	2.19	18.13	113	
	V3	2.93	*78*	118	1.66	19.97	104	
	V4	2.14	*85*	160	1.79	17.83	105	
	V5	4.24	*58*	192	1.74	17.77	105	
	V6	2.14	*85*	111	1.79	16.27	116	
	V7	3.32	*71*	121	1.24	17.47	102	
	V8	1.98	*92*	214	1.52	18.60	96	
	V9	1.38	*96*	178	1.58	20.20	116	
	V10	2.13	*87*	114	1.60	17.63	127	
	V11	1.83	*93*	185	1.57	18.47	96	
	V12	1.83	*93*	118	1.66	17.40	128	
	V13	1.61	*95*	107	1.63	18.40	132	
	V14	2.1	*89*	207	1.77	16.77	107	
	V15	1.02	*99*	192	1.63	19.17	86	
	V16	2.95	*76*	164	1.78	20.70	103	
	V17	2.11	*88*	128	1.85	20.70	88	
	V18	2.35	*83*	171	1.78	18.97	88	
	V19	2.48	*82*	114	1.67	18.27	108	
	V20	1.18	*97*	196	1.67	18.40	100	
	V21	2.1	*89*	171	1.55	17.33	108	
	V22	0.15	*100*	143	1.70	20.27	119	
	V23	2.24	*84*	171	1.59	20.43	79	
	V24	2.59	*80*	175	1.63	18.83	89	
	V25	2.07	*91*	132	1.72	18.30	98	
F2	V1	4.38	*54*	224	1.84	19.03	148	21.83
	V2	4.29	*57*	221	2.04	20.10	130	22.50
	V3	5.03	*49*	171	1.50	18.63	115	35.00
	V4	3.39	*68*	217	1.99	19.80	108	20.83
	V5	5.81	*34*	246	1.90	18.57	117	26.17
	V6	3.64	*64*	196	1.85	17.27	121	25.00
	V7	5.26	*41*	207	1.81	17.47	107	32.33
	V8	3.02	*75*	281	1.75	20.10	105	17.33
	V9	3.04	*74*	192	1.41	20.17	117	27.67
	V10	3.73	*61*	185	1.87	17.57	114	26.67
	V11	3.37	*69*	260	1.92	18.43	108	25.67
	V12	3.35	*70*	185	1.90	18.53	126	25.33
	V13	3.3	*72*	207	1.88	19.33	145	28.17
	V14	3.41	*67*	256	1.58	18.33	138	21.83
	V15	2.51	*81*	253	1.96	21.23	95	24.83
	V16	4.37	*55*	303	1.83	19.57	108	23.67
	V17	4.47	*53*	196	1.98	19.97	106	39.33
	V18	3.68	*62*	242	1.94	21.23	113	22.17
	V19	3.66	*63*	146	1.95	19.70	116	19.67
	V20	2.7	*79*	207	1.89	19.30	109	25.33
	V21	3.85	*60*	235	1.70	18.83	115	29.17
	V22	1.1	*98*	178	1.58	20.83	98	15.83
	V23	3.47	*65*	199	1.76	20.60	106	20.50
	V24	4.15	*59*	260	1.71	20.03	104	26.00
	V25	3.45	*66*	182	1.97	20.87	117	23.00

Table 4.1(m(iii)): Cntd….

N-levels	Varieties	ICAR-IIRR						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Panicle/m^2 (No.)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
F3	V1	6.86	*16*	316	2.02	20.37	170	31.58
	V2	7.31	*6*	306	2.43	21.10	154	36.42
	V3	7.29	*7*	249	2.29	20.80	138	36.33
	V4	5.34	*38*	309	2.01	20.43	164	26.67
	V5	6.4	*21*	295	2.18	18.17	157	18.00
	V6	5.75	*36*	299	2.08	17.70	160	30.08
	V7	7.29	*7*	299	2.35	18.60	132	33.08
	V8	7.24	*10*	331	2.17	21.40	109	43.83
	V9	5.07	*47*	281	2.15	21.73	130	30.75
	V10	6.35	*22*	299	2.06	19.17	147	35.17
	V11	5.29	*40*	327	2.34	20.50	140	28.83
	V12	5.88	*32*	274	2.37	20.33	166	33.75
	V13	6.12	*29*	288	2.20	21.60	171	37.58
	V14	5.3	*39*	299	2.22	19.63	135	26.67
	V15	4.37	*55*	320	2.22	21.43	107	27.92
	V16	7.1	*12*	334	2.09	21.43	121	34.58
	V17	6.16	*28*	256	2.13	23.67	114	33.75
	V18	6.23	*25*	324	2.35	21.83	127	32.33
	V19	5.08	*46*	252	2.14	20.17	126	21.67
	V20	5.83	*33*	302	2.38	20.00	115	38.75
	V21	5.07	*47*	313	1.96	20.53	141	24.75
	V22	4.51	*52*	242	2.29	21.77	108	36.33
	V23	6.23	*25*	288	2.41	21.83	113	33.25
	V24	6.27	*24*	320	2.56	19.17	122	30.67
	V25	7.03	*13*	299	2.11	21.30	131	41.33
F4	V1	6.96	*15*	380	2.36	21.13	153	21.61
	V2	7.55	*4*	363	2.63	24.20	150	25.61
	V3	8.03	*2*	324	2.49	24.17	138	28.33
	V4	5.21	*43*	334	2.31	17.77	162	17.06
	V5	6.55	*19*	309	2.20	20.40	151	12.83
	V6	5.21	*43*	327	2.18	18.37	160	17.06
	V7	7.49	*5*	324	2.33	21.40	123	23.17
	V8	7.99	*3*	341	2.21	22.83	113	33.39
	V9	4.88	*50*	306	2.35	20.37	130	19.44
	V10	5.68	*37*	327	1.92	21.20	140	19.72
	V11	5.12	*45*	306	2.55	19.07	156	18.28
	V12	6.35	*22*	324	2.44	18.80	164	25.11
	V13	8.75	*1*	341	2.62	23.30	156	39.67
	V14	5.23	*42*	334	2.17	17.57	151	17.39
	V15	5.81	*34*	331	2.41	21.57	123	26.61
	V16	7.18	*11*	327	1.88	21.90	136	23.50
	V17	6.09	*30*	263	2.91	20.93	125	22.11
	V18	6.72	*17*	352	2.81	20.53	128	24.28
	V19	6.23	*25*	281	2.43	19.50	135	20.83
	V20	5.97	*31*	327	2.49	21.13	109	26.61
	V21	4.83	*51*	295	1.98	18.23	151	15.17
	V22	6.67	*18*	263	2.50	19.83	123	36.22
	V23	6.99	*14*	313	2.54	19.87	117	26.39
	V24	6.43	*20*	334	2.30	18.33	131	21.33
	V25	7.28	*9*	313	1.83	20.33	124	28.94
Interaction								
N at same V		0.46		29.62	0.37	1.66	11.72	
V at same N		0.49		30.29	0.38	1.76	11.78	

Table 4.1(m(iii)): Cntd….

N-levels	Varieties	ICAR-IIRR Grain Yield (t/ha)	Rank	Panicle/m² (No.)	Panicle wt (g)	Teswt (g)	Panicle/m² (No.)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
Mean of ferilizer dosage								
	F1	2.20	*4*	155	1.68	18.52	106	
	F2	3.70	*3*	218	1.82	19.42	115	25.03
	F3	6.05	*2*	297	2.22	20.59	136	32.16
	F4	6.45	*1*	322	2.35	20.51	138	23.63
	C.D.(0.05)	0.24		10.93	0.13	0.87	3.28	
	C.V.(%)	13.01		11.03	16.43	10.99	6.64	
Mean of varieties:								
V1	IET 28081	5.32	*6*	266	1.98	19.34	149	25.01
V2	IET 28080	5.52	*4*	261	2.32	20.88	137	28.18
V3	IET 28084	5.82	*2*	215	1.99	20.89	124	33.22
V4	IET 28086	4.02	*18*	255	2.03	18.96	135	21.52
V5	IET 28087	5.75	*3*	261	2.01	18.73	133	19.00
V6	IET 28083	4.19	*17*	233	1.98	17.40	139	24.05
V7	IET 27730	5.84	*1*	238	1.93	18.74	116	29.53
V8	IET 28088	5.06	*7*	292	1.91	20.73	106	31.52
V9	IET 28085	3.59	*23*	239	1.87	20.62	123	25.95
V10	IET 28079	4.47	*14*	231	1.86	18.89	132	27.19
V11	IET 28082	3.90	*22*	270	2.10	19.12	125	24.26
V12	IET 28826	4.35	*16*	225	2.09	18.77	146	28.06
V13	IET 28827	4.95	*9*	236	2.08	20.66	151	35.14
V14	IET 28828	4.01	*19*	274	1.94	18.08	133	21.96
V15	IET 28829	3.43	*24*	274	2.06	20.85	103	26.45
V16	IET 28830	5.40	*5*	282	1.90	20.90	117	27.25
V17	IET 28831	4.71	*13*	211	2.22	21.32	108	31.73
V18	IET 28832	4.75	*11*	272	2.22	20.64	114	26.26
V19	IET 28833	4.36	*15*	198	2.05	19.41	121	20.72
V20	Rasi	3.92	*21*	258	2.11	19.71	108	30.23
V21	Improved Samba Mahsuri	3.96	*20*	254	1.80	18.73	129	23.03
V22	Varadhan	3.11	*25*	206	2.02	20.68	112	29.46
V23	BPT 5204	4.73	*12*	243	2.08	20.68	104	26.71
V24	Swarna	4.86	*10*	272	2.05	19.09	112	26.00
V25	TellaHamsa	4.96	*8*	231	1.91	20.20	118	31.09
	C.D.(0.05)	0.23		14.81	0.18	0.83	5.86	
	C.V.(%)	6.27		7.47	11.38	5.24	5.92	
	Expt. Mean	**4.60**		**248**	**2.02**	**19.76**	**124**	
	Soil type	Black clay						
	pH	7.6						
	N - levels (kg/ha)							
	F1	0						
	F2	60						
	F3	120						
	F4	180						
	Recommended NPK (kg/ha)	120:60:40						

Table 4.1(m(iii)): Cntd….

N-levels	Varieties	LUDHIANA							
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Days to 50% flowering	Straw Yield (t/ha)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
F1	V1	-		-	-	-	-	-	
	V2	-		-	-	-	-	-	
	V3	-		-	-	-	-	-	
	V4	-		-	-	-	-	-	
	V5	-		-	-	-	-	-	
	V6	-		-	-	-	-	-	
	V7	-		-	-	-	-	-	
	V8	-		-	-	-	-	-	
	V9	-		-	-	-	-	-	
	V10	-		-	-	-	-	-	
	V11	-		-	-	-	-	-	
	V12	-		-	-	-	-	-	
	V13	-		-	-	-	-	-	
	V14	-		-	-	-	-	-	
	V15	-		-	-	-	-	-	
	V16	-		-	-	-	-	-	
	V17	-		-	-	-	-	-	
	V18	-		-	-	-	-	-	
	V19	-		-	-	-	-	-	
	V20	-		-	-	-	-	-	
	V21	-		-	-	-	-	-	
	V22	-		-	-	-	-	-	
	V23	-		-	-	-	-	-	
	V24	-		-	-	-	-	-	
	V25	-		-	-	-	-	-	
F2	V1	3.48	*27*	250.8	2.46	14.11	98.33	5.4	
	V2	2.99	*31*	220	3.29	14.61	105.33	5.5	
	V3	4.98	*7*	264	2.89	18.21	97.33	5.69	
	V4	4.78	*13*	268.4	3.31	17.61	78.33	6.01	
	V5	4.99	*5*	286	2.35	14.44	101	7.01	
	V6	-		-	-	-	-	-	
	V7	-		-	-	-	-	-	
	V8	4.84	*10*	305.8	2.92	18.3	80	6.26	
	V9	1.95	*38*	259.6	1.11	14.9	101	4.67	
	V10	-		-	-	-	-	-	
	V11	2.82	*33*	242	1.66	19.2	80.33	6.89	
	V12	4.48	*17*	226.6	2.59	16.68	97.67	5.82	
	V13	4.98	*7*	231	3.34	20.18	80.33	5.61	
	V14	4.81	*12*	305.8	2.63	16.81	81.33	7.04	
	V15	2.28	*35*	266.2	1.29	13.73	100.33	4.56	
	V16	3.75	*22*	294.8	2.24	13.79	99.67	7.22	
	V17	3.53	*25*	297	2.64	23.5	92.33	6.7	
	V18	3.79	*21*	264	2.27	12.94	97	5.56	
	V19	4.11	*19*	233.2	2.65	18.24	81.33	5.04	
	V20	1.53	*40*	321.2	0.92	13.54	71.67	6.19	
	V21	2.25	*37*	270.6	1.45	16.59	102.67	4.38	
	V22	4.71	*14*	233.2	2.38	19.93	81.33	5.77	
	V23	-		-	-	-	-	-	
	V24	-		-	-	-	-	-	
	V25	2.99	*31*	270.6	1.8	18.14	69.33	6.1	

Table 4.1(m(iii)): Cntd….

N-levels	Varieties	LUDHIANA							
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Days to 50% flowering	Straw Yield (t/ha)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
F3	V1	4.67	*16*	257.4	2.74	14.94	100	6.48	11.33
	V2	3.54	*24*	246.4	3.66	15.5	104.33	5.79	5.24
	V3	4.93	*9*	257.4	2.87	17.46	96	6.31	-0.48
	V4	4.99	*5*	272.8	3.82	18.49	77.33	6.33	2.00
	V5	5.93	*1*	272.8	2.95	15.28	100.67	7.26	8.95
	V6	-		-	-	-	-	-	
	V7	-		-	-	-	-	-	
	V8	4.82	*11*	305.8	2.83	18.26	80	7.08	-0.19
	V9	2.26	*36*	316.8	2.07	14.03	100.67	6.5	2.95
	V10	-		-	-	-	-	-	
	V11	3.22	*30*	266.2	2.35	20.45	79.67	7.3	3.81
	V12	5.37	*4*	248.6	2.93	16.12	96	7.11	8.48
	V13	5.51	*2*	213.4	3.87	20.08	79.67	5.97	5.05
	V14	3.64	*23*	301.4	2.53	17.24	79	6.34	-11.14
	V15	3.4	*28*	297	1.88	14.62	98.33	6.42	10.67
	V16	3.52	*26*	288.2	2.05	12.2	100.33	6.89	-2.19
	V17	4.1	*20*	305.8	2.94	24.3	87.67	7.94	5.43
	V18	4.18	*18*	305.8	2.67	13.55	97.33	6.61	3.71
	V19	4.71	*14*	233.2	3.32	19.59	78	5.45	5.71
	V20	1.89	*39*	338.8	1.38	14.77	71	7.24	3.43
	V21	2.55	*34*	292.6	2.21	17.05	103	5.55	2.86
	V22	5.48	*3*	281.6	3.15	20.49	80	7.02	7.33
	V23	-		-	-	-	-	-	
	V24	-		-	-	-	-	-	
	V25	3.32	*29*	294.8	1.88	17.19	68.67	7.05	3.14
F4	V1	-	-	-	-	-	-	-	-
	V2	-	-	-	-	-	-	-	-
	V3	-	-	-	-	-	-	-	-
	V4	-	-	-	-	-	-	-	-
	V5	-	-	-	-	-	-	-	-
	V6	-	-	-	-	-	-	-	-
	V7	-	-	-	-	-	-	-	-
	V8	-	-	-	-	-	-	-	-
	V9	-	-	-	-	-	-	-	-
	V10	-	-	-	-	-	-	-	-
	V11	-	-	-	-	-	-	-	-
	V12	-	-	-	-	-	-	-	-
	V13	-	-	-	-	-	-	-	-
	V14	-	-	-	-	-	-	-	-
	V15	-	-	-	-	-	-	-	-
	V16	-	-	-	-	-	-	-	-
	V17	-	-	-	-	-	-	-	-
	V18	-	-	-	-	-	-	-	-
	V19	-	-	-	-	-	-	-	-
	V20	-	-	-	-	-	-	-	-
	V21	-	-	-	-	-	-	-	-
	V22	-	-	-	-	-	-	-	-
	V23	-	-	-	-	-	-	-	-
	V24	-	-	-	-	-	-	-	-
	V25	-	-	-	-	-	-	-	-
Interaction									
N at same V		NS		60.22	NS	NS	1.83	NS	
V at same N		NS		67.21	NS	NS	1.82	NS	

Table 4.1(m(iii)): Cntd.…

N-levels	Varieties	LUDHIANA Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Days to 50% flowering	Straw Yield (t/ha)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)
Mean of ferilizer dosage									
	F1								
	F2	3.70	*2*	266	2.31	16.77	89.83	5.87	
	F3	4.10	*1*	280	2.71	17.08	88.88	6.63	7.61
	F4								
	C.D.(0.05)	NS		NS	0.33	NS	0.43	NS	
	C.V.(%)	40.41		21.05	16.55	5.57	0.61	17.89	
Mean of varieties:									
V1	IET 28081	4.08	*10*	254	2.60	14.53	99.17	5.94	11.33
V2	IET 28080	3.27	*14*	233	3.48	15.06	104.83	5.65	5.24
V3	IET 28084	4.96	*4*	261	2.88	17.84	96.67	6.00	-0.48
V4	IET 28086	4.89	*6*	271	3.57	18.05	77.83	6.17	2.00
V5	IET 28087	5.46	*1*	279	2.65	14.86	100.84	7.14	8.95
V6	IET 28083	-		-	-	-	-	-	
V7	IET 27730	-		-	-	-	-	-	
V8	IET 28088	4.83	*7*	306	2.88	18.28	80.00	6.67	-0.19
V9	IET 28085	2.11	*19*	288	1.59	14.47	100.84	5.59	2.95
V10	IET 28079	-		-	-	-	-	-	
V11	IET 28082	3.02	*16*	254	2.01	19.83	80.00	7.10	3.81
V12	IET 28826	4.93	*5*	238	2.76	16.40	96.84	6.47	8.48
V13	IET 28827	5.25	*2*	222	3.61	20.13	80.00	5.79	5.05
V14	IET 28828	4.23	*9*	304	2.58	17.03	80.17	6.69	-11.14
V15	IET 28829	2.84	*17*	282	1.59	14.18	99.33	5.49	10.67
V16	IET 28830	3.64	*13*	292	2.15	13.00	100.00	7.06	-2.19
V17	IET 28831	3.82	*12*	301	2.79	23.90	90.00	7.32	5.43
V18	IET 28832	3.99	*11*	285	2.47	13.25	97.17	6.09	3.71
V19	IET 28833	4.41	*8*	233	2.99	18.92	79.67	5.25	5.71
V20	Rasi	1.71	*20*	330	1.15	14.16	71.34	6.72	3.43
V21	Improved Samba Mahsuri	2.40	*18*	282	1.83	16.82	102.84	4.97	2.86
V22	Varadhan	5.10	*3*	257	2.77	20.21	80.67	6.40	7.33
V23	BPT 5204	-		-	-	-	-	-	
V24	Swarna	-		-	-	-	-	-	
V25	TellaHamsa	3.16	*15*	283	1.84	17.67	69.00	6.58	3.14
	C.D.(0.05)	0.61		42.58	0.51	1.04	1.3	0.67	
	C.V.(%)	13.69		14.34	17.68	5.39	1.27	9.33	
	Expt. Mean	**3.90**		**273**	**2.51**	**16.93**	**89.36**	**6.25**	
	Soil type	Sandy loam							
	pH	7.8							
	N - levels (kg/ha)								
	F1	0							
	F2	52.5							
	F3	105							
	F4	-							
	Recommended NPK (kg/ha)	105:30:30							

Table 4.1(m(iii)): Cntd….

N-levels	Varieties	RANCHI							MARUTERU					
		Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Straw Yield (t/ha)	N uptake by grain (kg/ha)	N uptake by straw (kg/ha)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)	Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)	Mean of Grain Yield	Rank
	V1	1.68	*69*	131	2.69	21.85	9.73		2.27	*67*	232		2.34	*83*
	V2	1.77	*67*	134	2.83	22.90	10.16		2.11	*71*	215		2.27	*84*
	V3	2.23	*54*	215	3.68	29.69	14.38		2.56	*57*	235		2.57	*77*
	V4	2.02	*60*	196	3.25	26.42	11.61		2.58	*56*	236		2.25	*85*
	V5	1.55	*75*	128	2.57	20.02	9.48		2.47	*59*	229		2.75	*76*
	V6	1.84	*63*	141	3.00	24.15	11.37		2.36	*61*	231		2.11	*89*
	V7	1.97	*61*	152	3.21	25.90	12.49		2.29	*66*	226		2.53	*78*
	V8	2.30	*52*	193	3.84	31.20	14.24		2.38	*60*	230		2.22	*86*
	V9	1.59	*73*	131	2.59	20.72	9.90		2.21	*69*	222		1.73	*98*
	V10	1.65	*71*	135	2.70	21.44	9.98		2.68	*54*	233		2.15	*88*
	V11	2.12	*57*	165	3.46	27.75	12.38		2	*75*	201		1.98	*95*
	V12	1.94	*62*	156	3.24	25.76	12.37		2.23	*68*	224		2.00	*94*
F1	V13	1.83	*65*	136	2.95	24.18	10.51		2.32	*64*	228		1.92	*96*
	V14	2.33	*51*	236	3.57	31.52	13.96		2.83	*52*	236		2.42	*80*
	V15	1.62	*72*	125	2.60	21.35	9.65		2.35	*62*	227		1.66	*99*
	V16	1.84	*63*	131	3.04	24.57	11.61		2.3	*65*	225		2.36	*82*
	V17	2.12	*57*	159	3.39	28.38	13.26		3	*51*	241		2.41	*81*
	V18	2.24	*53*	220	3.63	30.18	13.75		2.71	*53*	239		2.43	*79*
	V19	1.59	*73*	138	2.77	20.71	9.89		2.02	*72*	208		2.03	*92*
	V20	2.22	*55*	221	3.64	29.54	13.84		2.34	*63*	231		1.91	*97*
	V21	1.75	*68*	140	2.90	22.95	10.12		2.63	*55*	235		2.16	*87*
	V22	2.08	*59*	163	3.41	27.50	13.69		2.53	*58*	232		1.59	*100*
	V23	1.83	*65*	150	3.06	23.94	11.66		2.02	*72*	207		2.03	*92*
	V24	1.67	*70*	138	2.78	22.15	10.28		2.02	*72*	209		2.09	*91*
	V25	2.13	*56*	171	3.59	28.57	12.81		2.12	*70*	223		2.11	*90*
	V1	3.03	*50*	196	4.78	41.22	19.58	22.50	4.68	*26*	292	53.56	3.89	*65*
	V2	3.19	*48*	200	4.98	43.43	19.86	23.67	4.03	*42*	276	42.67	3.63	*69*
	V3	3.77	*33*	256	6.03	52.31	27.68	25.67	5.41	*11*	302	63.33	4.80	*41*
	V4	3.55	*41*	235	5.61	49.63	23.51	25.50	5.43	*10*	303	63.33	4.29	*53*
	V5	3.43	*43*	230	5.47	47.43	21.91	31.33	4.68	*26*	291	49.11	4.73	*44*
	V6	3.73	*36*	250	5.86	52.28	25.24	31.50	4.93	*18*	297	57.11	4.10	*59*
	V7	3.94	*28*	261	6.26	55.19	28.27	32.83	4.52	*33*	284	49.56	4.57	*49*
	V8	3.65	*37*	265	5.81	51.77	25.75	22.50	4.72	*25*	293	52.00	4.06	*60*
	V9	3.17	*49*	256	4.96	43.82	18.91	26.33	4.57	*32*	288	52.44	3.18	*74*
	V10	3.60	*39*	198	5.31	50.44	21.21	32.50	5.52	*8*	307	63.11	4.28	*54*
	V11	3.75	*34*	255	5.94	53.18	23.23	27.17	3.44	*50*	273	32.00	3.35	*72*
	V12	3.48	*42*	251	5.39	49.82	21.63	25.67	4.83	*21*	294	57.78	4.04	*63*
F2	V13	3.85	*32*	260	6.12	53.88	27.12	33.67	4.68	*26*	292	52.44	4.20	*56*
	V14	4.05	*25*	246	6.48	57.60	29.22	28.67	5.87	*5*	309	67.56	4.54	*50*
	V15	3.62	*38*	255	5.83	50.27	22.21	33.33	4.48	*34*	283	47.33	3.22	*73*
	V16	3.42	*44*	226	6.00	48.24	25.24	26.33	4.66	*30*	290	52.44	4.05	*62*
	V17	3.96	*27*	265	6.26	55.35	27.77	30.67	6.52	*2*	301	78.22	4.62	*48*
	V18	3.75	*34*	252	5.90	53.68	24.18	25.17	5.37	*12*	299	59.11	4.15	*58*
	V19	3.35	*47*	232	5.40	46.26	23.29	29.33	3.68	*48*	275	36.89	3.70	*67*
	V20	3.91	*31*	241	6.18	54.71	27.72	28.17	4.24	*37*	279	42.22	3.10	*75*
	V21	3.36	*46*	235	5.31	46.99	20.76	26.83	5.53	*7*	308	64.44	3.75	*66*
	V22	3.40	*45*	241	5.34	48.07	21.29	22.00	5.02	*17*	298	55.33	3.56	*71*
	V23	4.02	*26*	271	6.39	57.10	28.70	36.50	3.47	*49*	274	32.22	3.65	*68*
	V24	3.56	*40*	248	5.70	49.11	24.49	31.50	4.08	*41*	277	45.78	3.93	*64*
	V25	3.92	*29*	258	6.19	55.50	27.45	29.83	4.12	*40*	278	44.44	3.62	*70*

Table 4.1(m(iii)): Cntd….

N-levels	Varieties	RANCHI							MARUTERU					
		Grain Yield (t/ha)	*Rank*	Panicle/ m^2 (No.)	Straw Yield (t/ha)	N uptake by grain (kg/ha)	N uptake by straw (kg/ha)	Nitrogen res. (kg grain/kg N) (Base level 0% RDN)	Grain Yield (t/ha)	*Rank*	Panicle/ m^2 (No.)	Nitrogen res. (kg grain/kg N) (Base level 0% RDN)	Mean Grain Yield (t/ha)	Rank
F3	V1	4.15	*20*	273	6.39	57.33	27.54	20.58	4.61	*31*	287	26.00	5.07	*31*
	V2	4.12	*23*	270	6.47	57.77	28.34	19.58	3.78	*47*	273	18.56	4.69	*47*
	V3	4.45	*10*	284	6.90	63.16	32.38	18.50	3.92	*46*	281	15.11	5.15	*28*
	V4	4.52	*8*	288	7.05	64.73	33.97	20.83	4.27	*36*	284	18.78	4.78	*42*
	V5	4.12	*23*	270	6.51	57.67	29.97	21.42	4.13	*39*	283	18.44	5.15	*29*
	V6	4.55	*5*	288	7.01	65.17	33.33	22.58	3.97	*44*	282	17.89	4.76	*43*
	V7	4.82	*1*	296	7.52	69.75	36.93	23.75	6.96	*1*	308	51.89	6.36	*14*
	V8	4.25	*16*	279	6.67	61.83	28.09	16.25	5.07	*16*	292	29.89	5.35	*23*
	V9	4.15	*20*	275	6.38	58.71	28.74	21.33	4.73	*23*	288	28.00	4.05	*61*
	V10	4.38	*12*	278	6.79	62.54	31.17	22.75	4.73	*23*	289	22.78	5.15	*27*
	V11	4.42	*11*	280	6.90	63.74	31.85	19.17	3.95	*45*	282	21.67	4.22	*55*
	V12	4.16	*18*	277	6.49	60.33	29.15	18.50	6.41	*3*	305	46.44	5.46	*21*
	V13	4.56	*4*	272	7.11	65.71	33.79	22.75	5.36	*14*	295	33.78	5.39	*22*
	V14	4.52	*8*	283	7.09	65.84	32.53	18.25	5.37	*12*	296	28.22	4.71	*45*
	V15	4.15	*20*	272	6.47	58.46	27.73	21.08	4.87	*19*	291	28.00	4.20	*57*
	V16	4.20	*17*	279	6.51	60.03	28.80	19.67	5.45	*9*	300	35.00	5.07	*32*
	V17	4.62	*2*	281	7.30	66.64	33.51	20.83	5.3	*15*	296	25.56	5.05	*33*
	V18	4.28	*15*	269	6.68	62.54	28.68	17.00	4.68	*26*	289	21.89	4.84	*38*
	V19	4.16	*18*	275	6.37	58.98	26.81	21.42	4.82	*22*	290	31.11	4.69	*46*
	V20	4.61	*3*	293	7.15	65.88	33.54	19.92	4.87	*19*	291	28.11	4.30	*52*
	V21	3.92	*29*	261	6.12	55.78	27.41	18.08	6.25	*4*	302	40.22	4.45	*51*
	V22	4.35	*13*	290	6.70	62.71	30.97	18.92	5.8	*6*	301	36.33	5.04	*34*
	V23	4.55	*5*	272	7.01	66.00	33.67	22.67	4.03	*42*	282	22.33	4.94	*35*
	V24	4.31	*14*	268	6.72	61.13	30.15	22.00	4.22	*38*	284	24.44	4.93	*36*
	V25	4.53	*7*	270	7.07	65.54	33.16	20.00	4.32	*35*	285	24.44	4.80	*40*
F4	V1	-	-	-	-	-	-	-	-	-	-	-	6.96	*9*
	V2	-	-	-	-	-	-	-	-	-	-	-	7.55	*4*
	V3	-	-	-	-	-	-	-	-	-	-	-	8.03	*2*
	V4	-	-	-	-	-	-	-	-	-	-	-	5.21	*25*
	V5	-	-	-	-	-	-	-	-	-	-	-	6.55	*12*
	V6	-	-	-	-	-	-	-	-	-	-	-	5.21	*25*
	V7	-	-	-	-	-	-	-	-	-	-	-	7.49	*5*
	V8	-	-	-	-	-	-	-	-	-	-	-	7.99	*3*
	V9	-	-	-	-	-	-	-	-	-	-	-	4.88	*37*
	V10	-	-	-	-	-	-	-	-	-	-	-	5.68	*20*
	V11	-	-	-	-	-	-	-	-	-	-	-	5.12	*30*
	V12	-	-	-	-	-	-	-	-	-	-	-	6.35	*15*
	V13	-	-	-	-	-	-	-	-	-	-	-	8.75	*1*
	V14	-	-	-	-	-	-	-	-	-	-	-	5.23	*24*
	V15	-	-	-	-	-	-	-	-	-	-	-	5.81	*19*
	V16	-	-	-	-	-	-	-	-	-	-	-	7.18	*7*
	V17	-	-	-	-	-	-	-	-	-	-	-	6.09	*17*
	V18	-	-	-	-	-	-	-	-	-	-	-	6.72	*10*
	V19	-	-	-	-	-	-	-	-	-	-	-	6.23	*16*
	V20	-	-	-	-	-	-	-	-	-	-	-	5.97	*18*
	V21	-	-	-	-	-	-	-	-	-	-	-	4.83	*39*
	V22	-	-	-	-	-	-	-	-	-	-	-	6.67	*11*
	V23	-	-	-	-	-	-	-	-	-	-	-	6.99	*8*
	V24	-	-	-	-	-	-	-	-	-	-	-	6.43	*13*
	V25	-	-	-	-	-	-	-	-	-	-	-	7.28	*6*
Interaction														
N at same V		NS		32	NS	NS	NS		0.34		NS			
V at same N		NS		31.7	NS	NS	NS		0.34		NS			

Table 4.1(m(iii)): Cntd….

N-levels	Varieties	RANCHI Grain Yield (t/ha)	Rank	Panicle/ m^2 (No.)	Straw Yield (t/ha)	N uptake by grain (kg/ha)	N uptake by straw (kg/ha)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)	MARUTERU Grain Yield (t/ha)	Rank	Panicle/m^2 (No.)	Nitrogen. res. (kg grain/kg N) (Base level 0% RDN)	Mean Grain Yield (t/ha)	Rank
Mean of ferilizer dosage														
F1		1.92	*3*	160	3.14	25.33	11.72		2.37	*3*	226		2.16	*4*
F2		3.62	*2*	243	5.74	50.69	24.25	28.37	4.74	*2*	291	52.58	3.94	*3*
F3		4.35	*1*	278	6.78	62.32	30.89	20.31	4.87	*1*	290	27.80	4.85	*2*
F4													6.45	*1*
C.D.(0.05)		0.13		7.55	0.16	1.77	0.53		0.04		5.87			
C.V.(%)		13.97		11.47	10.81	13.26	8.18		3.39		7.53			
Mean of varieties:														
V1	IET 28081	2.95	*25*	200	4.62	40.13	18.95	21.54	3.85	*15*	270	39.78	4.05	*12*
V2	IET 28080	3.03	*22*	201	4.76	41.37	19.45	21.63	3.31	*23*	255	30.61	3.78	*19*
V3	IET 28084	3.48	*6*	252	5.54	48.39	24.81	22.08	3.96	*13*	273	39.22	4.56	*2*
V4	IET 28086	3.36	*13*	240	5.30	46.93	23.03	23.17	4.09	*11*	274	41.06	4.09	*10*
V5	IET 28087	3.03	*20*	209	4.85	41.71	20.45	26.38	3.76	*18*	268	33.78	4.50	*3*
V6	IET 28083	3.37	*12*	226	5.29	47.20	23.31	27.04	3.75	*19*	270	37.50	3.77	*20*
V7	IET 27730	3.58	*3*	236	5.66	50.28	25.90	28.29	4.59	*4*	273	50.72	4.67	*1*
V8	IET 28088	3.40	*11*	246	5.44	48.27	22.69	19.38	4.06	*12*	272	40.94	4.34	*5*
V9	IET 28085	2.97	*24*	221	4.64	41.08	19.18	23.83	3.84	*16*	266	40.22	3.13	*25*
V10	IET 28079	3.21	*15*	204	4.93	44.81	20.79	27.63	4.31	*7*	276	42.94	4.00	*13*
V11	IET 28082	3.43	*8*	233	5.43	48.22	22.49	23.17	3.13	*25*	252	26.83	3.37	*22*
V12	IET 28826	3.19	*16*	228	5.04	45.30	21.05	22.08	4.49	*5*	274	52.11	4.24	*7*
V13	IET 28827	3.41	*10*	223	5.39	47.92	23.81	28.21	4.12	*10*	272	43.11	4.43	*4*
V14	IET 28828	3.63	*1*	255	5.71	51.65	25.24	23.46	4.69	*3*	280	47.89	4.14	*8*
V15	IET 28829	3.13	*19*	217	4.97	43.36	19.86	27.21	3.90	*14*	267	37.67	3.32	*23*
V16	IET 28830	3.15	*18*	212	5.18	44.28	21.88	23.00	4.14	*9*	272	43.72	4.08	*11*
V17	IET 28831	3.57	*4*	235	5.65	50.12	24.85	25.75	4.94	*1*	279	51.89	4.26	*6*
V18	IET 28832	3.42	*9*	247	5.40	48.80	22.20	21.08	4.25	*8*	276	40.50	4.10	*9*
V19	IET 28833	3.03	*20*	215	4.85	41.98	20.00	25.38	3.51	*21*	258	34.00	3.83	*15*
V20	Rasi	3.58	*2*	252	5.66	50.04	25.03	24.04	3.82	*17*	267	35.17	3.26	*24*
V21	Improved Samba Mahsuri	3.01	*23*	212	4.78	41.91	19.43	22.46	4.80	*2*	282	52.33	3.54	*21*
V22	Varadhan	3.28	*14*	231	5.15	46.09	21.98	20.46	4.45	*6*	277	45.83	3.98	*14*
V23	BPT 5204	3.47	*7*	231	5.49	49.01	24.68	29.58	3.17	*24*	254	27.28	3.79	*17*
V24	Swarna	3.18	*17*	218	5.07	44.13	21.64	26.75	3.44	*22*	257	35.11	3.83	*16*
V25	TellaHamsa	3.53	*5*	233	5.62	49.87	24.47	24.92	3.52	*20*	262	34.44	3.79	*18*
C.D.(0.05)		0.23		18.47	0.33	3.68	2.22		0.2		NS			
C.V.(%)		7.69		8.81	6.82	8.64	10.77		5.36		9.01			
Expt. Mean		**3.30**		**227**	**5.22**	**46.11**	**22**		**4.00**		**269**		**3.95**	
Soil type		-							Delta alluvial					
pH		-							7.16					
N - levels (kg/ha)														
F1		0							0					
F2		60							45					
F3		120							90					
F4		-							-					
Recommended NPK (kg/ha)		120:60:40							90:60:60					

NMT 1m(iv) Evaluation of identified cultures and cultivars for enhancing phosphorus use efficiency in irrigated rice

Rice is a major cereal crop of India. Phosphorus is an important nutrient for rice production but the use efficiency of this nutrient is very low (20-30%) and phosphorus deficiency has been identified as one of the major constraint limiting crop production. Enhancing phosphorus use efficiency in rice would offer an affordable option for improving yields and economic returns with reduced inputs. Further, research studies have revealed that genotypic differences for PUE exist. There is a need to identify the cultivars which are adapted to low P situations and have higher P use efficiency. Hence the present trial is constituted to evaluate the identified cultures and cultivars with the following objectives: 1) To study the comparative performance of elite lines and cultivars in different levels of Phosphorus and 2) To identify the elite lines for tolerance to low P soil conditions. The trial was conducted at 3 locations (**ICAR-IIRR, Ludhiana, and Nellore**). Split plot design was adopted with 3 main plots of phosphorus levels (P_1- No Phosphorus (Control) (N and K Constant), P_2: 50 % of recommended P dose (N and K is constant) and P_3: 100 % of recommended dose of P (N and K constant). Subplots consist of 36 advanced cultures. The results were summarized and presented in **Table 4.1. Im(iv)** and the salient findings are as followed.

Interaction effect of phosphorus level and advanced cultures on grain yield was found significant at **ICAR-IIRR** and **Nellore**.

The recommended phosphorus dose at clay loam soils of ICAR-IIRR research plot is 60 kg P_2O_5/ha (100% recommended dose of phosphorus). There are four fixed phosphorus plots (0, 20, 40 and 60 kg P_2O_5/ha) are maintained at Rajendranagar farm of ICAR-IIRR since last 20 years. So 20 and 40 kg P_2O_5/ha corresponds to 33.3 and 66.6% of recommended dose of phosphorus, respectively. Every season the above mentioned phosphorus dose is applied keeping other nutrients dose (N and K_2O) constant. The recommended nitrogen and potassium doses are 120 and 40 kg/ha, respectively. In *kharif* (rainy) season of 2019**,** IET 28060 was not grown/taken up due to lack of seeds. Further, for a better comparison and valid conclusion we have taken two phosphorus level (20 and 60 kg P_2O_5/ha) for in depth discussion. In *kharif* (rainy) season of 2019**,** IET 28061 at 100% RDP (60 kg P_2O_5/ha) resulted the highest grain yield (5.41 t/ha) closely followed by IET 28816 (5.15 t/ha), IET 28066 (5.0 t/ha), IET 28076 (4.93 t/ha). Similarly, at 66.6% of RDP (40 kg P_2O_5/ha) the highest grain yield was recorded in IET 28066 (4.67 t/ha) closely followed by IET 28076 (4.62 t/ha). Again at 33.3% of RDP (20 kg P_2O_5/ha) the highest grain yield was resulted in IET 28061 (3.73 t/ha) followed by IET 28065 (3.49 t/ha), IET 28076 (3.44 t/ha), IET 28776 (3.34 t/ha), IET 27641 (3.32 t/ha) and IET 28075 (3.32 t/ha). At 100% RDP the highest agronomic efficiency of P was recorded in IET 28071 (52.5%) followed by IET 28059 (50.0%). Similarly, among phosphorus levels, RDP (60 kg P_2O_5) resulted in significantly highest grain yield (4.44 t/ha) than 40 kg P_2O_5 (4.02 t/ha) and 20 kg P_2O_5 (2.78 t/ha). Among advanced cultures IET 28061 (4.57 t/ha) resulted the highest grain yield followed by IET 28076 (4.33 t/ha) and IET 28066 (4.32 t/ha).

Recommended dose of fertilizer at sandy loam soils of **Ludhiana** is **105:30:30 kg N: P_2O_5: K_2O/ha**. Two phosphorus levels (0, and 30 kg P_2O_5/ha) were adopted in the trial which corresponds to 0% and 100% of RDP. The above mentioned phosphorus doses are applied keeping other recommended nutrients dose (N and K_2O) constant. Entries/Cultivars not taken up/grown for the trial were (IET 28073, IET 28063, IET 28069, IET 28059, IET 28065, IET 28819, IET 28070, IET 28064, IET 28078, IET 28072). Interaction effect of phosphorus level and advanced cultivars on grain yield was found to be statistically non-significant. However, under the plots received no phosphorus, the highest grain yield was recorded in IET 28816 (3.84 t/ha) closely followed by IET 28061 (3.79 t/ha), IET 28066 (3.77 t/ha) and IET 28075 (3.56 t/ha). Similarly, at 100% RDP applied plots, IET 28066 resulted the highest grain yield (4.2 t/ha) followed by IET 28816 (3.9 t/ha), IET 28075 (3.88 t/ha) and IET 28061 (3.7 t/ha). Main plots (phosphorus level) effect on grain yield was also found to be statistically non-significant. Among advanced cultivars IET 28066 resulted the highest grain yield (3.99 t/ha) followed by IET 28816 (3.87), IET 28061 (3.75 t/ha) and IET 28075 (3.72 t/ha). The highest agronomic efficiency of P was recorded in IET 28824 (20.33%) followed by Rasi (15.67%).

Recommended dose of fertilizer at sandy clay loam soils of **Nellore** is **80:40:0 kg N: P_2O_5: K_2O/ha**. Three phosphorus levels (0, 20 kg and 40 P_2O_5/ha) were adopted in the trial which corresponds to 0%, 50% and 100% of RDP. The above mentioned phosphorus doses are applied keeping other recommended nutrients dose (N and K_2O) constant. Entries/Cultivars not taken up/grown for the trial were (IET 28060 and IET 28074). In *kharif* (rainy) season of 2019**,** at 100% RDP (40 kg P_2O_5/ha) IET 28070 resulted in the highest grain yield (6.4 t/ha) closely followed by IET 28816 (5.77 t/ha). Similarly, at 50% RDP the highest grain yield was recorded in IET 28071 (6.36 t/ha) followed by IET 28816 (6.02 t/ha). However, under the plots received no phosphorus, the highest grain yield was recorded in IET 28816 (6.1 t/ha) closely followed by IET 28070 (5.9 t/ha), IET 28818 (5.57 t/ha), IET 27641 (5.3 t/ha) and IET 28821 (5.3 t/ha). The highest agronomic efficiency of P was recorded in IET 28069 (72%) followed by IET 28072 (48%). Main plots (phosphorus level) effect on grain yield was also found to be non-significant. Among advanced cultures IET 28816 (5.96 t/ha) resulted the highest grain yield followed by IET 28070 (5.84 t/ha) and IET 28818 (5.53 t/ha).

Trials conducted at 3 locations revealed that the following cultivars/entries to be high grain yielding and phosphorus use efficient

Location	High grain yielding entries/cultivars (descending order) under low phosphorus condition	High grain yielding entries/cultivars (descending order) under recommended phosphorus dose
ICAR-IIRR	**IET 28061 (3.73 t/ha),** IET 28065 (3.49 t/ha), IET 28076 (3.44 t/ha), IET 28776 (3.34 t/ha), IET 27641 (3.32 t/ha) and IET 28075 (3.32 t/ha) *Rasi and BPT 5204 resulted the highest grain yield (2.38 t/ha) over other checks (Swarna and ISM) at 33.3% RDP (20 kg P_2O_5/ha)	**IET 28061 (5.41 t/ha),** **IET 28816 (5.15 t/ha),** **IET 28066 (5.0 t/ha)** and IET 28076 (4.93 t/ha) *Rasi resulted the highest grain yield (4.41 t/ha) over other checks (Swarna, ISM, BPT 5204) at 100% RDP (60 kg P_2O_5/ha)
PAU, Ludhiana	**IET 28816 (3.84 t/ha),** **IET 28061 (3.79 t/ha),** **IET 28066 (3.77 t/ha)** and IET 28075 (3.56 t/ha) *ISM resulted the highest grain yield (2.69 t/ha) over other checks (Rasi, Swarna, BPT 5204) at without P applied plots (0 kg P_2O_5/ha)	**IET 28066 (4.2 t/ha),** **IET 28816 (3.9 t/ha),** IET 28075 (3.88 t/ha) and IET 28061 (3.7 t/ha) *ISM resulted the highest grain yield (2.68 t/ha) over other checks (Rasi, Swarna, BPT 5204) at without 100% applied RDP (30 kg P_2O_5/ha)
Nellore, AP	**IET 28816 (6.1 t/ha),** IET 28070 (5.9 t/ha), IET 28818 (5.57 t/ha), IET 27641 (5.3 t/ha) and IET 28821 (5.3 t/ha) *Swarna resulted the highest grain yield (5.05 t/ha) over other checks (Rasi, ISM, BPT 5204) at without P applied plots (0 kg P_2O_5/ha)	IET 28070 (6.4 t/ha) closely followed by **IET 28816 (5.77 t/ha)** *Swarna resulted the highest grain yield (5.05 t/ha) over other checks (Rasi, ISM, BPT 5204) at 100% RDP applied plots (40 kg P_2O_5/ha)

High grain yielding entries/cultivars irrespective of phosphorus fertility levels

ICAR-IIRR	**IET 28061 (4.57 t/ha),** IET 28076 (4.33 t/ha) and **IET 28066 (4.32 t/ha)**
PAU, Ludhiana	**IET 28066 (3.99 t/ha), IET 28816 (3.87), IET 28061 (3.75 t/ha)** and IET 28075 (3.72 t/ha)
Nellore, AP	**IET 28816 (5.96 t/ha),** IET 28070 (5.84 t/ha) and IET 28818 (5.53 t/ha)

Table 4.1(m(ivi)): Summary of data on grain yield and ancillary characters of selected IVT NIL LPT cultures grown under transplanted conditions at graded levels of recommended N fertilizer doses, kharif 2019.

N-levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Days to 50% flowering	Phosphorous. res. (kg grain/kg P) (Base level 0% RDP)
F1	V1	3.77	*6*	301	2.29	22.72	76	
	V2	-		-	-	-	-	
	V3	-		-	-	-	-	
	V4	-		-	-	-	-	
	V5	-		-	-	-	-	
	V6	1.88	*37*	299	2.30	26.60	71	
	V7	3.84	*4*	295	2.66	20.44	104	
	V8	-		-	-	-	-	
	V9	3.79	*5*	396	2.85	22.18	95	
	V10	0.92	*52*	400	1.36	23.28	72	
	V11	2.48	*27*	352	2.41	22.89	88	
	V12	3.37	*10*	301	2.84	20.48	103	
	V13	2.68	*21*	367	2.63	24.65	101	
	V14	2.05	*34*	343	2.44	22.60	103	
	V15	-		-	-	-	-	
	V16	1.19	*46*	389	1.74	20.28	93	
	V17	1.57	*44*	341	1.36	19.99	99	
	V18	1.07	*50*	387	1.18	18.95	104	
	V19	2.34	*31*	312	1.93	20.33	71	
	V20	2.39	*29*	337	1.75	22.44	102	
	V21	2.67	*23*	284	1.74	26.63	102	
	V22	-		-	-	-	-	
	V23	2.65	*24*	312	1.91	24.62	101	
	V24	2.52	*25*	350	2.33	25.12	90	
	V25	-		-	-	-	-	
	V26	-		-	-	-	-	
	V27	-		-	-	-	-	
	V28	3.38	*9*	345	2.28	24.28	84	
	V29	2.45	*28*	343	2.28	25.69	91	
	V30	3.56	*8*	328	2.19	21.34	97	
	V31	2.52	*25*	345	2.33	20.75	96	
	V32	3.03	*16*	293	2.06	18.61	98	
	V33	1.40	*45*	330	1.87	18.41	101	
	V34	1.60	*41*	249	1.78	22.12	84	
	V35	2.69	*20*	323	2.09	23.23	98	
	V36	1.66	*40*	268	1.40	17.85	101	

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Days to 50% flowering	Phosphorous. res. (kg grain/kg P) (Base level 0% RDP)
F2	V1	-		-	-	-	-	
	V2	-		-	-	-	-	
	V3	-		-	-	-	-	
	V4	-		-	-	-	-	
	V5	-		-	-	-	-	
	V6	-		-	-	-	-	
	V7	-		-	-	-	-	
	V8	-		-	-	-	-	
	V9	-		-	-	-	-	
	V10	-		-	-	-	-	
	V11	-		-	-	-	-	
	V12	-		-	-	-	-	
	V13	-		-	-	-	-	
	V14	-		-	-	-	-	
	V15	-		-	-	-	-	
	V16	-		-	-	-	-	
	V17	-		-	-	-	-	
	V18	-		-	-	-	-	
	V19	-		-	-	-	-	
	V20	-		-	-	-	-	
	V21	-		-	-	-	-	
	V22	-		-	-	-	-	
	V23	-		-	-	-	-	
	V24	-		-	-	-	-	
	V25	-		-	-	-	-	
	V26	-		-	-	-	-	
	V27	-		-	-	-	-	
	V28	-		-	-	-	-	
	V29	-		-	-	-	-	
	V30	-		-	-	-	-	
	V31	-		-	-	-	-	
	V32	-		-	-	-	-	
	V33	-		-	-	-	-	
	V34	-		-	-	-	-	
	V35	-		-	-	-	-	
	V36	-		-	-	-	-	

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Days to 50% flowering	Phosphorous. res. (kg grain/kg P) (Base level 0% RDP)
F3	V1	4.20	*1*	298	2.85	22.65	78	14.33
	V2	-		-	-	-	-	
	V3	-		-	-	-	-	
	V4	-		-	-	-	-	
	V5	-		-	-	-	-	
	V6	1.94	*36*	299	2.33	26.73	70	2.00
	V7	3.90	*2*	299	2.66	20.49	103	2.00
	V8	-		-	-	-	-	
	V9	3.70	*7*	392	2.86	22.04	96	-3.00
	V10	1.07	*50*	398	1.42	23.32	72	5.00
	V11	2.33	*33*	345	2.33	22.61	86	-5.00
	V12	3.12	*12*	348	2.80	20.58	102	-8.33
	V13	2.82	*18*	293	2.73	24.42	101	4.67
	V14	2.00	*35*	332	2.35	22.46	104	-1.67
	V15	-		-	-	-	-	
	V16	1.09	*49*	403	1.66	21.36	94	-3.33
	V17	1.60	*41*	348	1.35	19.57	98	1.00
	V18	1.13	*48*	350	1.25	18.97	104	2.00
	V19	2.34	*31*	315	1.94	20.45	71	0.00
	V20	2.35	*30*	319	1.82	22.51	103	-1.33
	V21	2.77	*19*	293	2.18	26.45	101	3.33
	V22	-		-	-	-	-	
	V23	3.08	*14*	246	2.25	24.57	101	14.33
	V24	1.69	*39*	363	2.02	25.15	91	-27.67
	V25	-		-	-	-	-	
	V26	-		-	-	-	-	
	V27	-		-	-	-	-	
	V28	3.31	*11*	345	2.35	24.38	83	-2.33
	V29	3.06	*15*	290	2.98	26.13	92	20.33
	V30	3.88	*3*	361	2.46	21.68	96	10.67
	V31	2.86	*17*	356	2.49	20.84	96	11.33
	V32	3.12	*12*	293	2.10	18.40	98	3.00
	V33	1.87	*38*	295	2.18	18.78	101	15.67
	V34	1.18	*47*	268	1.46	22.20	84	-14.00
	V35	2.68	*21*	332	2.18	23.25	98	-0.33
	V36	1.58	*43*	271	1.44	17.74	103	-2.67
Interaction								
N at same V		NS		NS	NS	NS	NS	
V at same N		NS		NS	NS	NS	NS	
F1		2.44	*2*	331	2.08	22.17	93.28	
F2								
F3		2.49	*1*	325	2.17	22.22	93.41	1.54
C.D.(0.05)		NS		NS	0.05	NS	NS	
C.V.(%)		4.3		25.99	3.45	7.12	0.48	

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	LUDHIANA						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	Days to 50% flowering	Phosphorous. res. (kg grain/kg P) (Base level 0% RDP)
Mean of varieties:								
V1	IET 28066	3.99	*1*	300	2.57	22.69	76.84	14.33
V2	IET 28073	-		-	-	-	-	
V3	IET 28063	-		-	-	-	-	
V4	IET 28069	-		-	-	-	-	
V5	IET 28059	-		-	-	-	-	
V6	IET 28071	1.91	*19*	299	2.32	26.67	70.50	2.00
V7	IET 28816	3.87	*2*	297	2.66	20.47	103.67	2.00
V8	IET 28065	-		-	-	-	-	
V9	IET 28061	3.75	*3*	394	2.86	22.11	95.83	-3.00
V10	IET 28817	1.00	*26*	399	1.39	23.30	71.67	5.00
V11	IET 28818	2.41	*14*	349	2.37	22.75	87.00	-5.00
V12	IET 27641	3.25	*6*	325	2.82	20.53	102.83	-8.33
V13	IET 28076	2.75	*10*	330	2.68	24.54	100.67	4.67
V14	IET 28063	2.03	*18*	338	2.40	22.53	103.83	-1.67
V15	IET 28819	-		-	-	-	-	
V16	IET 28820	1.14	*24*	396	1.70	20.82	93.83	-3.33
V17	IET 28062	1.59	*22*	344	1.36	19.78	98.50	1.00
V18	IET 28821	1.10	*25*	369	1.22	18.96	103.67	2.00
V19	IET 28822	2.34	*16*	314	1.94	20.39	71.33	0.00
V20	IET 28067	2.37	*15*	328	1.79	22.48	102.50	-1.33
V21	IET 28060	2.72	*11*	288	1.96	26.54	101.83	3.33
V22	IET 28070	-		-	-	-	-	
V23	IET 28823	2.87	*8*	279	2.08	24.60	101.33	14.33
V24	IET 28074	2.11	*17*	356	2.18	25.14	90.50	-27.67
V25	IET 28064	-		-	-	-	-	
V26	IET 28078	-		-	-	-	-	
V27	IET 28072	-		-	-	-	-	
V28	IET 28776	3.35	*5*	345	2.32	24.33	83.50	-2.33
V29	IET 28824	2.76	*9*	317	2.63	25.91	91.83	20.33
V30	IET 28075	3.72	*4*	344	2.33	21.51	96.34	10.67
V31	IET 28077	2.69	*12*	351	2.41	20.80	95.84	11.33
V32	IET 28825	3.08	*7*	293	2.08	18.51	97.84	3.00
V33	Rasi	1.64	*20*	312	2.03	18.60	101.00	15.67
V34	Swarna	1.39	*23*	259	1.62	22.16	84.33	-14.00
V35	Improved Samba Mahsuri	2.69	*13*	328	2.14	23.24	97.84	-0.33
V36	BPT 5204	1.62	*21*	270	1.42	17.80	102.17	-2.67
C.D.(0.05)		0.5		58.77	0.42	2.08	2.79	
C.V.(%)		17.73		15.69	17.5	8.2	2.62	
Expt. Mean		**2.46**		**328**	**2.12**	**22.20**	**93.35**	
Soil type		Sandy loam						
pH		7.8						
N - levels (kg/ha)								
F1		0						
F2		15						
F3		30						
Recommended NPK (kg/ha)		105:30:30						
Availabe NPK of soil (kg/ha)		245:22.5;197						

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	NELLORE						Ove all mean	Rank
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Teswt (g)	Days to 50% flowering	P. res. (kg grain/kg P) (Base level 0% RDP)		
F1	V1	3.11	*95*	322	37.80	79		3.44	69
	V2	3.13	*93*	429	27.30	79		3.13	79
	V3	5.14	*21*	403	24.13	81		5.14	12
	V4	3.78	*82*	366	26.87	80		3.78	50
	V5	2.57	*102*	362	40.40	75		2.57	94
	V6	5.20	*18*	366	28.57	81		3.54	67
	V7	6.10	*3*	411	29.30	81		4.97	14
	V8	3.82	*79*	394	31.20	83		3.82	47
	V9	3.81	*80*	380	25.23	79		3.80	48
	V10	3.60	*89*	363	43.17	81		2.26	100
	V11	5.57	*9*	365	30.93	80		4.03	39
	V12	5.30	*12*	365	36.27	80		4.34	28
	V13	4.01	*68*	368	32.70	81		3.35	72
	V14	4.91	*28*	354	23.43	90		3.48	68
	V15	4.24	*57*	373	34.87	81		4.24	32
	V16	3.93	*72*	364	25.80	80		2.56	95
	V17	3.89	*76*	355	32.30	79		2.73	91
	V18	5.30	*12*	332	36.80	78		3.19	78
	V19	5.07	*24*	418	25.27	80		3.71	54
	V20	3.83	*78*	357	40.40	76		3.11	82
	V21	-		-	-	-		2.67	92
	V22	5.90	*5*	354	28.73	81		5.90	4
	V23	4.71	*34*	303	42.13	81		3.68	55
	V24	-		-	-	-		2.52	96
	V25	4.16	*62*	290	38.53	81		4.16	35
	V26	4.04	*67*	366	24.83	79			
	V27	3.64	*87*	386	42.80	76		3.64	58
	V28	4.69	*36*	337	30.47	81		4.04	38
	V29	4.87	*31*	360	28.33	81		3.66	57
	V30	3.69	*85*	298	29.33	81		3.63	61
	V31	4.21	*61*	354	30.43	81		3.37	71
	V32	4.32	*53*	386	32.57	81		3.68	56
	V33	2.59	*101*	352	38.67	74		2.00	101
	V34	5.05	*25*	366	28.83	80		3.33	74
	V35	4.00	*69*	371	21.90	81		3.35	72
	V36	4.33	*52*	375	24.83	88		3.00	86

Table 4.((m(ivi)): Cntd….

N-levels	Varieties	NELLORE						Ove all mean	Rank
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Teswt (g)	Days to 50% flowering	Phosphorous. res. (kg grain/kg P) (Base level 0% RDP)		
F2	V1	3.10	*96*	372	34.37	79	-0.5	3.10	83
	V2	3.32	*91*	415	26.60	80	9.5	3.32	75
	V3	5.62	*8*	307	23.97	80	24	5.62	6
	V4	5.22	*15*	343	26.77	80	72	5.22	9
	V5	2.85	*98*	366	36.67	79	14	2.85	88
	V6	6.36	*2*	339	26.57	80	58	6.36	2
	V7	6.02	*4*	339	27.57	56	-4	6.02	3
	V8	4.37	*50*	402	32.37	90	27.5	4.37	27
	V9	4.22	*60*	407	25.17	80	20.5	4.22	34
	V10	3.84	*77*	363	42.20	80	12	3.84	45
	V11	5.81	*6*	353	29.33	56	12	5.81	5
	V12	5.38	*11*	315	36.43	80	4	5.38	8
	V13	4.23	*58*	347	30.03	80	11	4.23	33
	V14	4.92	*27*	365	25.23	95	0.5	4.92	15
	V15	3.94	*71*	386	34.10	78	-15	3.94	42
	V16	3.91	*73*	313	31.10	84	-1	3.91	43
	V17	3.64	*87*	319	35.83	78	-12.5	3.64	58
	V18	5.20	*18*	356	34.30	80	-5	5.20	11
	V19	4.88	*30*	401	25.93	80	-9.5	4.88	16
	V20	4.62	*40*	376	37.20	76	39.5	4.62	21
	V21	-		-	-	-			
	V22	5.22	*15*	372	33.43	80	-34	5.22	9
	V23	4.37	*50*	357	43.70	80	-17		
	V24	-		-	-	-			
	V25	4.27	*56*	313	44.57	80	5.5	4.27	31
	V26	4.64	*38*	363	25.77	79	30		
	V27	4.60	*43*	374	32.70	80	48	4.60	23
	V28	4.60	*43*	320	35.20	80	-4.5	4.60	23
	V29	4.52	*48*	384	32.60	80	-17.5	4.52	25
	V30	3.91	*73*	312	30.27	80	11	3.91	43
	V31	4.62	*40*	337	30.60	80	20.5	4.62	21
	V32	4.63	*39*	360	30.17	80	15.5	4.63	20
	V33	2.82	*99*	378	41.63	80	11.5	2.82	89
	V34	5.43	*10*	402	29.70	85	19	5.43	7
	V35	4.29	*54*	344	26.33	80	14.5	4.29	29
	V36	5.09	*23*	328	23.53	80	38	5.09	13

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	NELLORE						Ove all mean	Rank
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Teswt (g)	Days to 50% flowering	Phosphorous. res. (kg grain/kg P) (Base level 0% RDP)		
F3	V1	3.30	*92*	355	35.33	81	4.75	3.75	52
	V2	3.12	*94*	356	27.73	79	-0.25	3.12	80
	V3	4.67	*37*	322	24.77	80	-11.75	4.67	19
	V4	4.44	*49*	332	25.43	56	16.50	4.44	26
	V5	3.07	*97*	311	44.30	79	12.50	3.07	85
	V6	4.83	*32*	413	28.87	80	-9.25	3.39	70
	V7	5.77	*7*	323	27.77	80	-8.25	4.84	17
	V8	3.56	*90*	283	32.57	80	-6.50	3.56	65
	V9	3.90	*75*	333	23.33	80	2.25	3.80	48
	V10	3.76	*83*	309	42.30	80	4.00	2.42	98
	V11	5.22	*15*	341	29.50	79	-8.75	3.78	51
	V12	5.15	*20*	360	36.07	80	-3.75	4.14	36
	V13	3.72	*84*	323	31.30	69	-7.25	3.27	76
	V14	5.23	*14*	314	22.67	85	8.00	3.62	64
	V15	4.13	*63*	381	31.07	83	-2.75	4.13	37
	V16	3.80	*81*	313	25.73	85	-3.25	2.45	97
	V17	3.68	*86*	346	35.30	80	-5.25	2.64	93
	V18	4.70	*35*	322	36.53	79	-15.00	2.92	87
	V19	5.11	*22*	390	26.47	80	1.00	3.73	53
	V20	4.12	*65*	336	37.17	80	7.25	3.24	77
	V21	-		-	-	-		2.77	90
	V22	6.40	*1*	325	36.17	80	12.50	6.40	1
	V23	4.89	*29*	330	39.20	80	4.50	3.99	40
	V24	-		-	-	-		1.69	102
	V25	4.79	*33*	333	42.93	80	15.75	4.79	18
	V26	4.61	*42*	450	25.24	80	14.25		
	V27	4.29	*54*	374	40.23	79	16.25	4.29	29
	V28	3.95	*70*	382	34.33	80	-18.50	3.63	60
	V29	4.59	*45*	363	31.00	80	-7.00	3.83	46
	V30	4.05	*66*	346	29.07	80	9.00	3.97	41
	V31	4.23	*58*	351	27.40	80	0.50	3.55	66
	V32	4.13	*63*	415	30.13	80	-4.75	3.63	61
	V33	2.72	*100*	338	39.90	80	3.25	2.30	99
	V34	5.05	*25*	386	27.87	90	0.00	3.12	81
	V35	4.56	*47*	367	25.67	82	14.00	3.62	63
	V36	4.59	*45*	399	23.87	83	6.50	3.09	84
Interaction									
N at same V		0.63	0.63		NS	3.91	NS		
V at same N		0.63	0.63		NS	3.88	NS		
F1		4.31	4.31	*3*	363	31.62	80		3.38
F2		4.54	4.54	*1*	357	31.82	79	12	4.54
F3		4.36	4.36	*2*	351	31.68	80	1.19	3.42
C.D.(0.05)		NS	NS		NS	NS	NS		
C.V.(%)		14.46	14.46		33.86	9.83	9.75		

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	NELLORE						Ove all mean	Rank
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Teswt (g)	Days to 50% flowering	Phosphorous. res. (kg grain/kg P) (Base level 0% RDP)		
Mean of varieties:									
V1	IET 28066	3.17	*32*	350	35.83	79.45	2.13	3.58	19
V2	IET 28073	3.19	*31*	400	27.21	79.44	4.63	3.19	26
V3	IET 28063	5.14	*7*	344	24.29	80.22	6.13	5.14	2
V4	IET 28069	4.48	*14*	347	26.36	72.00	44.25	4.48	4
V5	IET 28059	2.83	*33*	346	40.46	77.89	13.25	2.83	29
V6	IET 28071	5.46	*4*	373	28.00	80.33	24.38	3.69	17
V7	IET 28816	5.96	*1*	358	28.21	72.33	-6.13	4.92	3
V8	IET 28065	3.92	*26*	360	32.05	84.44	10.50	3.92	10
V9	IET 28061	3.98	*25*	373	24.58	79.67	11.38	3.86	12
V10	IET 28817	3.73	*30*	345	42.56	80.11	8.00	2.36	33
V11	IET 28818	5.53	*3*	353	29.92	71.78	1.62	3.97	9
V12	IET 27641	5.28	*5*	347	36.26	79.89	0.13	4.26	6
V13	IET 28076	3.99	*24*	346	31.34	76.67	1.88	3.37	23
V14	IET 28063	5.02	*9*	345	23.78	90.00	4.25	3.52	20
V15	IET 28819	4.10	*23*	380	33.35	80.78	-8.88	4.10	8
V16	IET 28820	3.88	*28*	330	27.54	82.89	-2.13	2.51	32
V17	IET 28062	3.74	*29*	340	34.48	78.89	-8.88	2.66	31
V18	IET 28821	5.07	*8*	337	35.88	79.33	-10.00	3.08	28
V19	IET 28822	5.02	*10*	403	25.89	80.22	-4.25	3.68	18
V20	IET 28067	4.19	*21*	356	38.26	77.11	23.38	3.28	25
V21	IET 28060	-		-	-	-		2.72	30
V22	IET 28070	5.84	*2*	350	32.78	80.33	-10.75	5.84	1
V23	IET 28823	4.66	*13*	330	41.68	80.33	-6.25	3.76	14
V24	IET 28074	-		-	-	-		2.11	35
V25	IET 28064	4.41	*17*	312	42.01	80.33	10.63	4.41	5
V26	IET 28078	4.43	*15*	393	25.28	79.33	22.13		
V27	IET 28072	4.18	*22*	378	38.58	78.33	32.13	4.18	7
V28	IET 28776	4.41	*16*	347	33.33	80.33	-11.50	3.88	11
V29	IET 28824	4.66	*12*	369	30.64	80.22	-12.25	3.71	16
V30	IET 28075	3.88	*27*	319	29.56	80.22	10.00	3.80	13
V31	IET 28077	4.35	*19*	347	29.48	80.22	10.50	3.52	21
V32	IET 28825	4.36	*18*	387	30.96	80.22	5.37	3.72	15
V33	Rasi	2.71	*34*	356	40.07	77.78	7.38	2.17	34
V34	Swarna	5.18	*6*	385	28.80	85.00	9.50	3.28	24
V35	Improved Samba Mahsuri	4.28	*20*	361	24.63	81.11	14.25	3.48	22
V36	BPT 5204	4.67	*11*	367	24.08	83.78	22.25	3.15	27
	C.D.(0.05)	0.37		47.9	2.26	6.85			
	C.V.(%)	8.99		14.53	7.71	9.29			
	Expt. Mean	**4.40**		**357**	**31.71**	**79.74**		3.43	
	Soil type	Sandy clay loam							
	pH	-							
	N - levels (kg/ha)								
	F1	0							
	F2	20							
	F3	40							
	Recommended NPK (kg/ha)	80:40:0							
	Availabe NPK of soil (kg/ha)	163:55:555							

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	IIRR						
		Grain Yield (t/ha)	*Rank*	Panicle/m^2 (No.)	Panicle wt (g)	Teswt (g)	No of grains/panicle	Phosphorous. res. (kg grain/kg P) (Base level 33.3% RDP)
F1 (P 20kg/ha) (33.3%)	V1	3.28	*78*	263	1.55	18.30	91	
	V2	2.92	*80*	196	1.35	20.73	96	
	V3	2.68	*87*	203	1.58	19.27	149	
	V4	2.63	*90*	206	1.93	21.30	109	
	V5	2.55	*92*	217	1.59	17.47	78	
	V6	2.23	*103*	235	1.86	21.33	109	
	V7	3.30	*77*	281	1.97	17.33	157	
	V8	3.49	*68*	196	1.50	23.93	109	
	V9	3.73	*61*	295	2.09	18.70	160	
	V10	2.38	*100*	260	2.15	16.63	73	
	V11	2.55	*92*	238	1.36	20.37	79	
	V12	2.85	*84*	284	1.83	21.30	142	
	V13	3.32	*75*	199	3.05	19.20	105	
	V14	3.44	*70*	306	2.51	21.03	115	
	V15	2.89	*82*	213	2.05	17.60	194	
	V16	2.52	*94*	256	1.73	20.97	133	
	V17	2.52	*94*	302	1.67	18.40	123	
	V18	2.62	*91*	231	1.61	17.23	82	
	V19	2.34	*102*	213	1.74	15.60	110	
	V20	2.67	*88*	217	1.47	16.27	121	
	V21	2.46	*98*	288	1.55	16.40	98	
	V22	2.64	*89*	299	2.09	20.70	76	
	V23	-	-	-	-	-	-	
	V24	2.79	*85*	188	1.45	16.13	103	
	V25	3.06	*79*	228	1.71	18.53	137	
	V26	2.77		220	1.40	17.43	128.89	
	V27	2.92	*80*	267	1.57	24.03	109	
	V28	2.50	*96*	206	1.30	19.13	102	
	V29	2.49	*97*	235	1.57	24.77	75	
	V30	3.34	*74*	267	1.99	16.80	107	
	V31	2.46	*98*	249	1.61	20.50	114	
	V32	3.32	*75*	167	2.00	21.40	103	
	V33	2.14	*104*	213	2.07	19.47	95	
	V34	2.88	*83*	213	1.87	20.40	107	
	V35	2.12	*105*	217	1.69	20.83	100	
	V36	2.38	*100*	196	1.59	17.47	108	

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	IIRR						
		Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle wt (g)	Teswt (g)	No of grains/panicle	Phosphorous. res. (kg grain/kg P) (Base level 33.3% RDP)
F2 (P 40kg/ha) (66.6%)	V1	4.67	*10*	302	1.69	19.07	132	69.5
	V2	4.29	*35*	213	1.49	21.40	128	68.5
	V3	4.01	*51*	210	1.99	19.70	175	66.5
	V4	4.03	*49*	210	2.06	21.23	122	70
	V5	4.00	*52*	235	1.69	18.30	97	72.5
	V6	3.74	*60*	302	2.14	23.23	138	75.5
	V7	4.49	*21*	327	2.25	18.00	184	59.5
	V8	4.32	*33*	238	1.72	24.97	128	41.5
	V9	4.57	*13*	331	2.28	21.27	167	42
	V10	3.67	*64*	295	2.17	16.67	104	64.5
	V11	4.11	*43*	313	1.34	20.60	102	78
	V12	4.30	*34*	356	2.06	21.30	176	72.5
	V13	4.42	*24*	245	3.22	19.90	121	55
	V14	4.62	*12*	327	2.36	21.60	131	59
	V15	4.36	*27*	231	1.93	17.50	215	73.5
	V16	3.45	*69*	267	2.14	19.73	129	46.5
	V17	3.71	*63*	377	1.97	18.57	156	59.5
	V18	4.27	*36*	274	1.80	18.47	116	82.5
	V19	3.58	*66*	220	1.65	17.60	141	62
	V20	3.82	*57*	270	1.27	17.53	142	57.5
	V21	3.85	*56*	359	1.67	18.37	122	69.5
	V22	3.82	*57*	331	1.85	21.33	96	59
	V23	-	-	-	-	-	-	-
	V24	4.22	*37*	220	1.98	18.50	121	71.5
	V25	4.33	*29*	302	1.99	21.67	141	63.5
	V26	4.17	39	263	1.72	21.63	119.78	70.0
	V27	4.14	*42*	299	1.96	26.40	116	61
	V28	3.65	*65*	231	1.45	22.33	134	57.5
	V29	3.40	*71*	324	2.07	27.43	103	45.5
	V30	4.33	*29*	320	2.23	19.77	127	49.5
	V31	3.72	*62*	313	1.75	21.53	132	63
	V32	4.53	*17*	196	1.91	21.30	126	60.5
	V33	3.36	*72*	228	2.13	18.33	134	61
	V34	3.95	*53*	263	1.98	19.70	137	53.5
	V35	3.35	*73*	284	1.86	19.53	127	61.5
	V36	3.56	*67*	213	1.56	16.67	131	59

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	IIRR						
		Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle wt (g)	Teswt (g)	No of grains/panicle	Phosphorous. res. (kg grain/kg P) (Base level 33.3% RDP)
F3 (P 60kg/ha) (100%)	V1	5.00	*3*	348	1.81	21.50	133	43.0
	V2	4.63	*11*	267	1.62	23.60	135	42.8
	V3	4.47	*22*	260	2.17	20.27	205	44.8
	V4	4.53	*17*	331	2.30	24.60	137	47.5
	V5	4.55	*14*	306	1.95	21.30	100	50.0
	V6	4.33	*29*	338	2.12	28.03	158	52.5
	V7	5.15	*2*	359	2.42	22.30	208	46.3
	V8	4.89	*5*	256	1.84	29.37	133	35.0
	V9	5.41	*1*	345	2.51	20.63	211	42.0
	V10	4.41	*25*	334	2.22	17.43	98	50.8
	V11	4.53	*17*	316	1.47	21.63	101	49.5
	V12	4.53	*17*	370	2.43	22.57	213	42.0
	V13	4.83	*7*	267	3.58	21.07	129	37.8
	V14	4.93	*4*	373	2.70	23.77	145	37.3
	V15	4.70	*8*	288	2.19	18.73	233	45.3
	V16	4.06	*45*	320	2.26	22.37	153	38.5
	V17	4.05	*47*	377	1.90	21.63	169	38.3
	V18	4.45	*23*	309	1.80	18.47	111	45.8
	V19	4.02	*50*	284	1.85	20.50	164	42.0
	V20	4.16	*41*	309	1.34	17.70	148	37.3
	V21	4.17	*39*	359	1.83	18.93	123	42.8
	V22	4.20	*38*	331	2.10	20.80	93	39.0
	V23	-	-	-	-	-	-	-
	V24	4.40	*26*	302	2.02	24.97	138	40.3
	V25	4.54	*15*	320	1.84	22.47	167	37.0
	V26	4.33	*29*	302	1.67	21.80	125.33	39.0
	V27	4.35	*28*	338	2.17	31.20	122	35.8
	V28	4.06	*45*	277	1.43	24.63	142	39.0
	V29	3.81	*59*	331	2.10	37.30	96	33.0
	V30	4.70	*8*	313	2.34	22.20	136	34.0
	V31	4.08	*44*	320	1.75	25.23	140	40.5
	V32	4.86	*6*	199	2.24	21.30	132	38.5
	V33	3.87	*54*	224	2.45	20.47	138	43.3
	V34	4.54	*15*	309	2.12	19.83	155	41.5
	V35	3.86	*55*	299	2.09	21.57	132	43.5
	V36	4.05	*47*	213	1.76	17.80	142	41.8
Interaction								
N at same V		0.2		32.21	0.18	1.95	9.74	
V at same N		0.2		31.94	0.18	1.94	9.7	
F1		2.78	*3*	236	1.77	19.34	111	
F2		4.02	*2*	277	1.92	20.32	134	62
F3		4.44	*1*	308	2.07	22.51	145	41.62
C.D.(0.05)		0.03		5.62	0.05	0.35	2.27	
C.V.(%)		2.83		8.37	11.17	6.81	7.13	

Table 4.1(m(ivi)): Cntd….

N-levels	Varieties	IIRR						
		Grain Yield (t/ha)	*Rank*	Panicle/m² (No.)	Panicle wt (g)	Teswt (g)	No of grains/panicle	Phosphorous. res. (kg grain/kg P) (Base level 33.3% RDP)
Mean of varieties:								
V1	IET 28066	4.32	*3*	305	1.68	19.62	118	56.25
V2	IET 28073	3.95	*11*	225	1.49	21.91	120	55.63
V3	IET 28063	3.72	*19*	224	1.91	19.75	176	55.63
V4	IET 28069	3.73	*17*	249	2.10	22.38	123	58.75
V5	IET 28059	3.70	*20*	252	1.74	19.02	92	61.25
V6	IET 28071	3.43	*25*	292	2.04	24.20	135	64.00
V7	IET 28816	4.31	*4*	322	2.21	19.21	183	52.88
V8	IET 28065	4.23	*6*	230	1.69	26.09	123	38.25
V9	IET 28061	4.57	*1*	324	2.29	20.20	179	42.00
V10	IET 28817	3.49	*24*	296	2.18	16.91	92	57.63
V11	IET 28818	3.73	*17*	289	1.39	20.87	94	63.75
V12	IET 27641	3.89	*12*	337	2.11	21.72	177	57.25
V13	IET 28076	4.19	*7*	237	3.28	20.06	118	46.38
V14	IET 28063	4.33	*2*	335	2.52	22.13	130	48.13
V15	IET 28819	3.98	*9*	244	2.06	17.94	214	59.38
V16	IET 28820	3.34	*29*	281	2.04	21.02	138	42.50
V17	IET 28062	3.43	*26*	352	1.85	19.53	149	48.88
V18	IET 28821	3.78	*16*	271	1.74	18.06	103	64.13
V19	IET 28822	3.31	*31*	239	1.75	17.90	139	52.00
V20	IET 28067	3.55	*22*	265	1.36	17.17	137	47.38
V21	IET 28060	3.49	*23*	335	1.68	17.90	114	56.13
V22	IET 28070	3.55	*21*	320	2.01	20.94	88	49.00
V23	IET 28823	-		-	-	-	-	
V24	IET 28074	3.80	*13*	237	1.82	19.87	121	55.88
V25	IET 28064	3.98	*10*	283	1.85	20.89	148	50.25
V26	IET 28078	-		-	-	-	-	
V27	IET 28072	3.80	*13*	301	1.90	27.21	116	48.38
V28	IET 28776	3.40	*28*	238	1.39	22.03	126	48.25
V29	IET 28824	3.23	*32*	296	1.91	29.83	91	39.25
V30	IET 28075	4.12	*8*	300	2.19	19.59	123	41.75
V31	IET 28077	3.42	*27*	294	1.70	22.42	129	51.75
V32	IET 28825	4.24	*5*	187	2.05	21.33	121	49.50
V33	Rasi	3.12	*33*	222	2.22	19.42	122	52.13
V34	Swarna	3.79	*15*	262	1.99	19.98	133	47.50
V35	Improved Samba Mahsuri	3.11	*34*	267	1.88	20.64	120	52.50
V36	BPT 5204	3.33	*30*	207	1.64	17.31	127	50.38
C.D.(0.05)		0.12		18.6	0.11	1.13	5.62	
C.V.(%)		3.35		7.35	5.92	5.89	4.68	
Expt. Mean		**3.75**		**274**	**1.93**	**20.74**	**130**	
Soil type		Clay loam						
pH		-						
N - levels (kg/ha)								
F1		20						
F2		40						
F3		60						
Recommended NPK (kg/ha)		120:60:40						
Availabe NPK of soil (kg/ha)		-						

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

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

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

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

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

Based on the GYEI values few promising cultivars identified in different groups is furnished below:

Based on the Grain yield efficiency index GYEI values (stable and efficient genotypes), the top ten identified cultures were *viz*., IET 25838 (1.33), IET 26579 (1.28) and IET 26594 (1.26) in AVT-MH (irrigated); IET 25713 ((1.20), IET 26477 (1.17), IET 24914 (1.12) and IET 26767 (1.06) in AVT-2 E-TP; IET 24950 (1.33) and IET 25745 (1.18) in AVT-2 IME-TP;IET 27263 (1.26) and IET 26420 (1.16) in AVT-IM-TP; IET 26974 (1.15), IET 26948(1.12) and IET 25948 (1.11) in AVT-2 L' IET 25802 (1.18), IET 25798 and IET 26549 (1.05) in AVT-2 MS;IET 26692 (1.46) in AVT-2 RSL; IET 27077 (1.27) in AL-ISTVT; IET 26999 (1.21) in AVT-2 BT; IET 27179 (1.25) in AVT-2 Bio-fortified; IET 27280 (1.31) and IET 27285 (1.16) in AVT-2 NIL BL&BLB. Further critical analysis of the data based on higher GYEI, as well as lesser yield reduction in reduced nutrient application (50% of RDF) over 100% RDF, a total Twelve cultures identified viz., IET 25838 in AVT-MH irrigated; IET 26477 and IET 24954 in AVT-2 E; IET 25745 in AVT-2 IME-TP; IET 26420 in IM-TP; IET 25948 in AVT-2 Late; IET 25802 in AVT_2 MS; IET 27077 in AVT-2 AL&ISTVT; IET 26999 in AVT-2 BT; IET 27179in AVT-2 Bio-fortified; IET 27285 and IET 27280 in AVT-2 NIL (BL&BLB) (Table. 4.1.n &4.1. o) were identified as higher nutrient use and efficient cultures during kharif 2019. These cultures can be recommended for low input management.

With regards to evaluate to identify high nitrogen and phosphorous use efficient cultures, four IET cultures viz., IET 27730 and IET 28084 (1.35), IET 28087 (1.29) and IET 28831 (1.18) were found promising with higher mean GYEI value for Nitrogen: IET 28081 (30.09%) and IET 28087 (48.79%) recorded lesser grain yield reduction due to reduction in 'N' level with higher GYEI hence considered to be promising cultures.

Phosphorous use efficiency of 32 cultures tested varied with GYEI values 0.73 to 1.67. the best cultures identified were IET 28816 (1.67) followed by IET 28819 (1.41), IET 28063 (1.38), IET 27641 (1.35) and IET 28075 (1.35) (Table. 4.1.n &4.1.o). however, there was no yield reduction due to 50% of P application in IET 28071, IET 28063, IET 28067, IET 28820, IET 28822, IET 28076, IET 28821which are found to be high 'P' use efficient cultures and superior to Rasi (Test entry).

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

AVT-2 EH (Irrigated)			AVT-2 MH (Irrigated)			AVT-2 E-TP			AVT-2-IME (TP)		
Nutrient-Levels	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI
F2	IET 26565	0.88	F2	IET 26579	1.28	F2	IET 26767	1.06	F2	IET 24950	1.33
	Shalimar Rice-3	1.06		IET 26594	1.26		IET 26803	0.77		IET 25745	1.18
	Vivekdhan-86	1.04		IET 25838	1.33		IET 26477	1.17		NC- IR 64	0.84
	VL Dhan-86	0.62		Vivekdhan-62	1.16		IET 24914	1.12		ZC- PR 113 (N)	1.23
	Local Check	1.83		V L Dhan-65	0.83		IET 25713	1.20		Lalat (E & NE)	0.85
				Local Check	1.37		Sahbhagidhan	0.90		Karjat 7 (W)	0.84
							Vandana	0.82		MTU 1010	0.96
							ZC-Govind (NW)	0.77		HC- US 312	0.46
							Narendra 97 E	1.14		Local check	0.89
							Varalu	0.88			
							CR Dhan 201	0.87			
							Local check	1.05			
	Mean	**1.09**		**Mean**	**1.20**		**Mean**	**0.98**		**Mean**	**0.95**

Table. 4.1(n): Cntd…

AVT-2 IM (TP)			AVT-2 L			AVT-2 MS			AVT 2 - RSL		
Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI	Nutrient-Level	Varieties	GYEI
F2	IET 27263	1.26	F2	IET 26927	0.95	F2	IET 26549	1.06	F2	IET 26692	1.46
	IET 26418	1.00		IET 26974	1.15		IET 27136	0.95		Dhanrasi	0.68
	IET 26420	1.16		IET 25948	1.11		IET 25802	1.18		Pooja	0.81
	NC-NDR 359	1.34		IET 26948	1.12		IET 25798	1.06		Savithri	0.78
	ZC- Pant Dhan-19	0.82		Samba Masuri	0.84		IET 24990	0.96		Local Check	1.02
	NDR 8002 (E&C)	0.78		Swarna	0.90		DRRH 3	1.03			
	Jaya (NE & S)	0.80		Pushyami	0.96		27 P 63	1.01			
	Akshayadhan (W)	0.77		Local Check	0.90		KRH 4	1.00			
	Local Check	1.05					WGL 14	0.82			
							Local Check	0.28			
	Mean	**1.00**		**Mean**	**0.99**		**Mean**	**1.03**		**Mean**	**0.95**

Table. 4.1(n): Cntd…

AL & ISTVT			AVT-2 BT			AVT 2- Biofotified			AVT 2- NIL BL, BLB		
Nutrient-Level	**Varieties**	**GYEI**	**Nutrient-Level**	**Varieties**	**GYEI**	**Nutrient-Level**	**Varieties**	**GYEI**	**Nutrient-Level**	**Varieties**	**GYEI**
F2	IET 27077	1.27	**F2**	IET 26995	0.93	**F2**	IET 27179	1.25	**F2**	IET 27285	1.16
	CSR-10	0.84		IET 26999	1.21		BPT 5204	1.28		IET 27294	0.91
	CSR-23	1.00		Sugandhamati	0.70		Chittimuthyalu	0.73		IET 27280	1.31
	CSR-36	1.05		Tulasi	0.89		IR 64	1.42		IET 27286	0.96
	Jaya	0.93		Local Check	0.78		Kalanamak	0.70		IET 28014	0.82
	Local Check	1.04								BPT 5204	1.13
										Swarna	0.96
										RP Bio 226	0.76
										Local Check	1.65
	Mean	**1.02**		**Mean**	**0.90**		**Mean**	**1.08**		**Mean**	**1.07**

Table. 4.1(n): Cntd…

IVT NIL LNT									Mean GYEI	Rank
Nutrient-Level	**Varieties**	**GYEI**	**Nutrient-Level**	**Varieties**	**GYEI**	**Nutrient-Level**	**Varieties**	**GYEI**		
N2	IET 28081	1.07	**N3**	IET 28081	1.10	**N4**	IET 28081	1.17	**1.11**	**9**
	IET 28080	0.97		IET 28080	1.15		IET 28080	1.23	**1.12**	**8**
	IET 28084	1.45		IET 28084	1.10		IET 28084	1.48	**1.35**	**2**
	IET 28086	1.13		IET 28086	1.26		IET 28086	0.84	**1.08**	**11**
	IET 28087	1.53		IET 28087	1.04		IET 28087	1.29	**1.29**	**3**
	IET 28083	1.02		IET 28083	1.15		IET 28083	0.79	**0.98**	**13**
	IET 27730	1.36		IET 27730	1.35		IET 27730	1.36	**1.35**	**1**
	IET 28088	1.06		IET 28088	0.88		IET 28088	1.27	**1.07**	**12**
	IET 28085	0.65		IET 28085	0.83		IET 28085	0.60	**0.69**	**25**
	IET 28079	1.08		IET 28079	0.98		IET 28079	0.88	**0.98**	**15**
	IET 28082	0.78		IET 28082	0.81		IET 28082	0.73	**0.77**	**23**
	IET 28826	0.95		IET 28826	1.00		IET 28826	0.91	**0.95**	**18**
	IET 28827	0.95		IET 28827	1.24		IET 28827	1.21	**1.13**	**7**
	IET 28828	1.29		IET 28828	0.75		IET 28828	0.91	**0.98**	**14**
	IET 28829	0.63		IET 28829	0.95		IET 28829	0.69	**0.76**	**24**
	IET 28830	1.12		IET 28830	1.17		IET 28830	1.22	**1.17**	**6**
	IET 28831	1.31		IET 28831	1.17		IET 28831	1.05	**1.18**	**5**
	IET 28832	1.19		IET 28832	0.94		IET 28832	1.17	**1.10**	**10**
	IET 28833	0.88		IET 28833	0.86		IET 28833	0.91	**0.88**	**19**
	Rasi	0.70		Rasi	0.89		Rasi	0.82	**0.80**	**20**
	Improved Samba Mahsuri	0.95		Improved Samba Mahsuri	0.67		Improved Samba Mahsuri	0.75	**0.79**	**22**
	Varadhan	0.66		Varadhan	0.98		Varadhan	0.76	**0.80**	**21**
	BPT 5204	0.87		BPT 5204	0.99		BPT 5204	1.02	**0.96**	**17**
	Swarna	0.97		Swarna	0.99		Swarna	0.97	**0.97**	**16**
	Tella Hamsa	0.81		Tella Hamsa	1.78		Tella Hamsa	1.10	**1.23**	**4**
	Mean	**1.01**		**Mean**	**1.04**		**Mean**	**1.01**	**1.02**	

Table. 4.1(n): Cntd…

IVT NIL LPT			Rank
Nutrient-Level	**Varieties**	**GYEI**	
P2	IET 28066	0.97	**22**
	IET 28073	0.88	**26**
	IET 28063	1.38	**3**
	IET 28069	1.28	**6**
	IET 28059	0.75	**31**
	IET 28071	1.15	**13**
	IET 28816	1.67	**1**
	IET 28065	1.21	**10**
	IET 28061	1.25	**8**
	IET 28817	0.52	**35**
	IET 28818	0.82	**29**
	IET 27641	1.35	**4**
	IET 28076	1.35	**5**
	IET 28063	0.99	**20**
	IET 28819	1.41	**2**
	IET 28820	0.73	**33**
	IET 28062	0.74	**32**
	IET 28821	0.70	**34**
	IET 28822	1.07	**15**
	IET 28067	1.07	**17**
	IET 28060	1.07	**16**
	IET 28070	1.10	**14**
	IET 28823		
	IET 28074	1.21	**9**
	IET 28064	1.27	**7**
	IET 28078	0.87	**27**
	IET 28072	1.19	**12**
	IET 28776	1.04	**19**
	IET 28824	0.96	**23**
	IET 28075	1.20	**11**
	IET 28077	0.97	**21**
	IET 28825	1.05	**18**
	Rasi	0.82	**30**
	Swarna	0.90	**25**
	Improved Samba Mahsuri	0.86	**28**
	BPT 5204	0.92	**24**
	Mean	**1.05**	

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

Group	Group	Entry No	50	100	Diffrence -50	(%) Reduction
EH (Irrigated)	**V1**	IET 26565	3.74	4.30	0.56	13.02
	V2	Shalimar Rice-3	3.94	4.90	0.97	19.69
	V3	Vivekdhan-86	4.09	4.67	0.58	12.43
	V4	VL Dhan-86	3.18	3.54	0.36	10.17
	V5	Local Check	5.16	6.49	1.33	20.51
MH (Irriaged)	**V1**	IET 26579	4.21	4.08	-0.12	-3.05
	V2	IET 26594	3.83	4.42	0.59	13.24
	V3	IET 25838	3.96	4.54	0.58	12.81
	V4	Vivekdhan-62	3.99	3.92	-0.07	-1.66
	V5	V L Dhan-65 (N)	3.77	2.97	-0.80	-26.91
	V6	Local Check	3.75	4.89	1.14	23.30
E(TP)	**V1**	IET 26767	4.46	5.19	0.73	14.11
	V2	IET 26803	3.59	4.67	1.08	23.13
	V3	IET 26477	4.92	5.19	0.27	5.25
	V4	IET 24914	4.70	5.18	0.48	9.27
	V5	IET 25713	4.64	5.61	0.96	17.19
	V6	NC- Sahbhagidhan	4.18	4.70	0.52	11.00
	V7	Vandana	3.78	4.72	0.94	19.94
	V8	ZC-Govind (NW)	3.87	4.33	0.46	10.55
	V9	Narendra 97 E	4.77	5.20	0.43	8.27
	V10	Varalu	4.16	4.59	0.43	9.28
	V11	CR Dhan 201 (W&S)	4.27	4.46	0.19	4.26
	V12	Local check	4.51	5.05	0.54	10.75

Group	Group	Entry No	50	100	Diffrence -50	(%) Reduction
IME (TP)	**V1**	IET 24950	5.39	5.75	0.36	6.20
	V2	IET 25745	5.15	5.37	0.22	4.13
	V3	NC- IR 64	4.32	4.57	0.25	5.53
	V4	ZC- PR 113 (N)	5.37	5.36	-0.01	-0.14
	V5	Lalat (E & NE)	4.37	4.57	0.20	4.42
	V6	Karjat 7 (W)	4.39	4.45	0.06	1.44
	V7	MTU 1010 (C & S)	4.61	4.86	0.25	5.13
	V8	HC- US 312	2.86	3.74	0.88	23.43
	V9	Local check	4.49	4.65	0.16	3.47

Group	Group	Entry No	100	150	Diffrence -50	(%) Reduction
IM (TP)	**V1**	IET 27263	5.34	5.98	0.64	10.77
	V2	IET 26418	4.76	5.35	0.58	10.94
	V3	IET 26420	5.24	5.65	0.41	7.27
	V4	NC-NDR 359	5.58	6.11	0.53	8.67
	V5	ZC- Pant Dhan-19 (N)	4.35	4.79	0.44	9.19
	V6	NDR 8002 (E&C)	4.19	4.73	0.53	11.31
	V7	Jaya (NE & S)	4.29	4.73	0.44	9.39
	V8	Akshayadhan (W)	4.21	4.65	0.45	9.63
	V9	Local Check	4.95	5.40	0.45	8.29

Group	Group	Entry No	100	150	Diffrence -50	(%) Reduction
Late	**V1**	IET 26927	4.89	5.27	0.39	7.31
	V2	IET 26974	5.36	5.87	0.51	8.62
	V3	IET 25948	5.40	5.62	0.22	3.88
	V4	IET 26948	5.34	5.70	0.36	6.35
	V5	Samba Masuri	4.58	4.98	0.40	8.10
	V6	Swarna	4.82	5.10	0.28	5.54
	V7	Pushyami	4.95	5.29	0.34	6.47
	V8	Local Check	4.74	5.19	0.45	8.62

Table. 4.1. (o): Cntd….

Group	Group	Entry No	100	150	Diffrence -50	(%) Reduction
MS	V1	IET 26549	5.70	6.12	0.43	6.95
	V2	IET 27136	5.36	5.85	0.48	8.28
	V3	IET 25802	6.06	6.42	0.36	5.63
	V4	IET 25798	5.61	6.26	0.64	10.27
	V5	IET 24990	5.39	5.84	0.45	7.70
	V6	DRRH 3	5.52	6.18	0.66	10.63
	V7	27 P 63	5.58	5.96	0.38	6.34
	V8	KRH 4	5.57	5.92	0.35	5.89
	V9	WGL 14	4.98	5.46	0.47	8.64
	V10	Local Check	2.60	3.52	0.92	26.14

Group	Group	Entry No	100	150	Diffrence -50	(%) Reduction
RSL	V1	IET 26692	4.43	4.92	0.49	10.00
	V2	Dhanrasi	3.00	3.36	0.36	10.71
	V3	Pooja	3.23	3.74	0.51	13.63
	V4	Savithri	3.13	3.70	0.56	15.25
	V5	Local Check	3.74	4.06	0.32	7.84

Group	Group	Entry No	100	150	Diffrence -50	(%) Reduction
AL&ISTVT	V1	IET 27077	5.59	6.03	0.45	7.40
	V2	CSR-10	4.50	4.92	0.41	8.41
	V3	CSR-23	5.09	5.22	0.13	2.49
	V4	CSR-36	4.98	5.56	0.59	10.52
	V5	Jaya	4.78	5.16	0.39	7.49
	V6	Local Check	4.99	5.49	0.50	9.10

Group	Group	Entry No	100	150	Diffrence -50	(%) Reduction
BT	V1	IET 26995	3.48	3.80	0.32	8.46
	V2	IET 26999	4.05	4.27	0.22	5.26
	V3	Sugandhamati	3.05	3.26	0.21	6.30
	V4	Tulasi	3.32	3.82		
	V5	Local Check	3.17	3.49	0.31	8.99

Biofortified	V1	IET 27179	4.58	4.98	0.40	8.04
	V2	BPT 5204	4.55	5.10	0.55	10.78
	V3	Chittimuthyalu	3.55	3.74	0.19	5.15
	V4	IR 64	4.93	5.25	0.32	6.17
	V5	Kalanamak	3.40	3.74	0.34	9.06

Group	Group	Entry No	100	150	Diffrence -50	(%) Reduction
NIL BL, BLB	V1	IET 27285	4.89	5.05	0.16	3.12
	V2	IET 27294	4.38	4.41	0.02	0.57
	V3	IET 27280	5.21	5.37	0.16	2.98
	V4	IET 27286	4.42	4.63	0.22	4.64
	V5	IET 28014	4.04	4.31	0.28	6.38
	V6	BPT 5204	4.78	5.05	0.27	5.40
	V7	Swarna	4.36	4.72	0.36	7.58
	V8	RP Bio 226	3.87	4.22	0.35	8.36
	V9	Local Check	6.20	5.66	-0.54	-9.54

Table. 4.1. (o): Cntd….

Group	Group	Entry No	0% RDN	50% RDN	100% RDN	150% RDN	0-50% difference	Reduction %	50-100% difference	Reduction %	100-150% difference	Reduction %	Mean Grain Yield difference	Mean Reduction %
NIL LNT	V1	IET 28081	2.34	3.89	5.07	6.96	1.55	39.88	1.18	23.26	1.89	27.12	1.54	30.09
	V2	IET 28080	2.27	3.63	4.69	7.55	1.35	37.29	2.41	51.50	5.28	69.89	3.01	52.89
	V3	IET 28084	2.57	4.80	5.15	8.03	2.22	46.36	2.57	50.01	5.46	67.95	3.42	54.77
	V4	IET 28086	2.25	4.29	4.78	5.21	2.04	47.60	2.53	53.00	2.96	56.88	2.51	52.49
	V5	IET 28087	2.75	4.73	5.15	6.55	1.97	41.76	2.39	46.49	3.80	57.96	2.72	48.74
	V6	IET 28083	2.11	4.10	4.76	5.21	1.99	48.46	2.64	55.57	3.10	59.44	2.58	54.49
	V7	IET 27730	2.53	4.57	6.36	7.49	2.05	44.75	3.83	60.25	4.96	66.27	3.61	57.09
	V8	IET 28088	2.22	4.06	5.35	7.99	1.84	45.29	3.13	58.47	5.77	72.22	3.58	58.66
	V9	IET 28085	1.73	3.18	4.05	4.88	1.46	45.74	2.33	57.39	3.15	64.62	2.31	55.92
	V10	IET 28079	2.15	4.28	5.15	5.68	2.13	49.73	3.00	58.21	3.53	62.09	2.89	56.68
	V11	IET 28082	1.98	3.35	4.22	5.12	1.36	40.71	2.24	53.00	3.14	61.26	2.25	51.66
	V12	IET 28826	2.00	4.04	5.46	6.35	2.04	50.43	3.46	63.34	4.35	68.50	3.28	60.76
	V13	IET 28827	1.92	4.20	5.39	8.75	2.28	54.31	3.47	64.36	6.83	78.06	4.19	65.58
	V14	IET 28828	2.42	4.54	4.71	5.23	2.12	46.64	2.29	48.59	2.81	53.73	2.40	49.65
	V15	IET 28829	1.66	3.22	4.20	5.81	1.56	48.38	2.53	60.37	4.15	71.37	2.75	60.04
	V16	IET 28830	2.36	4.05	5.07	7.18	1.69	41.65	2.70	53.36	4.82	67.08	3.07	54.03
	V17	IET 28831	2.41	4.62	5.05	6.09	2.21	47.84	2.64	52.23	3.68	60.43	2.84	53.50
	V18	IET 28832	2.43	4.15	4.84	6.72	1.71	41.33	2.41	49.75	4.29	63.79	2.80	51.62
	V19	IET 28833	2.03	3.70	4.69	6.23	1.67	45.14	2.66	56.74	4.20	67.42	2.84	56.43
	V20	Rasi	1.91	3.10	4.30	5.97	1.18	38.18	2.39	55.50	4.06	67.95	2.54	53.88
	V21	Improved Samba Mahsuri	2.16	3.75	4.45	4.83	1.59	42.36	2.29	51.43	2.67	55.28	2.18	49.69
	V22	Varadhan	1.59	3.56	5.04	6.67	1.97	55.40	3.45	68.49	5.08	76.21	3.50	66.70
	V23	BPT 5204	2.03	3.65	4.94	6.99	1.62	44.43	2.91	58.88	4.96	70.96	3.16	58.09
	V24	Swarna	2.09	3.93	4.93	6.43	1.84	46.73	2.84	57.57	4.34	67.44	3.00	57.25
	V25	Tella Hamsa	2.11	3.62	4.80	7.28	1.51	41.80	2.69	56.11	5.17	71.06	3.13	56.33

Table. 4.1. (o): Cntd….

Group	Group	Entry No	50% P	100 % P	Diffrence -50	(%) Reduction
NIL LPT	V1	IET 28066	3.19	4.17	0.98	23.44
	V2	IET 28073	3.12	3.88	0.76	19.48
	V3	IET 28063	4.15	4.57	0.42	9.19
	V4	IET 28069	3.93	4.49	0.56	12.49
	V5	IET 28059	2.70	3.81	1.11	29.13
	V6	IET 28071	4.30	3.70	-0.60	-16.08
	V7	IET 28816	4.66	4.94	0.28	5.67
	V8	IET 28065	3.93	4.23	0.29	6.98
	V9	IET 28061	3.98	4.34	0.36	8.34
	V10	IET 28817	2.60	2.73	0.13	4.88
	V11	IET 28818	3.20	3.54	0.35	9.75
	V12	IET 27641	4.33	4.29	-0.04	-0.93
	V13	IET 28076	4.35	4.27	-0.08	-1.95
	V14	IET 28063	3.84	3.55	-0.29	-8.03
	V15	IET 28819	3.91	4.97	1.06	21.35
	V16	IET 28820	3.23	3.09	-0.14	-4.42
	V17	IET 28062	3.22	3.15	-0.06	-2.06
	V18	IET 28821	3.13	3.09	-0.04	-1.40
	V19	IET 28822	3.89	3.80	-0.08	-2.15
	V20	IET 28067	3.94	3.74	-0.20	-5.31
	V21	IET 28060	3.67	4.02	0.35	8.63
	V22	IET 28070	3.63	4.16	0.53	12.74
	V23	IET 28823		3.08	3.08	
	V24	IET 28074	4.01	4.16	0.16	3.80
	V25	IET 28064	3.72	4.72	1.00	21.21
	V26	IET 28078	2.77	4.33		
	V27	IET 28072	3.60	4.57	0.98	21.33
	V28	IET 28776	3.57	3.99	0.42	10.60
	V29	IET 28824	3.55	3.72	0.18	4.70
	V30	IET 28075	3.97	4.18	0.21	4.95
	V31	IET 28077	3.49	3.84	0.35	9.19
	V32	IET 28825	3.62	4.01	0.40	9.85
	V33	Rasi	3.38	3.32	-0.06	-1.71
	V34	Swarna	3.76	3.28	-0.47	-14.37
	V35	Improved Samba Mahsuri	3.21	3.70	0.50	13.38
	V36	BPT 5204	3.74	3.41	-0.33	-9.64

100% RDP **Ludhiana 30 kg/ha**
Nellore 40 kg/ha
IIRR 60 kg/ha

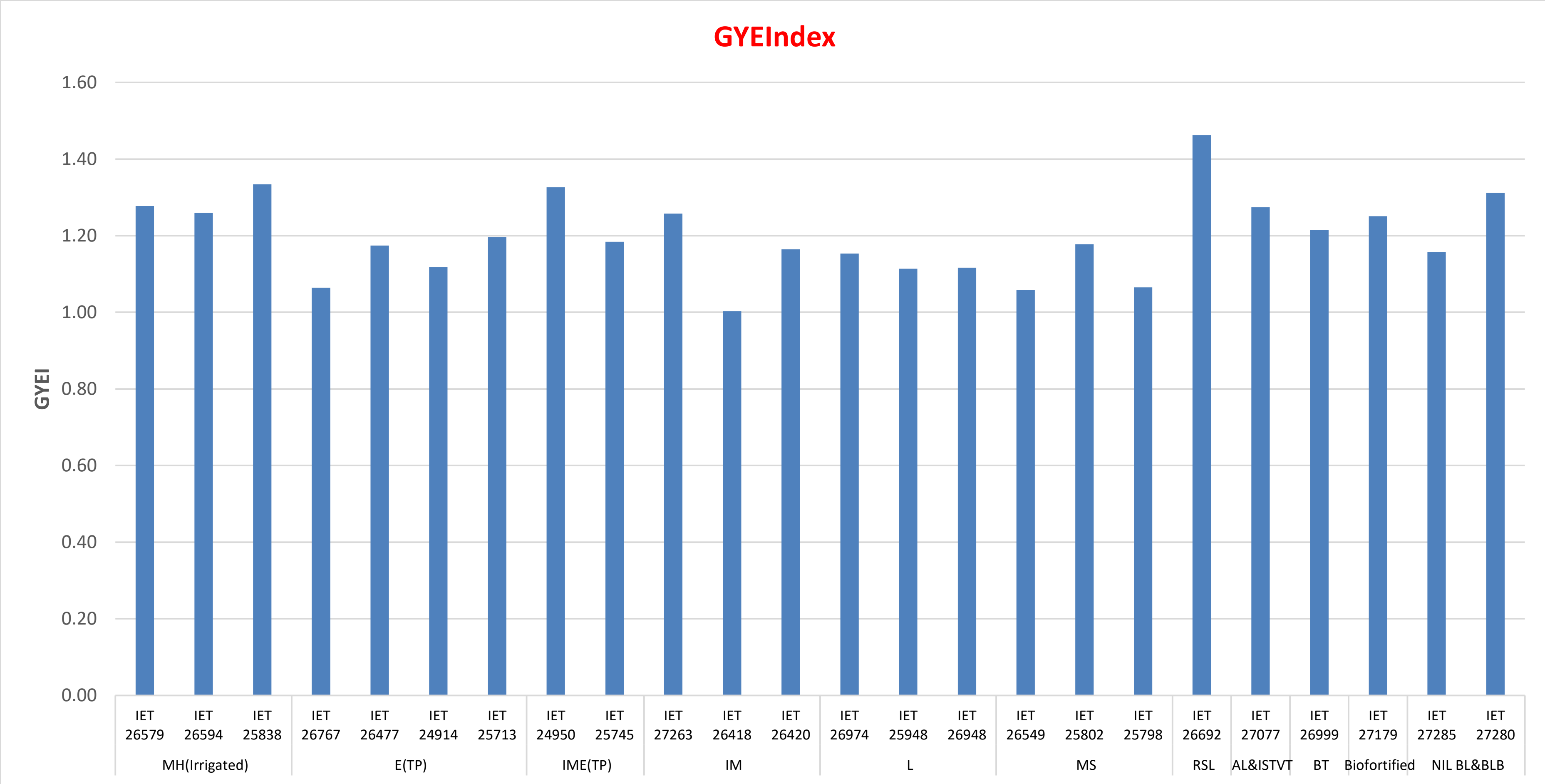


Fig. Promising cultivars identified in different groups based on GYEI

CULTURAL MANAGEMENT TRIALS

4.2. CULTURAL MANAGEMENT TRIALS (CMTs)

Cultural management practices include all the activities carried out on the farm before, during and after planting of crops like pre-planting, planting and post-planting operations. These practices are adopted to improve crop growth, prevent or reduce weed problems and increase the grain yields in different systems of rice establishment by manipulating the micro climate. With the idea of utilizing economic and effective cultural practices in enhancing grain yields of rain fed, aerobic, direct sown rice under puddle condition, water management, mechanized transplanting a total of eight trials were conducted during *Kharif* 2019 & Rabi 2018-19 to enhance production, productivity and profitability of rice. The traditional rice establishment method is transplanting with 30-40 days old rice seedlings, which involves replanting of rice seedlings grown in nurseries to puddled soils. However, rising labour costs and the need to intensify rice production through double and triple cropping, provide economic incentives for a shift to alternative establishment methods, such as direct sowing, mechanical transplanting, seedling broadcasting or a combination of methods. Simultaneously, the availability of high-yielding, short-duration varieties and chemical weed control methods have made such a shift technically viable.

4.2.1. Development of package of practices for mechanized transplanting

Mechanical transplanting of rice is the process of transplanting young rice seedlings, which have been grown in a mat nursery, using a paddy transplanter. In conventional manual transplanting practice, 8-12 labourers are required to transplant one acre. The process is also very time consuming and difficult. However, if self-propelled paddy transplanters are used, three people can transplant up to three to four acres in one day. This has great advantages in areas where farm labor is scarce and expensive. Hence the present trial is constituted to enhance the productivity of the mechanized transplanted rice with the following objectives: 1) To enhance the productivity of mechanized transplanted rice and 2) To identify the suitable agronomic management practices to enhance the efficiency of mechanized transplanting. The trial was conducted at 7 locations (**Aduthurai, Chiplima,Gangavathi, Puducherry, ARI Rajendranagar, Ranchi and Warangal**). Split plot design was adopted with 3 main plots of crop establishments {M_1: Normal Planting time Mechanical Transplanting (15 days seedlings and recommended spacing);M_2: Normal Planting time Mechanical Transplanting (21 days seedling and recommended spacing);M_3: Delayed Planting time (15 days late) Mechanical Transplanting (15 days seedlings and recommended spacing); M_4: Manual transplanting – Normal time (25 days old seedlings) and M_5: Manual transplanting – Delayed sowing time (25 days old seedlings) and 3 subplots consists of local latest released rice varieties. The results were summarized and presented in **Table 4.2.1** and the salient findings are as followed.

At all locations except **Gangavathi** interaction between crop establishment methods and varieties were found to be non-significant.

At **Aduthurai**, among main plot treatments, M_1{(normal planting time under mechanical transplanting (15 days seedlings with recommended spacing)} resulted significantly highest grain yield of 4.97 t/ha than those all other treatments. Both manual transplanted treatments either planted in normal time or delayed (M_5 and M_6) resulted lower grain yield than rest four mechanized transplanting treatments (M_1, M_2, M_3 and M_4). ADT-53 resulted higher grain yield (4.57 t/ha) than ADT-43 (4.09 t/ha). Similarly, in sandy clay loam soils at **Chiplima** both M_1 (4.41 t/ha) and M_4 (4.41 t/ha) are found to be equally effective and superior over M_5 (manual transplanting, 2.98 t/ha) in terms of grain yield. Among varieties Arize Gold resulted higher yield (4.0 t/ha) than MTU-1156 (3.62 t/ha). In black clay soils of **Gangavathi**, GGV-05-01 resulted the highest grain yield (8.1 t/ha) under mechanically transplanting of 21 days seedlings at normal time of sowing. In clay soils of **Puducherry**, mechanical transplanting of 15 days seedlings sown at normal time resulted the highest yield (6.3 t/ha). Among the two varieties, TKM 13 (6.27 t/ha) was found to be superior than CR 1009 (6.0 t/ha). In clay loam soils of **Rajendranagar**, mechanically transplanting of 15 days seedlings at normal sowing time resulted the highest grain yield (7.15 t/ha). All mechanically transplanted plots resulted higher yield than manually transplanted plots. Among varieties KNM 733 produced the highest yield (5.84 t/ha), however, similar to RNR 15048 (5.8 t/ha). In clay loam soils of **Ranchi**, mechanically transplanting of 15 days seedlings at normal sowing time resulted the highest grain yield (4.9 t/ha). Among varieties, Naveen yielded (4.32 t/ha) higher than IR 64 DRT1 (4.11 t/ha) and BVD 203 (3.89 t/ha). In clay loam soils of **Warangal**, 15 days delayed mechanical transplanting of 21 days seedlings resulted the highest grain yield of 7.27 t/ha, however, rest of the establishment methods also found equally effective with respect to yield. Both varieties WGL 739 and WGL 915 resulted similar yield of 6.65 and 6.22 t/ha, respectively.

Mechanical transplanting of 15 days seedlings at normal sowing time resulted the highest grain yield (5.87 t/ha) at five locations out of seven locations. Among the cultures tested, ADT-53 at **Aduthurai** (4.57 t/ha), Arize Gold at **Chiplima** (4.00 t/ha), GGV -0501 at **Gangavathi** (7.38 t/ha) TKM-13 at **Puducherry** (6.27 t/ha), Naveen at **Ranchi** (4.32 t/ha) were found promising.

Table-4.2.1: Development of package of practices for Mechanized Transplanting, Kharif-2019

Methods of crop establishment	Varieties	ADUTHURAI Grain yield (t/ha)	ADUTHURAI Panicle/ m² (No.)	ADUTHURAI Panicle wt (g)	ADUTHURAI Test wt (g)	CHIPLIMA Grain yield (t/ha)	CHIPLIMA Panicle/m² (No.)	CHIPLIMA Panicle wt (g)	CHIPLIMA Test wt (g)	CHIPLIMA Days for 50% flowering
M1	V1	5.41	326	2.46	17.3	4.22	188	6.77	25.0	74
	V2	4.53	306	2.35	18.3	4.59	198	7.43	25.3	85
	V3	-	-	-	-	-	-	-	-	-
M2	V1	4.52	298	2.38	17.0	3.82	170	6.27	25.7	70
	V2	4.05	282	2.27	18.2	4.32	158	6.57	25.0	82
	V3	-	-	-	-	-	-	-	-	-
M3	V1	4.68	308	2.41	17.1	3.02	167	5.28	24.0	68
	V2	4.24	279	2.35	18.5	3.37	146	5.90	24.0	81
	V3	-	-	-	-	-	-	-	-	-
M4	V1	4.55	287	2.30	17.0	4.24	207	6.30	25.0	74
	V2	4.45	269	2.22	18.1	4.58	185	7.13	26.0	84
	V3	-	-	-	-	-	-	-	-	-
M5	V1	4.01	266	2.27	17.0	2.82	133	4.87	24.0	75
	V2	3.43	244	2.16	18.0	3.13	175	5.30	24.0	79
	V3	-	-	-	-	-	-	-	-	-
M6	V1	4.22	238	2.17	17.2	-	-	-	-	-
	V2	3.84	211	2.14	18.1	-	-	-	-	-
	V3	-	-	-	-	-	-	-	-	-
Interaction										
M and S		NS	NS	0.03	NS	NS	NS	NS	NS	2.93
S and M		NS	NS	0.03	NS	NS	NS	NS	NS	2.39
Mean of Methods										
M1		4.97	316	2.40	17.8	4.41	193	7.10	25.2	79
M2		4.28	290	2.33	17.6	4.07	164	6.42	25.3	76
M3		4.46	294	2.38	17.8	3.19	156	5.59	24.0	75
M4		4.50	278	2.26	17.6	4.41	196	6.72	25.5	79
M5		3.72	255	2.22	17.5	2.98	154	5.09	24.0	77
M6		4.03	224	2.15	17.7					
C.D. (0.05)		0.41	9.81	0.03	0.19	0.30	23.77	0.46	NS	1.64
C.V. (%)		7.43	2.76	0.98	0.82	5.84	10.33	5.63	4.25	1.59
Mena of Varieties										
V1		4.57	287	2.33	17.1	3.62	173	5.90	24.7	72
V2		4.09	265	2.25	18.2	4.00	172	6.47	24.9	82
V3		-	-	-	-	-	-	-	-	-
CD (0.05)		0.18	6.90	0.01	0.08	0.30	NS	0.42	NS	1.31
C.V. (%)		5.72	3.44	0.67	0.60	9.78	9.64	8.34	4.16	2.09
Experimental Mean		4.33	276	2.29	17.7	3.81	173	6.18	24.8	77
Soil type		-				Sandy clay loam				
pH		-				-				
EC		-				-				
Variety & Duration		ADT 53 120 days		ADT 43		MTU 1156 & ARIZR GOLD				
Available NPK kg/ha		-				-				

T_1 – Normal planting time Mechanical Transplanting (15 days seedlings)

T_2 - Normal planting time Mechanical Transplanting (21 days seedlings)

T_3 – Delayed planting time (15 days late) Mechanical transplanting (15 days seedlings)

T_4 - Delayed planting time (15 days late) Mechanical transplanting (21 days seedlings)

T_5 – Manual transplanting – Normal time (25 days old seedlings)

T_6 – Manual transplanting – Delayed sowing time (25 days old seedlings)

Table-4.2.1: Contd….

Methods of crop establishment	Varieties	GANGAVATHI						PUDUCHERRY					
		Grain yield (t/ha)	Straw yield (t/ha)	Panicle/ m^2 (No.)	Panicle wt (g)	Test wt (g)	No of Grains/panicle	Grain yield (t/ha)	Straw yield (t/ha)	Panicle/ m^2 (No.)	Panicle wt (g)	Test wt (g)	No of Grains/panicle
M1	V1	8.04	8.92	428	2.63	14.6	166	6.39	7.88	383	3.44	16.7	89
	V2	6.17	7.10	393	2.90	17.6	142	6.21	7.61	379	3.69	25.3	113
	V3	6.72	7.73	481	2.66	12.8	188						
M2	V1	8.10	9.31	357	2.94	15.2	179	6.31	7.78	377	3.35	16.5	89
	V2	6.91	7.95	420	3.29	17.8	157	6.02	7.42	197	3.56	24.6	114
	V3	7.03	8.08	443	2.76	13.4	187						
M3	V1	6.74	7.75	383	2.89	15.1	168	6.26	7.71	369	3.27	16.7	89
	V2	6.43	7.39	460	3.23	16.9	166	5.93	7.32	355	3.43	24.8	115
	V3	6.77	7.79	440	2.59	13.4	176						
M4	V1	7.35	8.45	429	2.68	15.2	163	6.32	7.80	375	3.36	16.6	89
	V2	6.51	7.48	425	3.49	17.3	177	6.04	7.44	360	3.56	24.7	115
	V3	6.73	7.74	397	2.29	13.0	159						
M5	V1	6.68	7.68	434	2.64	15.5	146	6.07	7.49	340	3.10	16.5	90
	V2	6.91	7.94	462	3.08	17.0	162	5.79	7.15	337	3.34	24.8	115
	V3	6.38	7.34	482	2.37	13.7	160						
M6	V1	-	-	-	-	-	-	-	-	-	-	-	-
	V2	-	-	-	-	-	-	-	-	-	-	-	-
	V3	-	-	-	-	-	-	-	-	-	-	-	-
Interaction													
M and S		0.65	NS	35.54	NS	NS	NS	NS	NS	NS	NS	NS	NS
S and M		0.64	NS	33.31	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Methods													
M1		6.98	7.92	434	2.73	15.0	166	6.30	7.75	381	3.56	21.0	101
M2		7.35	8.44	407	3.00	15.4	175	6.16	7.60	287	3.45	20.5	102
M3		6.65	7.65	428	2.90	15.1	170	6.09	7.52	362	3.35	20.8	102
M4		6.86	7.89	417	2.82	15.2	166	6.18	7.62	368	3.46	20.7	102
M5		6.66	7.65	459	2.70	15.4	156	5.93	7.32	338	3.22	20.6	102
M6		-	-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)		NS	0.53	21.90	NS	NS	NS	0.20	0.24	61.29	0.12	NS	NS
C.V. (%)		6.37	6.19	4.70	9.19	2.93	7.03	2.51	2.43	13.26	2.54	2.73	1.05
Mena of Varieties													
V1		7.38	8.42	406	2.76	15.1	164	6.27	7.73	369	3.30	16.6	89
V2		6.59	7.57	432	3.20	17.3	161	6.00	7.39	326	3.51	24.9	115
V3		6.73	7.73	449	2.53	13.3	174						
CD (0.05)		0.29	0.38	15.90	0.22	0.35	NS	0.10	0.12	36.80	0.06	0.38	0.71
C.V. (%)		5.51	6.28	4.87	10.19	3.02	8.87	2.06	1.96	13.02	2.11	2.26	0.86
Experimental Mean		6.90	7.91	429	2.83	15.2	167	6.13	7.56	347	3.41	20.7	102
Soil type		**Blackclay**						Clay					
pH		8.2						6.14					
EC		1.6						0.26					
Variety & Duration		GGV-05-01		GNV10-89 & RNR15048				TKM 13 & CR 1009					
Available NPK kg/ha		-						112:15:136					

T_1 – Normal planting time Mechanical Transplanting (15 days seedlings)
T_2 - Normal planting time Mechanical Transplanting (21 days seedlings)
T_3 – Delayed planting time (15 days late) Mechanical transplanting (15 days seedlings)
T_4 - Delayed planting time (15 days late) Mechanical transplanting (21 days seedlings)
T_5 – Manual transplanting – Normal time (25 days old seedlings)
T_6 – Manual transplanting – Delayed sowing time (25 days old seedlings)

Table-4.2.1: Contd….

Methods of crop establishment	Varieties	RAJENDRANAGAR						RANCHI				
		Grain yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	No of Grains/panicle	Grain yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	No of Grains/panicle
M1	V1	6.61	362	4.20	12.87	89	272	4.83	264	3.41	24.4	106
	V2	6.97	430	3.84	16.93	90	147	5.17	288	3.62	24.6	111
	V3	7.87	425	4.58	26.20	89	417	4.70	261	3.39	24.4	104
M2	V1	6.43	396	4.28	12.87	89	348	3.59	206	2.72	23.9	82
	V2	6.08	463	3.10	16.97	89	157	3.52	220	2.87	24.0	89
	V3	6.36	430	3.18	24.73	87	221	3.25	201	2.67	23.9	77
M3	V1	5.90	318	3.87	13.77	86	263	4.38	245	3.37	24.4	105
	V2	5.75	377	4.23	15.07	85	251	4.76	261	3.52	24.4	108
	V3	5.70	375	4.29	24.73	86	344	4.17	240	3.27	24.2	102
M4	V1	6.43	352	3.64	11.53	89	192	4.13	232	3.25	24.3	102
	V2	6.56	377	3.66	15.07	91	121	4.25	247	3.37	24.4	105
	V3	6.75	375	3.66	27.33	90	256	3.91	230	3.12	24.3	96
M5	V1	3.63	356	3.69	12.73	86	352	3.65	220	3.14	24.2	94
	V2	3.82	367	4.09	15.07	88	151	3.88	234	3.20	24.2	97
	V3	4.01	374	3.52	23.93	86	223	3.42	217	3.10	24.1	90
M6	V1	-	-	-	-	-	-	-	-	-	-	-
	V2	-	-	-	-	-	-	-	-	-	-	-
	V3	-	-	-	-	-	-	-	-	-	-	-
Interaction												
M and S		NS	NS	NS	1.17	NS	88.97	NS	NS	NS	NS	NS
S and M		NS	NS	NS	1.19	NS	84.20	NS	NS	NS	NS	NS
Mean of Methods												
M1		7.15	406	4.21	18.67	90	279	4.90	271	3.47	24.5	107
M2		6.29	430	3.52	18.19	88	242	3.45	209	2.75	23.9	83
M3		5.79	357	4.13	17.86	86	286	4.44	249	3.39	24.3	105
M4		6.58	368	3.66	17.98	90	190	4.10	236	3.25	24.3	101
M5		3.82	365	3.76	17.24	87	242	3.65	224	3.15	24.2	94
M6		-	-	-	-	-	-	-	-	-	-	-
C.D. (0.05)		0.84	29.43	0.44	NS	2.44	57.13	0.36	17.59	0.32	0.16	9.06
C.V. (%)		13.04	7.03	10.52	4.91	2.55	21.21	8.07	6.81	9.08	0.60	8.51
Mena of Varieties												
V1		5.80	357	3.94	12.75	88	285	4.11	233	3.18	24.2	98
V2		5.84	403	3.78	15.82	89	166	4.32	250	3.32	24.3	102
V3		6.14	396	3.85	25.39	88	292	3.89	230	3.11	24.2	94
CD (0.05)		NS	20.60	NS	0.52	NS	39.79	0.29	11.19	NS	NS	NS
C.V. (%)		11.97	7.02	14.59	3.82	2.22	21.08	9.39	6.18	12.07	0.98	8.93
Experimental Mean		5.93	385	3.86	17.99	88	248	4.11	238	3.20	24.2	98
Soil type		**Clay loam**						**Clay loam**				
pH		7.7						-				
EC		1.1						-				
Variety & Duration		RNR15048, KNM 733 & KNM 118						IR 64 drt1, NAVEEN & BVD 203				
Available NPK kg/ha		-						240:37:161				

T_1 – Normal planting time Mechanical Transplanting (15 days seedlings)

T_2 - Normal planting time Mechanical Transplanting (21 days seedlings)

T_3 – Delayed planting time (15 days late) Mechanical transplanting (15 days seedlings)

T_4 - Delayed planting time (15 days late) Mechanical transplanting (21 days seedlings)

T_5 – Manual transplanting – Normal time (25 days old seedlings)

T_6 – Manual transplanting – Delayed sowing time (25 days old seedlings)

Table-4.2.1: Contd….

Methods of crop establishment	Varieties	WARANGAL					Over all Mean	Rank
		Grain yield (t/ha)	Panicle/ m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering		
M1	V1	6.72	362	1.63	21.21	101	6.03	2
	V2	6.01	212	2.10	29.60	101	5.66	5
	V3	-	-	-	-	-	6.43	1
M2	V1	6.46	292	1.75	19.81	99	5.60	7
	V2	5.42	203	1.95	29.33	99	5.19	12
	V3	-	-	-	-	-	5.55	8
M3	V1	6.25	277	1.47	18.98	98	5.32	10
	V2	5.98	170	1.63	27.76	99	5.21	11
	V3	-	-	-	-	-	5.55	8
M4	V1	7.36	391	1.82	21.37	100	5.77	4
	V2	7.17	296	2.05	29.64	100	5.65	6
	V3	-	-	-	-	-	5.80	3
M5	V1	6.45	351	1.55	20.40	99	4.76	14
	V2	6.53	208	1.74	28.89	99	4.78	13
	V3	-	-	-	-	-	4.60	15
M6	V1	-	-	-	-	-	4.22	16
	V2	-	-	-	-	-	3.84	17
	V3	-	-	-	-	-		
Interaction								
M and S		NS	NS	NS	NS	NS		
S and M		NS	NS	NS	NS	NS		
Mean of Methods								
M1		6.36	287	1.87	25.40	101	5.87	1
M2		5.94	247	1.85	24.57	99	5.36	3
M3		6.12	223	1.55	23.37	99	5.25	4
M4		7.27	344	1.93	25.51	100	5.70	2
M5		6.49	280	1.64	24.64	99	4.75	5
M6		-	-	-	-	-	4.03	6
C.D. (0.05)		NS	45.82	0.80	0.70	0.49		
C.V. (%)		10.78	12.46	3.41	2.12	0.37		
Mena of Varieties								
V1		6.65	335	1.64	20.35	100	5.49	2
V2		6.22	218	1.90	29.04	100	5.29	3
V3		-	-	-	-	-	5.59	1
CD (0.05)		NS	19.72	0.59	0.26	NS		
C.V. (%)		8.32	8.78	4.12	1.28	0.18		
Experimental Mean		6.44	276	1.77	24.70	100		
Soil type		**Clay loam**						
pH		7.3						
EC								
Variety & Duration		WGL 739 & WGL 915						
Available NPK kg/ha		-						

T_1 – Normal planting time Mechanical Transplanting (15 days seedlings)

T_2 - Normal planting time Mechanical Transplanting (21 days seedlings)

T_3 – Delayed planting time (15 days late) Mechanical transplanting (15 days seedlings)

T_4 - Delayed planting time (15 days late) Mechanical transplanting (21 days seedlings)

T_5 – Manual transplanting – Normal time (25 days old seedlings)

T_6 – Manual transplanting – Delayed sowing time (25 days old seedlings)

4.2.2. Developing suitable package of practices for dry DSR

Imminent water crisis, labour scarcity and climate change threaten the sustainability and profitability of traditional transplanted rice. Direct-seeded rice (DSR) technology has been proposed to reduce water requirement, save labour demand, mitigate greenhouse gas emission and improve environmental sustainability. It involves three principal methods viz., dry seeding, wet seeding, and water seeding, among which dry DSR is gaining momentum due to relatively high grain yield, less water consumption, reduced labour intensity, facilitating to mechanization during crop establishment, and less greenhouse gases emission. The major challenges confronting the development of dry DSR in India are poor crop establishment, weed infestation, lodging susceptibility, yield decline under continuous cropping, and variety breeding; and the strategies which may help in mitigating the constraints to dry DSR. Hence the present trial is constituted to enhance the productivity of the wet DSR with the following objectives 1) To identify suitable and cost effective agronomic management practices to enhance the productivity of dry DSR and 2) To maximize the resource use efficiency. The trial was conducted at 15 locations (**Arundhatinagar, Chatha, Gangavathi, Jagdalpur, Kota, Mandya, Nagina, Nawagam, Pantnagar, Ragolu, Tuljapur, Ranchi, Ludhiana and Pusa**). Split plot design was adopted with 2 main plots of sowing time (M_1: Normal sowing time andM_2: Delayed sowing by 30 days). Four subplots consist of S_1: Broadcasting of seeds; S_2: Manual line sowing of seed (20-25 cm row spacing sown in solid row); S_3: Mechanized line sowing of seeds (Dribbler, Happy Seeder or any Drum Seeder) and S_4: Any improved system in that particular location. The results were summarized and presented in **Table 4.2.2** and the salient findings are as followed.

Interaction effect of grain yield between sowing time and crop establishment methods were found to be non-significant at all locations except at **Gangavathi** and **Nawagam**. At **Jagdalpur** main plots and sub plots CV are very high. So, grain yield data may not be considered. Similarly, **Jagtial** centre grain yield data was not correctly provided. Further, **Tuljapur** experimental mean grain yield was very low (1.24 t/ha). So both locations data were not included. At all the locations normal sowing resulted higher grain yield than late sowing except at **Gangavathi** and **Ragolu**. Normal sowing time resulted higher grain yield at **Arundhatinagar** (3.98 t/ha), **Chatha** (2.67 t/ha), **Jagdalpur** (3.25 t/ha), **Kota** (5.87 t/ha), **Mandya** (5.9 t/ha), **Nagina** (4.37 t/ha), **Nawagam** (5.01 t/ha), **Pantnagar** (4.73 t/ha) and **Ranchi** (4.27 t/ha).

At **Arundhatinagar,** crop establishment methods were found to be non-significant. At **Chatha** local management practices (dibbling SRI) with 3.31 t/ha grain yield found to be best compared to all other practices. At **Gangavathi**, manual line sowing of seeds resulted the highest grain yield (5.85 t/ha). However, at **Jagdalpur** mechanized line sowing of seeds gave higher yield (2.32 t/ha). Similar effect of same treatment was also recorded at **Kota, Mandya, Nagina, Nawagam** and **Pantnagar**) with mechanized line sowing of seeds gave the highest grain yield (5.91, 5.54, 4.59, 4.59 and 4.74 t/ha, respectively). At **Mandya** weed population were not affected due to late sowing either at active tillering or panicle initiation stage. However, broadcasting method of rice seeds resulted in more weed population compared to other methods at active tillering stage. At **Nagina**, broadcasting method of rice seeds resulted in more weed population and dry weight compared to other methods either at active tillering or panicle initiation stage. At **Nawagam**, broadcasting method of rice seeds resulted in more weed population and dry weight compared to other methods at active tillering stage. At **Ragolu**, local establishment method (semi dry rice, 20 x 15 cm) resulted the highest grain yield (5.83 t/ha) than other methods. Similarly, broadcasting method of rice seeds resulted in more weed population and dry weight compared to other methods at active tillering stage. At **Ranchi**, local establishment method (Rice + Sesbania was broadcasted, Sesbania was broadcasted at the rate of 40 kg/ha and then rice was sown in lines 20 cm apart , at 25th DAS sesbania was uprooted and placed in between rice rows) resulted the highest grain yield (4.58 t/ha) than all other methods.

The experimental mean of cost of cultivation at Gangavathi (Rs. 63155/-), Mandya (Rs. 56251/-), Nagina (Rs. 25236/-), Nawagam (Rs. 39014/-) and Ragolu (Rs. 28365/-).

In silty loam soils of **Ludhiana** mechanized line sowing of seeds resulted in higher yield (7.39 t/ha) than other treatments. Broadcasting method of rice seeds resulted in more weed population and dry weight compared to other methods at active tillering stage. Similarly, in silty loam soils of **Pusa** also mechanized line sowing of seeds resulted in higher yield (3.75 t/ha) than other treatments.

Multi-location trial revealed that normal date of sowing at most of the locations resulted in higher grain yield. Similarly, mechanized line sowing found to be the best among all establishment methods. Local practices at **Chatha, Ragolu** and **Ranchi** also showing better results in terms of economics.

4.2.2(R). Nutrient and Weed management for higher productivity in different rice establishment methods

Rice crop suffers more from weed competition unlike other cereal crops. Weed infestation and weed competition are more in direct seeded rice as compared to transplanted rice and SRI because the land is exposed till the initial seedling establishment in direct seeded rice. Crop establishment and weed management techniques are critical in rice farming. So, present investigation to study the weed infestation and nutrient removal by weeds in different crop establishment methods of rice, their influence on productivity of rice and nutrient uptake by rice was taken up. A trial was conducted i) to identify the optimum and cost effective nutrient management practices in different crop establishment methods and ii) to assess the agronomic efficiency, plant and soil nutrient status under different nutrient management practices in different crop establishment methods. The experiment was conducted during *rabi*2018-19 in split-split design with four replications. Treatments consisting of five crop establishment methods {Mechanical Transplanting method (All the principles as per the SRI); M_2: Direct seeding (Use of Drum seeder/ dibbling of sprouted seed at 25 x25 cm) fb

SRI principles (saturation method of water management, weeding with cono-weeder and fertilizer management); M_3: Normal Transplanting (20 x15 cm with flooding water management,3-4 seedlings transplanted at 25-30 days old seedlings); M_4: SRI; M_5: Aerobic rice and M_6: Semi dry rice} were assessed for their system productivity performance at 2locations (**Mandya and Puducherry**). The results were summarized and presented in **Table 4.2.2(R)** and the salient findings are as followed.

At red sandy loam soils of **Mandya**, cowpea was grown in 2018-19 *rabi* season. Main plots and sub plots effect on grain yield was non-significant. Rice equivalent yield of rice-cowpea system was highest (11.66 t/ha) under direct seeding followed by SRI principles. Similarly, at 150% RDF this system produced highest system productivity (12.0 t/ha). In clay loam soils of **Puducherry**, rice was grown in *rabi* season. In *rabi* season mechanical transplanting resulted the highest rice grain yield (6.89 t/ha). Among nutrient managements practices LCC based nitrogen application resulted the highest yield (7.07 t/ha). The highest rice-rice system productivity was recorded under mechanical transplanting followed by LCC based N management. Lower weed population at active tillering stage was also recorded under mechanical transplanting and LCC based N management.

Table-4.2.2: (CMT-2)(Dry DSR) - Developing suitable package of practices for dry DSR, Kharif-2019

Treatment		ARUNDATHINAGAR										
Main Plot	**Sub-plots**	**Grain yield (t/ha)**	**Straw yield (t/ha)**	**Tillers/m^2 (No.)**	**Panicle/m^2 (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Days for 50% flowering**	**Weed population at AT (no/m^2)**	**Weed population PI (no/m^2)**	**Weed dry weight at AT (g/m2)**	**Weed dry weight at PI (g/m^2)**
M1- Normal sowing time	S1	3.52	1.06	315	302	4.94	20.95	72	318	169	425.0	162.5
	S2	4.14	1.12	320	308	5.38	21.14	73	260	164	451.3	178.3
	S3	3.96	1.06	334	316	4.52	21.01	74	239	180	333.8	195.0
	S4	4.31	1.48	386	369	4.81	21.11	74	401	195	420.0	280.0
M2- Delayed sowing by 30 days	S1	3.13	0.55	185	178	4.42	20.27	71	249	189	423.8	173.8
	S2	3.14	0.55	225	211	3.72	20.93	72	263	183	432.5	183.8
	S3	3.21	0.53	254	241	3.66	19.82	72	299	187	456.3	188.8
	S4	3.31	2.85	236	219	4.54	20.28	72	280	196	427.5	198.8
Interaction												
I and M		NS	NS	NS	29.96	NS	NS	NS	NS	NS	37.24	NS
M and I		NS	NS	NS	41.09	NS	NS	NS	NS	NS	40.74	NS
Mean of Main plot												
M1		3.98	1.18	339	324	4.91	21.05	73	304	177	407.5	203.9
M2		3.19	1.12	225	212	4.08	20.33	72	273	189	435.0	186.3
C.D. (0.05)		0.54	NS	41.05	41.36	0.39	NS	0.88	NS	NS	NS	NS
C.V. (%)		13.33	128	12.94	13.72	7.80	7.58	1.09	44.99	7.69	6.62	19.78
Method of Sub plots												
S1		3.32	0.80	250	240	4.68	20.61	71	283	179	424.4	168.1
S2		3.64	0.83	273	260	4.55	21.04	72	261	174	441.9	181.0
S3		3.58	0.80	294	279	4.09	20.41	73	269	183	395.0	191.9
S4		3.81	2.16	311	294	4.67	20.70	73	341	195	423.8	239.4
CD (0.05)		NS	NS	23.52	21.18	NS	NS	0.68	NS	NS	26.33	38.64
C.V. (%)		14.93	132	7.94	7.52	16.17	4.51	0.90	38.03	10.08	5.95	18.84
Experimental Mean		3.59	1.15	282	268	4.50	20.69	72	288	183	421.3	195.1
Soil type		-										
pH		4.92										
Variety		Sahabhagidhan										
Available NPK kg/ha		180:44:295										

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

Table-4.2.2: Contd….

Treatment		CHATHA								
Main Plot	Sub-plots	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at AT (no/m^2)	Weed population PI (no/m^2)
M1- Normal sowing time	S1	2.32	3.29	164	138	1.16	19.17	103	1.7	44.0
	S2	2.77	3.92	195	172	1.31	19.57	100	2.3	37.7
	S3	2.13	2.99	141	117	0.93	18.43	101	2.3	47.3
	S4	3.45	4.81	282	256	2.07	20.33	104	0.3	13.7
M2- Delayed sowing by 30 days	S1	2.02	2.73	138	110	1.02	18.20	98	1.3	45.0
	S2	2.45	3.34	159	127	1.16	18.80	100	2.0	38.7
	S3	1.89	2.59	142	104	0.87	17.73	101	2.7	50.3
	S4	3.16	4.44	252	221	1.96	19.57	106	0.3	13.3
Interaction										
I and M		NS	NS	NS	NS	NS	NS	1.54	NS	NS
M and I		NS	NS	NS	NS	NS	NS	1.75	NS	NS
Mean of Main plot										
M1		2.67	3.75	195	171	1.37	19.38	102	1.7	35.7
M2		2.38	3.28	173	141	1.25	18.57	101	1.6	36.8
C.D. (0.05)		0.03	0.10	2.00	0.95	0.06	0.06	NS	NS	NS
C.V. (%)		0.74	1.58	0.62	0.35	2.42	0.19	0.80	33.23	2.82
Method of Sub plots										
S1		2.17	3.01	151	124	1.09	18.68	101	1.5	44.5
S2		2.61	3.63	177	150	1.23	19.18	100	2.2	38.2
S3		2.01	2.79	142	111	0.90	18.08	101	2.5	48.8
S4		3.31	4.63	267	238	2.01	19.95	105	0.3	13.5
CD (0.05)		0.11	0.13	14.00	15.63	0.05	0.36	1.09	0.66	2.76
C.V. (%)		3.59	3.01	6.05	7.98	3.33	1.50	0.85	32.43	6.05
Experimental Mean		2.53	3.51	184	156	1.31	18.98	102	1.6	36.3
Soil type		Sandy clay loam								
pH		8.03								
Variety		Basmathi - 370								
Available NPK kg/ha		245:14.3:146.3								

S1: Broadcasting of seeds *S4-Dibling SRI

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

Table-4.2.2: Contd….

Treatment		GANGAVATHI									
Main Plot	Sub-plots	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Weed population at AT (no/m2)	Weed population at PI (no/m2)	Weed dry wt at AT(g/m2)	Weed dry wt at PI
M1-Normal sowing time	S1	4.70	5.48	739	344	3.72	18.6	46	67	9.50	10.85
	S2	5.36	6.19	655	383	3.38	18.3	32	31	4.65	4.80
	S3	4.37	5.09	757	404	3.05	18.8	42	46	5.58	6.25
	S4	5.16	5.92	533	385	3.50	17.7	38	41	6.69	7.52
M2-Delayed sowing by 30 days	S1	5.59	6.44	769	427	2.99	17.3	12	15	3.35	3.82
	S2	6.35	7.37	747	499	2.74	18.3	11	12	3.00	3.17
	S3	6.05	6.97	745	466	2.56	17.9	21	27	3.03	3.45
	S4	5.94	6.88	592	469	2.32	17.3	12	15	2.25	2.28
Interaction											
I and M		0.33	NS	34.87	NS	0.23	NS	NS	6.66	0.93	1.90
M and I		0.30	NS	38.92	NS	0.37	NS	NS	8.12	1.07	1.78
Mean of Main plot											
M1		4.90	5.67	671	379	3.41	18.3	39	46	6.60	7.36
M2		5.98	6.92	713	465	2.65	17.7	14	17	2.91	3.18
C.D. (0.05)		0.12	0.16	31.01	18.26	0.42	0.26	2.49	7.30	0.90	0.81
C.V. (%)		1.91	2.27	3.98	3.85	12.25	1.29	8.35	20.55	16.77	13.70
Method of Sub plots											
S1		5.14	5.96	754	385	3.36	18.0	29	41	6.42	7.34
S2		5.85	6.78	701	441	3.06	18.3	21	22	3.82	3.99
S3		5.21	6.03	751	435	2.80	18.4	31	36	4.30	4.85
S4		5.55	6.40	563	427	2.91	17.5	25	28	4.47	4.90
CD (0.05)		0.23	0.46	24.66	25.67	0.16	0.40	4.85	4.71	0.66	1.35
C.V. (%)		4.03	6.95	3.39	5.79	5.03	2.13	17.37	14.20	13.11	24.32
Experimental Mean		5.44	6.29	692	422	3.03	18.0	27	32	4.75	5.27
Soil type		Black clay									
pH		8.20									
Variety		GGV-10-89									
Available NPK kg/ha		-									

*S4-Dibling

Table-4.2.2: Contd….

Treatment		JAGDALPUR										KOTA		
Main Plot	**Sub-plots**	**Grain yield (t/ha)**	**Straw yield (t/ha)**	**Panicle/m² (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Days for 50% flowering**	**Weed population at AT (no/m2)**	**Weed population PI (no/m²)**	**Weed dry weight at AT (g/m2)**	**Weed dry weight at PI (g/m²)**	**Grain yield (t/ha)**	**Panicle/m² (No.)**	**Panicle wt (g)**
M1- Normal sowing time	S1	3.55	3.58	434	2.75	40.0	85	43	103	3.30	9.41	5.26	268	3.22
	S2	2.84	3.51	332	2.55	38.6	83	62	150	5.07	13.81	5.98	297	3.65
	S3	3.36	3.84	418	2.63	40.4	82	42	143	3.15	13.25	6.12	305	3.76
	S4	-	-	-	-	-	-	-	-	-	-	6.11	278	3.41
M2- Delayed sowing by 30 days	S1	0.75	0.63	111	1.86	38.2	75	163	213	14.74	20.22	4.74	232	2.96
	S2	0.43	0.41	79	1.66	36.1	75	211	263	18.51	21.76	5.58	279	3.38
	S3	1.29	0.71	108	1.72	38.0	74	193	219	17.92	20.87	5.70	286	3.47
	S4	-	-	-	-	-	-	-	-	-	-	5.05	259	3.18
Interaction														
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot														
M1		3.25	3.64	395	2.64	39.6	83	49	132	3.84	12.16	5.87	287	3.51
M2		0.82	0.58	99	1.75	37.4	75	189	232	17.06	20.95	5.27	264	3.25
C.D. (0.05)		1.06	0.65	160.61	0.18	2.19	4.42	16.10	22.73	0.98	5.44	0.29	17	0.16
C.V. (%)		39.99	23.75	50.08	6.31	4.38	4.32	10.44	9.63	7.20	25.28	4.71	5	4.33
Method of Sub plots														
S1		2.15	2.10	273	2.30	39.1	80	103	158	9.02	14.82	5.00	250	3.09
S2		1.64	1.96	205	2.10	37.3	79	136	207	11.79	17.78	5.78	288	3.51
S3		2.32	2.27	263	2.18	39.2	78	118	181	10.54	17.06	5.91	296	3.62
S4		-	-	-	-	-	-	-	-	-	-	5.58	268	3.29
CD (0.05)		NS	NS	51.77	NS	1.58	NS	22.80	29.45	2.14	NS	0.40	14.85	0.33
C.V. (%)		29.69	23.74	19.25	13.83	3.76	2.54	17.62	14.87	18.82	14.29	6.76	5.13	9.35
Experimental Mean		2.04	2.11	247	2.20	38.5	79	119	182	10.45	16.55	5.57	275	3.38
Soil type		-										Clay loam		
pH		6.20										7.80		
Variety		Samleswari										Pusa sungandha-5		
Available NPK kg/ha		-										318:60:523		

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

Table-4.2.2: Contd….

Treatment		MANDYA										
Main Plot	Sub-plots	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at active tillering (no/m2)	Weed population panicle initiation (no/m²)	Weed dry weight at active tillering (g/m2)	Weed dry weight at panicle initiation (g/m²)
M1- Normal sowing time	S1	5.29	8.70	346	306	4.02	22.7	85	10.8	21.8	1.88	6.54
	S2	5.95	9.18	371	344	4.57	25.5	85	9.8	9.3	1.81	2.19
	S3	6.47	9.63	355	340	4.79	24.1	85	8.8	7.8	1.28	1.61
	S4	-	-	-	-	-	-	-	-	-	-	-
M2- Delayed sowing by 30 days	S1	4.08	8.49	284	260	4.06	23.9	86	20.5	28.3	1.85	7.80
	S2	4.44	8.93	253	247	4.09	23.1	86	15.8	13.8	1.95	3.90
	S3	4.61	9.09	277	268	4.12	22.6	85	13.8	10.8	2.19	3.31
	S4	-	-	-	-	-	-	-	-	-	-	-
Interaction												
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot												
M1		5.90	9.17	358	330	4.46	24.1	85	9.8	12.9	1.66	3.45
M2		4.38	8.83	271	258	4.09	23.2	86	16.7	17.6	1.99	5.00
C.D. (0.05)		0.97	NS	41.97	49.54	NS	NS	1.09	NS	2.81	NS	NS
C.V. (%)		14.60	5.74	10.27	12.97	8.39	7.58	0.99	42.41	14.17	35.80	53.82
Method of Sub plots												
S1		4.68	8.59	315	283	4.04	23.3	85	15.6	25.0	1.86	7.17
S2		5.20	9.05	312	295	4.33	24.3	86	12.8	11.5	1.88	3.05
S3		5.54	9.36	316	304	4.45	23.3	85	11.3	9.3	1.73	2.46
S4		-	-	-	-	-	-	-	-	-	-	-
CD (0.05)		0.51	NS	NS	NS	NS	NS	NS	2.80	4.95	NS	0.85
C.V. (%)		9.06	9.48	10.45	9.45	7.36	8.75	0.81	19.45	29.81	31.81	18.53
Experimental Mean		5.14	9.00	314	294	4.27	23.7	85	13.2	15.3	1.83	4.23
Soil type		Red Sandy loam										
pH		6.84										
Variety		KMP 175										
Available NPK kg/ha		334:110:265										

S1: Broadcasting of seeds
S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)
S3: Mechanized line sowing of seeds (Dribbler, Happy seeder of any Drum Seeder: Spacing as per the equipment specifications)
S4:Any improved system in that particular location

Table-4.2.2: Contd….

Treatment		NAGINA										NAWAGAM								
Main Plot	Sub-plots	Grain yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at AT (no/m2)	Weed population PI (no/m²)	Weed dry weight at AT (g/m2)	Weed dry weight at PI (g/m²)	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at AT (no/m2)	Weed dry weight at AT (g/m2)
M1- Normal sowing time	S1	3.99	300	293	2.78	25.9	82	9.4	4.8	5.68	4.20	4.39	4.83	242	215	2.39	17.9	70	43.8	17.6
	S2	4.44	320	316	2.81	26.0	85	8.5	4.6	5.29	3.43	4.55	5.01	193	167	3.80	17.1	71	34.5	12.9
	S3	4.69	333	328	2.83	26.2	92	5.6	3.5	3.76	2.34	6.22	6.85	212	183	4.54	19.1	72	28.3	10.8
	S4	-	-	-	-	-	-	-	-	-	-	4.86	5.34	219	189	2.59	18.7	73	40.0	15.5
M2- Delayed sowing by 30 days	S1	3.91	292	282	2.78	25.8	86	8.8	5.4	6.45	4.62	2.54	2.56	179	148	2.34	17.0	61	60.3	23.6
	S2	4.35	315	307	2.81	26.0	86	7.9	4.8	5.57	3.74	3.33	3.36	151	131	2.18	16.4	62	36.8	16.2
	S3	4.48	326	317	2.84	26.2	94	5.7	3.8	4.36	2.76	2.95	2.98	191	160	2.29	16.9	62	38.8	15.9
	S4	-	-	-	-	-	-	-	-	-	-	3.89	3.93	188	151	2.59	16.9	62	35.8	14.1
Interaction																				
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.66	0.64	NS	14.30	0.43	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.75	0.70	NS	20.24	0.49	NS	NS	NS	NS
Mean of Main plot																				
M1		4.37	317	312	2.81	26.0	86	7.8	4.3	4.91	3.32	5.01	5.51	216	188	3.33	18.2	72	36.6	14.2
M2		4.25	311	302	2.81	26.0	88	7.5	4.7	5.46	3.71	3.18	3.21	177	148	2.35	16.8	62	42.9	17.5
C.D. (0.05)		NS	NS	NS	NS	NS	1.40	NS	0.14	NS	NS	0.61	0.54	19.60	20.87	0.39	1.39	0.88	1.09	0.72
C.V. (%)		2.82	2.14	3.27	0.30	0.28	1.24	13.48	2.46	11.22	11.16	13.24	11.00	8.86	11.04	12.19	7.05	1.18	2.43	4.04
Method of Sub plots																				
S1		3.95	296	287	2.78	25.8	84	9.1	5.1	6.07	4.41	3.46	3.70	211	181	2.36	17.5	66	52.0	20.6
S2		4.39	317	311	2.81	26.0	85	8.2	4.7	5.43	3.58	3.94	4.18	172	149	2.99	16.7	67	35.6	14.5
S3		4.59	330	322	2.83	26.2	93	5.7	3.7	4.06	2.55	4.59	4.91	201	172	3.42	18.0	67	33.5	13.4
S4		-	-	-	-	-	-	-	-	-	-	4.38	4.64	203	170	2.59	17.8	67	37.9	14.8
CD (0.05)		0.09	7.67	8.75	0.01	0.07	1.82	0.73	0.85	0.98	0.62	0.47	0.45	13.13	10.11	0.31	NS	1.31	8.27	3.72
C.V. (%)		2.02	2.24	2.62	0.37	0.23	1.91	8.75	17.34	17.42	16.13	10.89	9.82	6.36	5.73	10.26	6.92	1.87	19.80	22.34
Experimental Mean		4.31	314	307	2.81	26.0	87	7.6	4.5	5.19	3.51	4.09	4.36	197	168	2.84	17.5	67	39.8	15.8
Soil type		-										-								
pH		7.70										7.56								
Variety		Pusa Basmati 1509										Mahisagar 100-110 Days								
Available NPK		21:18:209										-								

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

*S4- Sprouted seed on unpuddle

Table-4.2.2: Contd….

Treatment		PANTNAGAR									
Main Plot	**Sub-plots**	**Grain yield (t/ha)**	**Straw yield (t/ha)**	**Tillers/m^2 (No.)**	**Panicle/m^2 (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Weed population at active tillering (no/m2)**	**Weed population panicle initiation (no/m^2)**	**Weed dry weight at active tillering (g/m2)**	**Weed dry weight at panicle initiation (g/m^2)**
M1- Normal sowing time	S1	4.17	4.77	281	323	1.56	23.7	143	131	53.0	53.0
	S2	4.98	5.32	173	335	1.78	23.7	157	137	47.7	47.7
	S3	5.03	5.30	187	340	1.80	26.4	132	124	48.0	48.0
	S4	-	-	-	-	-	-	-	-	-	-
M2- Delayed sowing by 30 days	S1	3.58	4.26	245	308	1.37	22.8	148	124	42.0	42.0
	S2	4.43	4.93	158	295	1.83	20.9	139	119	42.2	42.2
	S3	4.45	4.89	171	303	1.72	23.9	137	143	51.8	51.8
	S4	-	-	-	-	-	-	-	-	-	-
Interaction											
I and M		NS	NS	NS	NS	NS	0.77	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	0.79	NS	NS	NS	NS
Mean of Main plot											
M1		4.73	5.13	214	333	1.71	24.6	144	131	49.6	49.6
M2		4.15	4.69	192	302	1.64	22.5	141	128	45.3	45.3
C.D. (0.05)		0.06	0.22	19.72	NS	NS	0.61	NS	NS	NS	NS
C.V. (%)		0.64	2.22	4.80	6.07	2.97	1.28	6.06	23.96	21.80	21.80
Method of Sub plots											
S1		3.87	4.51	263	315	1.46	23.2	145	127	47.5	47.5
S2		4.70	5.13	165	315	1.80	22.3	148	128	45.0	45.0
S3		4.74	5.10	179	321	1.76	25.1	135	133	49.9	49.9
S4											
CD (0.05)		0.17	0.19	13.31	NS	0.18	0.54	NS	NS	NS	NS
C.V. (%)		2.79	2.93	4.94	4.96	7.91	1.74	18.04	11.71	17.24	17.24
Experimental Mean		4.44	4.91	203	317	1.67	23.6	143	130	47.5	47.5
Soil type		Silt loam									
pH		7.80									
Variety		HKR-47									
Available NPK kg/ha		239:21:219									

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

Table-4.2.2: Contd….

Treatment		RAGOLU										TULJAPUR						
Main Plot	Sub-plots	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Weed population at active tillering (no/m2)	Weed population panicle initiation (no/m^2)	Weed dry weight at AT (g/m2)	Weed dry weight at PI (g/m^2)	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
M1- Normal sowing time	S1	4.77	6.29	162	151	2.97	22.8	67.0	53.0	83.60	28.30	0.94	3.36	469	299	1.94	24.88	87
	S2	4.92	7.05	261	252	3.17	23.7	25.3	38.3	59.25	15.40	1.63	3.17	613	334	2.09	26.48	85
	S3	5.53	7.12	268	260	3.28	23.8	19.5	20.0	72.05	16.60	1.75	3.76	625	359	2.28	26.40	83
	S4	5.23	7.35	270	262	3.22	24.0	26.5	20.3	23.67	8.80	1.39	3.92	533	300	1.94	24.92	85
M2- Delayed sowing by 30 days	S1	4.70	8.48	185	180	3.98	22.6	119.5	44.3	138.60	48.04	0.53	2.90	359	196	1.73	24.90	84
	S2	6.14	8.18	276	273	4.20	22.8	117.8	41.3	113.54	36.38	1.14	2.89	390	286	2.01	26.20	84
	S3	5.76	9.47	287	283	4.07	23.0	62.5	31.8	67.58	23.06	1.31	3.60	497	315	2.17	26.10	82
	S4	6.44	9.85	308	281	4.06	21.8	50.0	20.5	55.90	18.50	1.19	3.66	397	291	1.80	24.60	83
Interaction																		
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	30.78	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	37.60	NS	NS	NS
Mean of Main plot																		
M1		5.11	6.95	240	231	3.16	23.6	34.6	32.9	59.64	17.28	1.43	3.55	560	323	2.06	25.67	85
M2		5.76	9.00	264	254	4.08	22.6	87.4	34.4	93.90	31.49	1.04	3.26	411	272	1.93	25.45	83
C.D. (0.05)		0.45	1.37	NS	NS	0.21	NS	52.60	NS	NS	NS	0.16	0.06	26.51	33.91	NS	NS	1.26
C.V. (%)		7.29	15.24	26.93	22.32	5.25	7.73	76.65	111.04	57.04	78.63	11.73	1.47	4.86	10.14	10.15	1.15	1.33
Method of Sub plots																		
S1		4.73	7.39	173	166	3.48	22.7	93.3	48.6	111.10	38.17	0.74	3.13	414	248	1.83	24.89	86
S2		5.53	7.61	268	263	3.69	23.2	71.5	39.8	86.39	25.89	1.38	3.03	502	310	2.05	26.34	84
S3		5.64	8.30	278	272	3.68	23.4	41.0	25.9	69.81	19.83	1.53	3.68	561	337	2.22	26.25	83
S4		5.83	8.60	289	271	3.64	22.9	38.3	20.4	39.79	13.65	1.29	3.79	465	296	1.87	24.76	84
CD (0.05)		0.54	NS	44.73	45.96	NS	NS	35.92	18.59	41.10	NS	0.17	0.35	62.69	21.76	0.20	0.31	0.99
C.V. (%)		9.41	11.79	16.90	18.02	11.89	4.53	56.03	52.54	50.93	74.28	13.16	9.90	12.29	6.96	9.38	1.14	1.12
Experimental Mean		5.44	7.97	252	243	3.62	23.1	61.0	33.7	76.77	24.38	1.24	3.41	485	297	1.99	25.56	84
Soil type		Red Sandy Clay Loam										-						
pH		7.80										7.60						
Variety		VASUNDHARA 135Days										TJP-48 110Days						
Available NPK kg/ha		227:39:285										-						

S1: Broadcasting of seeds *S4 - Semi dry rice 20 x 15 cm

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

Table-4.2.2: Contd….

Treatment		RANCHI					Over all Mean	Rank	Cost of Cultivation (Rs./ha)					Total Water Input mm/ha
Main Plot	Sub-plots	Grain yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Weed dry weight at active tillering (g/m2)			GANGAVATHI	MANDYA	NAGINA	NAWAGAM	RAGOLU	RAGOLU
M1- Normal sowing time	S1	4.02	236	2.96	24.17	36.25	3.91	5	61405	55289	22720	38785	25120	2500
	S2	4.32	251	3.20	24.22	25.23	4.32	3	62155	58082	24615	39670	32100	2500
	S3	3.96	228	2.94	24.12	42.23	4.47	1	62655	57256	28372	38642	28620	2500
	S4	4.78	276	3.27	24.34	10.16	4.41	2	66405			38958	27120	3000
M2- Delayed sowing by 30 days	S1	3.52	214	2.93	23.97	42.36	3.26	8	61405	54299	22720	38785	25367	2000
	S2	3.75	224	2.99	24.19	30.23	3.79	6	62155	56849	24615	39679	32350	2000
	S3	3.36	208	2.92	23.90	50.48	3.76	7	62655	55733	28372	38643	28870	2000
	S4	4.38	253	3.22	25.38	11.50	4.17	4	66405			38954	27370	2500
Interaction														
I and M		NS	NS	NS	NS	NS			-	-	-	-	-	-
M and I		NS	NS	NS	NS	NS			-	-	-	-	-	-
Mean of Main plot														
M1		4.27	248	3.09	24.21	28.47	4.29	1	63155	56876	25236	39014	28240	2625
M2		3.75	225	3.02	24.36	33.64	3.68	2	63155	55627	25236	39015	28489	2125
C.D. (0.05)		0.34	NS	NS	NS	1.94			-	-	-	-	-	-
C.V. (%)		7.54	15.19	2.28	3.75	5.56			-	-	-	-	-	-
Method of Sub plots														
S1		3.77	225	2.95	24.07	39.31	3.58	4	61405	54794	22720	38785	25244	2250
S2		4.04	238	3.09	24.20	27.73	4.06	3	62155	57465	24615	39674	32225	2250
S3		3.66	218	2.93	24.01	46.35	4.11	2	62655	56495	28372	38643	28745	2250
S4		4.58	265	3.25	24.86	10.83	4.29	1	66405	-	-	38956	27245	2750
CD (0.05)		0.42	21.53	0.16	NS	3.52			-	-	-	-	-	-
C.V. (%)		9.98	8.67	4.98	3.73	10.78			-	-	-	-	-	-
Experimental Mean		4.01	236	3.05	24.29	31.06	3.99		63155	56251.307	25235.667	39014.375	28364.625	2375
Soil type		Red Sandy Clay Loam												
pH		7.80												
Variety		VASUNDHARA 135Days												
Available NPK kg/ha		227:39:285												

*S4- Rice + Sesbania was broadcasted (Sesbania was broadcasted at the rate of 40 kg/ha and then rice was sown in lines 20 cm apart.At 25th DAS sesbania was uprooted and placed in between rice rows.

Table-4.2.2: Contd….

Treatment		LUDHIANA									PUSA		
Main Plot	Sub-plots	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at active tillering (no/m^2)	Weed dry weight at active tillering (g/m2)	Grain yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)
M1- Normal sowing time	S1	7.30	9.76	526.0	508.5	2.91	21.42	76.3	20.13	12.94	3.18	287	2.92
	S2	7.26	9.65	461.1	450.4	3.34	21.27	79.7	5.77	4.75	3.69	298	2.90
	S3	7.39	9.56	471.9	460.9	3.36	21.30	80.3	5.33	4.89	3.75	301	2.89
	S4	-	-	-	-	-	-	-	-	-	3.58	295	2.90
Exp. mean		7.32	9.66	486.3	473.3	3.20	21.33	78.8	10.41	7.53	3.55	295	2.90
CD(0.05)		0.28	0.18	33.81	24.86	0.14	0.15	0.48	2.82	1.64	0.31	23.33	0.23
CV		2.64	1.30	4.79	3.62	2.93	0.49	0.42	18.71	15.06	6.29	5.73	5.87
res(t)		NS	NS	NS	*	**	NS	**	**	**	**	NS	NS
Soil type		Silty loam									Silty loam		
pH		7.80									7.80		
Variety		-									Abhishek		
Available NPK kg/ha		210:19:247									-		

S1: Broadcasting of seeds

*S4 - Broad casting of seed (20% higher than S1)

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

Table-4.2.2: (Rabi)YET-2Evaluation of nutrient and weed management for higher productivity in different rice establishment methods, Rabi-2018-19

Method of crop establishment	Sub plot (Nitrogen splits)	Sub sub plot	MANDYA					
			Grain Yield (t/ha) Kharif 2018	Grain Yield (t/ha) Rabi 18-19	Germination%	Plant population/m2	REY	(K+R)REY
M2 - DS fb SRI	S1	F0- Without fertilizer	5.88	1.26	95.00	19.67	5.40	11.28
		F1- 100% of RDF		1.14	91.67	19.67	4.91	4.91
	S2	F0- Without fertilizer	5.64	1.26	93.33	20.74	5.43	11.07
		F1- 100% of RDF		1.43	96.67	20.74	6.15	6.15
	S3	F0- Without fertilizer	6.5	1.20	98.33	20.37	5.13	11.63
		F1- 100% of RDF		1.37	90.00	20.00	5.87	5.87
	S4	F0- Without fertilizer	5.66	1.45	93.33	19.26	6.24	11.90
		F1- 100% of RDF		1.45	91.67	19.63	6.21	6.21
	S5	F0- Without fertilizer	5.39	1.44	93.33	20.37	6.17	11.56
		F1- 100% of RDF		1.62	96.67	20.00	6.97	6.97
M3 - Normal Transplanting	S1	F0- Without fertilizer	6.34	1.19	95.00	20.37	5.11	11.45
		F1- 100% of RDF		1.11	91.67	18.89	4.79	4.79
	S2	F0- Without fertilizer	5.85	1.01	83.33	18.89	4.31	10.16
		F1- 100% of RDF		0.99	93.33	20.74	4.25	4.25
	S3	F0- Without fertilizer	6.75	1.15	90.00	20.00	4.93	11.68
		F1- 100% of RDF		1.07	91.67	20.00	4.60	4.60
	S4	F0- Without fertilizer	6.02	1.14	100.00	20.74	4.88	10.90
		F1- 100% of RDF		0.97	95.00	19.26	4.17	4.17
	S5	F0- Without fertilizer	6.25	1.12	96.67	20.74	4.80	11.05
		F1- 100% of RDF		1.08	91.67	19.63	4.64	4.64
M6- Semi dry rice	S1	F0- Without fertilizer	5.68	1.46	91.67	20.74	6.26	11.94
		F1- 100% of RDF		1.21	88.33	20.00	5.21	5.21
	S2	F0- Without fertilizer	4.89	1.29	85.00	20.00	5.55	10.44
		F1- 100% of RDF		1.26	83.33	17.04	5.40	5.40
	S3	F0- Without fertilizer	6.81	1.42	100.00	20.74	6.10	12.91
		F1- 100% of RDF		1.22	96.67	21.48	5.26	5.26
	S4	F0- Without fertilizer	5.61	1.20	90.00	20.00	5.15	10.76
		F1- 100% of RDF		1.22	85.00	18.89	5.26	5.26
	S5	F0- Without fertilizer	4.61	1.47	90.00	18.89	6.31	10.92
		F1- 100% of RDF		0.92	98.33	20.74	3.97	3.97
	Mean of M levels:							
	M1		5.81	1.36	94.00	20.04	5.85	11.66
	M2		6.24	1.08	92.83	19.92	4.65	10.89
	M3		5.52	1.27	90.83	19.85	5.45	10.97
	C.D.(0.05)		0.11	NS	NS	NS		
	SE(m)		3.54	0.13	2.117	0.258		

Table-4.2.2: (Rabi)YET-2Cntd….

Method of crop establishment	Sub plot (Nitrogen splits)	Sub sub plot	MANDYA					
			Grain Yield (t/ha) Kharif 2018	Grain Yield (t/ha) Rabi 18-19	Germination %	Plant population/m 2	REY	(K+R)REY
	Mean of Sub Plots:							
	S1		5.97	1.23	92.22	19.89	5.28	11.25
	S2		5.46	1.21	89.17	19.69	5.18	10.64
	S3		6.69	1.24	94.44	20.43	5.31	12.00
	S4		5.76	1.24	92.50	19.63	5.32	11.08
	S5		5.42	1.28	94.44	20.06	5.48	10.89
	C.D.(0.05)		0.21	NS	NS	NS		
	SE(m)		4.47	0.07	1.362	0.287		
	Mean of Sub-sub Plots:							
	F0 Without fertilizer			1.27	93.00	20.10	5.45	5.45
	F1 100% RDF			1.21	92.11	19.78	5.18	5.18
	C.D.(0.05)			N/A	N/A	N/A		
	SE(m)			0.04	0.868	0.164		
	Interactions							
				NS	NS	1.836		
	Expt. Mean		**5.86**	**1.24**	**92.56**	**19.94**	**5.31**	**11.17**
	Soil type		Red sandy loam	Red sandy loam				
	pH		6.97	7.2				
	Variety		MTU 1001	Cowpea-KBC-9				
	Location specific RDF NPK (kg/ha)			25:50:25				
	Availabe NPK of soil (kg/ha)		226:98:276	28.5:72.5:132				

Rice-Cowpea MSP for Chickpea Rs.7511/Q

M1 - Mechanical Transplanting
M2 - DS fb SRI
M3 - Normal Transplanting
M4 - SRI
M5 - Aerobic rice
M6 - Semi dry rice

S1:100% recommended inorganic fertilizers (120:60:40 kg NPK/ha)
S2:75% inorganic + 25% (equivalent of N dose) organic
S3:150% recommended fertilizer dose
S4:LCC based N application
S5:Location specific fertiliser management

Table-4.2.2: (Rabi)YET-2Contd….

Treatment		**PUDUCHERRY**									
Methods of crop establishment	**Method of Nutrient**	**Grain yield (t/ha) Kharif-2018**	**Grain yield (t/ha) Ra bi 2018-19**	**REY**	**Straw yield (t/ha)**	**Panicle/ m^2 (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Weed population at active tillering (no/m2)**	**Weed dry weight at active tillering (g\/m2)**	**Cost of cultivation (Rs/ha)**
M1 - Mechanical Transplanting	**S1**	6.15	6.69	12.84	10.95	356	3.87	14.77	46.70(6.87)	43.07	44025
	S2	6.41	6.89	13.30	11.29	371	3.99	14.88	44.40(6.70)	39.30	45569
	S3	6.55	7.05	13.60	11.54	379	4.14	15.02	42.04(6.52)	35.12	46402
	S4	6.74	7.20	13.94	11.78	386	4.26	15.18	38.60(6.25)	28.00	43300
	S5	5.99	6.62	12.61	10.85	356	3.82	14.30	49.31(7.05)	45.75	51153
M2 - DS fb SRI	**S1**	5.61	6.57	12.18	10.76	341	3.64	14.07	52.35(7.27)	50.43	42151
	S2	5.73	6.61	12.34	10.82	340	3.69	14.29	48.77(7.02)	47.27	43695
	S3	6.15	6.78	12.93	11.09	358	4.01	14.48	46.31(6.84)	46.92	44528
	S4	6.4	6.97	13.37	11.57	364	4.19	14.98	44.68(6.72)	43.86	41676
	S5	5.33	6.37	11.70	10.43	332	3.56	13.86	56.24(7.53)	54.72	48778
M3 - Normal Transplanting	**S1**	5.75	6.64	12.39	10.87	347	3.86	14.80	48.36(6.99)	45.15	46276
	S2	6.18	6.74	12.92	11.06	353	3.97	14.91	45.15(6.75)	40.17	47820
	S3	6.38	6.94	13.32	11.50	378	4.16	14.64	43.53(6.63)	39.01	48653
	S4	6.58	7.05	13.63	11.55	373	4.19	14.98	40.43(6.40)	33.33	45301
	S5	5.54	6.44	11.98	10.54	342	3.78	14.72	50.80(7.16)	48.48	52153
Interaction											
M and S		NS	NS		NS	NS	NS	NS	NS	2.04	
S and M		NS	NS		NS	NS	NS	NS	NS	1.88	
Mean of Methods											
M1		6.37	6.89	13.26	11.28	370	4.02	14.83	44.21(6.68)	38.25	46090
M2		5.84	6.66	12.50	10.93	347	3.82	14.34	49.67(7.07)	48.64	44166
M3		6.09	6.76	12.85	11.10	359	3.99	14.81	45.66(6.79)	41.23	48041
C.D. (0.05)		0.09	0.07		NS	4.34	0.05	0.24	0.05	0.77	
C.V. (%)		2.25	1.71		3.35	1.87	2.03	2.54	1.18	2.78	
Method of Nutrition											
S1		5.84	6.63	12.47	10.86	348	3.79	14.54	49.14(7.04)	46.22	44151
S2		6.11	6.75	12.86	11.06	355	3.88	14.69	46.11(6.82)	42.24	45695
S3		6.36	6.92	13.28	11.38	372	4.10	14.71	43.96(6.66)	40.35	46528
S4		6.57	7.07	13.64	11.63	375	4.22	15.04	41.24(6.46)	35.06	43426
S5		5.62	6.48	12.10	10.61	343	3.72	14.29	52.12(7.25)	49.65	50695
CD (0.05)		0.15	0.10		0.23	6.91	0.09	0.39	0.08	1.18	
C.V. (%)		2.55	1.59		2.09	1.98	2.33	2.75	1.23	2.83	
Experimental Mean		**6.1**	6.77	12.87	11.11	358	3.94	14.66	6.85	42.70	46099
Soil type		Clay loam	Clay loam								
pH		6.62	7.95								
EC		0.26	0.08								
Variety & Duration		CO-52	ADT-53								
Available NPK kg/ha		324.8:36.35:200	157:30:102								

Rice - Rice

S1: 100% RDF inorganic(120:60:40)

S2: 75% inorganic + 25% organic(equivalent of N dose)

S3: 150 % RDF

S4:LCC based N application

S5: Location specific fertilizer management

4.2.3. Developing suitable package of practices for wet DSR

Direct wet seeding offers the advantage of faster and easier planting, reduced labour and less drudgery, 7-10 days earlier crop maturity, more efficient water use and higher tolerance to water deficit, less methane emission, and often higher profit in areas with assured water supply. This method of seeding in the past has received relatively less attention than transplanting. Sowing of sprouted rice seed or wet-seeded rice in puddled soil though becoming increasingly important as a method of crop establishment under lowland rice is beset with weed problems, particularly grassy weeds besides other management practices. Weeds emerge at about the same time that the rice seeds germinate, and therefore the yield losses caused by weeds will become greater with the trend towards wet seeding. Effective weed control is one of the key issue and major requirements to ensure a successful wet-seeded rice crop. Furthermore, varieties must be improved for early seeding vigour, weed competitiveness, submergence tolerance to survive untimely rainfall during stand establishment and drought tolerance to survive dry conditions during germination and later growth stages, and for lodging resistance at maturity. Hence the present trial is constituted to enhance the productivity of the wet DSR with the following objectives 1) To identify suitable and cost effective agronomic management practices to enhance the productivity of wet DSR 2) To maximize the resource use efficiency. The trial was conducted at 16 locations (**Aduthurai, Chatha, Chiplima, Coimbatore, Karjat, Kota, Mandya, Navsari, Nawagam, Puducherry, Rajendranagar, Ranchi, Rewa, Titabar, Warangal and Pusa**). Split plot design was adopted with 2 main plots of sowing time (M_1: Normal sowing time andM_2: Delayed sowing by 30 days). Four subplots consist of S_1: Broadcasting of seeds; S_2: Manual line sowing of seed (20-25 cm row spacing sown in solid row); S_3: Mechanized line sowing of seeds (Dribbler, Happy Seeder or any Drum Seeder), S_4: Any improved system in that particular location and S_5: Normal Transplanting. The results were summarized and presented in **Table 4.2.3** and the salient findings are as followed.

At one location (**Pusa**) only one treatment (normal sowing time) was taken up out of 2 main plots treatment. So results were presented separately. Further, interaction effect between sowing time and crop establishment methods were found to be non-significant at **Aduthurai, Chiplima, Coimbatore, Kota, Mandya, Navsari, Rajendranagar, Ranchi, Rewa, Titabar** and **Warangal.**

All locations recorded higher grain yield when rice crop was sown in normal sowing time except Aduthurai, where 30 days late sown crop resulted higher grain yield.Normal sowing time resulted higher grain yield in sandy clay loam soils of **Chatha**(2.86 t/ha),**Chiplima** (4.34 t/ha), clay loam soils of **Coimbatore** (5.44 t/ha), **Karjat**(6.36 t/ha), clay loam soil of **Kota** (6.1 t/ha), red sandy loam soils of **Mandya** (6.22 t/ha), clay soils of **Navsari** (5.31 t/ha), Clay loam soils of **Nawagam** (4.85 t/ha), clay loam soils of **Puducherry**(6.1 t/ha), clay loam soils of **Ranchi** (4.82 t/ha), **Rewa** (4.62 t/ha), **Titabar** (3.16 t/ha) and clay loam soils of **Warangal** (6.47 t/ha). Delay in sowing time by 30 days reduced grain yield by 16% across the locations.

Among crop establishment methods transplanting method resulted in the highest grain yield at Chiplima (4.78 t/ha), Coimbatore (6.13 t/ha), Puducherry (6.26 t/ha), Ranchi (5.01 t/ha), Titabar (3.98 t/ha), Warangal (6.27 t/ha)and Pusa (4.32 t/ha).

At **Aduthurai**, delayed sowing by 30 days resulted higher grain yield (5.45 t/ha) than normal sowing time (4.92 t/ha). Among all establishment methods, local practices gave the highest grain yield (7.38 t/ha). Higher weed population and dry weight were recorded under manual line sowing treatment at active tillering stage. At **Chatha**, local establishment system at normal sowing time found to be best combination giving the highest grain yield of 3.5 t/ha than other combinations. Among establishment methods, mechanized line sowing resulted in higher weed population at active tillering and panicle initiation stages. At **Chiplima**, Normal sowing resulted higher grain yield (4.34 t/ha) than late sowing (3.86 t/ha). Among establishment methods, apart from transplanting, mechanized line sowing resulted higher grain yield (4.27 t/ha). At **Coimbatore**, among crop establishment methods, apart from transplanting, local system (Paddy + Dhaincha drum seeder) showed encouraging result (5.39 t/ha). Broadcasting of seeds resulted more weed population at active tillering and panicle initiation stage. At **Karjat**, local establishment method followed at normal sowing time resulted the highest grain yield (7.22 t/ha). Local package and practices was not provided. Among establishment methods, broadcasting of seeds resulted more weed population at active tillering and panicle initiation stage. At **Kota**, among establishment methods, locally followed method resulted the highest yield (6.27 t/ha). At **Mandya**, mechanized line sowing produced the highest grain yield (6.06 t/ha). Similarly, among establishment methods, broadcasting of seeds resulted more weed population and dry matter at active tillering and panicle initiation stage. At **Navsari**, among establishment methods, local package and practices provided the higher grain yield (5.51 t/ha). However, details of local packages and practices not provided. Similarly, among establishment methods, broadcasting of seeds resulted more weed dry matter at active tillering and panicle initiation stage. At **Nawagam**, locally practiced establishment method at normal sowing time resulted the highest grain yield (5.66 t/ha). Similarly, among establishment methods, broadcasting of seeds resulted more weed population and dry matter at active tillering and panicle initiation stage. At **Puducherry**, among crop establishment methods apart from transplanting (6.26 t/ha), mechanized line sowing resulted higher grain yield (6.14 t/ha). At **Rajendranagar**, mechanized line sowing resulted in the higher grain yield (7.05 t/ha) than transplanting (5.41 t/ha). At **Ranchi**, among crop establishment methods apart from transplanting (5.01 t/ha), mechanized line sowing resulted higher grain yield (4.93 t/ha). However, at **Rewa**, locally practiced establishment method gave the highest grain yield (5.21 t/ha). Details of package and practices was not provided. At Titabar, mechanized line sowing (3.11 t/ha) was encouraging though manual transplanting recorded the highest yield (3.98 t/ha). At **Warangal** apart from transplanting (6.27 t/ha) locally practiced establishment method resulted in the highest grain yield (5.59 t/ha).

The experimental mean of cost of cultivation at Coimbatore (Rs. 38039/-), Mandya (Rs. 55909/-), Navsari (Rs. 35415/-), Nawagam (Rs. 39986/-) and Puducherry (Rs. 44163/-) and Rewa (Rs. 23720/-).

In silty loam soils of **Pusa** apart from manual transplanting (4.32 t/ha) locally practiced **random transplanting** resulted in higher yield (4.17 t/ha) than other treatments.

Multi-locational trials revealed that locally practiced establishment methods sown at normal time were found to be superior in resulting higher grain yield.

Table-4.2.3: (CMT-3)(Wet DSR) - Developing suitable package of practices for Wet DSR, Kharif-2019

Treatment		ADUTHURAI									
Main Plot	Sub-plot	Grain yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	No of grains/panicles	Weed population at AT stage (no/m^2)	Weed population at PI stage (no/m^2)	Weed dry weight at active tillering (g/m2)	Weed dry weight at panicle initiation (g/m^2)
M1- Normal sowing time	S1	3.33	318	302	2.32	17.4	150	45.50(6.77)	22.75(4.82)	4.80	3.65
	S2	4.07	310	290	2.36	17.4	161	49.00(7.01)	28.50(5.38)	4.93	3.60
	S3	6.24	345	328	2.51	17.8	166	51.75(7.22)	16.25(4.03)	5.15	3.27
	S4	6.82	387	376	2.70	18.2	188	32.25(5.71)	13.75(3.76)	4.62	3.01
	S5	4.12	334	321	2.42	17.4	164	34.25(5.89)	16.00(4.05)	4.56	2.52
M2- Delayed sowing by 30 days	S1	4.21	352	337	2.45	17.7	176	53.00(7.27)	15.75(3.99)	4.63	3.99
	S2	4.31	346	333	2.43	17.4	163	59.00(7.69)	17.25(4.21)	4.81	4.10
	S3	6.69	352	334	2.52	18.0	184	48.00(6.95)	14.00(3.79)	5.13	3.61
	S4	7.94	420	405	2.80	18.4	214	47.75(6.94)	15.00(3.92)	4.54	3.53
	S5	4.08	336	319	2.42	17.5	154	36.00(6.03)	15.00(3.90)	4.56	3.56
Interaction											
I and M		NS	NS	16.09	0.04	NS	5.89	NS	NS	NS	0.27
M and I		NS	NS	18.04	0.04	NS	6.03	NS	NS	NS	0.30
Mean of Main plot											
M1		4.92	339	323	2.46	17.6	166	42.55(6.52)	19.45(4.41)	4.81	3.21
M2		5.45	361	346	2.53	17.8	178	48.75(6.98)	15.40(3.96)	4.73	3.76
C.D. (0.05)		0.19	16.90	13.67	0.02	0.14	3.64	0.33	0.12	NS	0.23
C.V. (%)		3.57	4.80	4.06	0.66	0.81	2.11	4.88	2.93	3.33	6.58
Method of Sub plots											
S1		3.77	335	320	2.39	17.5	163	49.25(7.02)	19.25(4.41)	4.71	3.82
S2		4.19	328	311	2.40	17.4	162	54.00(7.35)	22.88(4.79)	4.87	3.85
S3		6.47	348	331	2.52	17.9	175	49.88(7.09)	15.13(3.91)	5.14	3.44
S4		7.38	404	390	2.75	18.3	201	40.00(6.33)	14.38(3.84)	4.58	3.27
S5		4.10	335	320	2.42	17.4	159	35.13(5.96)	15.50(3.97)	4.56	3.04
CD (0.05)		0.39	12.42	11.38	0.03	0.20	4.17	0.50	0.48	0.21	0.19
C.V. (%)		7.27	3.44	3.30	1.13	1.07	2.35	7.17	11.12	4.36	5.34
Experimental Mean		5.18	350	334	2.49	17.7	172	6.75	4.18	4.77	3.48
Soil type		-									
pH		-									
Variety		-									
Available NPK kg/ha		-									

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		CHATHA									CHIPLIMA					
Main Plot	Sub-plot	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at AT (no/m^2)	Weed population PI (no/m^2)	Grain yield (t/ha)	Straw yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering
M1- Normal sowing time	S1	2.48	3.45	171	145	1.30	19.4	106	1.67(1.46)	44.33(6.69)	3.71	4.81	166	4.68	25.5	79
	S2	2.63	3.68	198	170	1.39	19.7	101	2.33(1.68)	39.67(6.33)	4.30	5.22	193	5.85	23.8	79
	S3	2.79	3.90	195	167	1.63	19.7	100	2.33(1.68)	47.00(6.89)	4.51	5.26	210	6.40	26.5	80
	S4	3.50	5.07	279	257	2.20	20.5	105	0.33(0.88)	13.67(3.76)	4.17	5.40	184	5.50	27.5	83
	S5	2.90	4.20	247	215	1.82	20.0	110	0.00(0.71)	13.33(3.72)	5.00	5.88	209	7.25	26.3	84
M2- Delayed sowing by 30 days	S1	2.09	2.88	156	121	1.13	18.3	103	1.33(1.34)	45.67(6.79)	3.18	4.24	151	4.72	24.3	76
	S2	2.43	3.42	161	135	1.20	19.1	100	2.00(1.58)	40.00(6.36)	3.76	4.64	174	5.20	23.0	76
	S3	2.53	3.54	172	145	1.35	19.4	101	2.67(1.77)	50.67(7.15)	4.03	4.79	174	6.65	25.8	78
	S4	3.28	4.75	262	240	2.02	19.7	106	0.33(0.88)	14.00(3.81)	3.78	4.87	179	5.10	26.0	81
	S5	2.40	3.47	233	202	1.73	19.6	110	0.33(0.88)	14.67(3.89)	4.57	5.70	186	6.35	26.3	81
Interaction																
I and M		0.09	0.14	NS	NS	NS	0.23	NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		0.12	0.17	NS	NS	NS	0.31	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot																
M1		2.86	4.06	218	191	1.67	19.9	104	1.33(1.28)	31.60(5.48)	4.34	5.31	193	5.94	25.9	81
M2		2.54	3.61	197	168	1.49	19.2	104	1.33(1.29)	33.00(5.60)	3.86	4.85	173	5.60	25.1	78
C.D. (0.05)		0.12	0.15	10.9	6.96	0.02	0.29	NS	NS	0.08	0.25	0.25	18.90	NS	NS	0.26
C.V. (%)		2.75	2.54	3.35	2.47	0.61	0.95	0.70	22.79	0.95	6.08	4.83	10.29	17.90	4.10	0.32
Method of Sub plots																
S1		2.28	3.17	163	133	1.22	18.8	104	1.50(1.40)	45.00(6.74)	3.45	4.53	158	4.70	24.9	77
S2		2.53	3.55	179	153	1.30	19.4	100	2.17(1.63)	39.83(6.35)	4.03	4.93	184	5.52	23.4	78
S3		2.66	3.72	183	156	1.49	19.6	100	2.50(1.73)	48.83(7.02)	4.27	5.02	192	6.52	26.1	79
S4		3.39	4.91	271	248	2.11	20.1	106	0.33(0.88)	13.83(3.78)	3.97	5.13	182	5.30	26.8	82
S5		2.65	3.84	240	209	1.77	19.8	110	0.17(0.79)	14.00(3.81)	4.78	5.79	198	6.80	26.3	82
CD (0.05)		0.06	0.10	9.38	9.69	0.05	0.16	1.07	0.22	0.17	0.33	0.36	25.92	0.68	1.60	NS
C.V. (%)		1.85	2.14	3.70	4.41	2.46	0.68	0.84	14.14	2.51	7.79	6.82	13.75	11.43	6.08	5.39
Experimental Mean		2.70	3.84	207	180	1.58	19.5	104	1.29	5.54	4.10	5.08	183	5.77	25.5	80
Soil type		Sandy clay loam									-					
pH		8.03									-					
Variety		Basmathi - 370									MTU 1156					
Available NPK kg/ha		245:14.3:146.3									-					

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S5:Normal transplanting

Table-4.2.3: Contd….

Treatment		COIMBATORE									KOTA		
Main Plot	Sub-plot	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Weed population at AT (no/m^2)	Weed population PI (no/m^2)	Weed dry weight at AT (g/m2)	Grain yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)
M1- Normal sowing time	S1	4.64	6.07	348	286	2.34	16.25	32.28(5.72)	10.70(3.35)	5.32	5.72	276	4.12
	S2	5.22	6.8	370	326	2.43	16.2	26.78(5.22)	8.57(3.01)	4.65	6.05	294	4.27
	S3	5.45	6.88	379	333	2.3	16.3	22.00(4.74)	7.30(2.79)	4.17	6.16	308	4.36
	S4	5.57	7.16	384	335	2.49	16.42	12.92(3.66)	5.60(2.47)	3.73	6.46	325	4.6
	S5	6.31	7.36	436	375	2.71	16.25	9.88(3.22)	5.00(2.34)	2.32			
M2- Delayed sowing by 30 days	S1	4.05	5.55	318	275	2.11	16.18	35.90(6.03)	11.95(3.53)	5.6	5.2	255	3.3
	S2	5.04	6.25	363	325	2.96	16.18	28.17(5.35)	8.80(3.05)	4.9	5.56	278	3.51
	S3	5.13	6.5	368	324	2.49	16.27	22.93(4.84)	7.27(2.79)	4.27	5.66	290	3.6
	S4	5.21	6.76	370	327	2.28	16.23	13.88(3.79)	5.47(2.44)	3.57	6.07	309	3.83
	S5	5.95	7.09	408	340	2.53	16.15	8.95(3.07)	4.93(2.33)	2.38			
Interaction													
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot													
M1		5.44	6.85	383	331	2.45	16.28	20.77(4.51)	7.43(2.79)	4.04	6.1	301	4.34
M2		5.08	6.43	365	318	2.47	16.2	21.97(4.62)	7.68(2.83)	4.14	5.62	283	3.56
C.D. (0.05)		0.11	0.05	7.48	6.47	NS	NS	0.05	NS	NS	0.34	16.83	0.24
C.V. (%)		2.02	0.69	1.99	1.98	12.05	0.89	1.01	2.92	4.86	5.11	5.12	5.4
Method of Sub plots													
S1		4.35	5.81	333	280	2.22	16.21	34.09(5.88)	11.32(3.44)	5.46	5.46	265.5	3.71
S2		5.13	6.52	366	326	2.7	16.19	27.48(5.29)	8.69(3.03)	4.77	5.8	286	3.89
S3		5.29	6.69	373	328	2.4	16.29	22.46(4.79)	7.29(2.79)	4.22	5.91	299	3.98
S4		5.39	6.96	377	331	2.39	16.32	13.40(3.73)	5.54(2.46)	3.65	6.27	317	4.21
S5		6.13	7.23	422	357	2.62	16.2	9.41(3.14)	4.96(2.34)	2.35			
CD (0.05)		0.13	0.17	12.67	12.27	0.31	0.07	0.16	0.08	0.23	0.3	16.61	0.15
C.V. (%)		2.41	2.45	3.28	3.66	12.32	0.45	3.31	2.74	5.42	4.93	5.41	3.64
Experimental Mean		5.26	6.64	374	324	2.46	16.24	4.57	2.81	4.09	5.86	292	3.95
Soil type		Clay loam									Clay loam		
pH		8.05									7.80		
Variety		CO 51									PUSA SUGANDHA-5		
Available NPK kg/ha		216:28:466									318:60:523		

S1: Broadcasting of seeds *S4-Paddy + Daincha drum seeder

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		KARJAT										
Main Plot	Sub-plot	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at AT (no/m²)	Weed population PI (no/m²)	Weed dry weight at AT (g/m2)	Weed dry weight at PI (g/m²)
M1- Normal sowing time	S1	6.04	8.45	225	219	2.75	22.6	83	7.50(2.83)	5.50(2.45)	1.13	0.88
	S2	6.12	9.74	386	382	1.60	22.2	82	6.50(2.64)	4.50(2.23)	0.91	0.72
	S3	5.97	8.12	279	272	2.19	25.4	82	5.75(2.50)	4.25(2.18)	0.75	0.68
	S4	7.22	8.52	377	372	1.94	25.4	89	4.50(2.23)	3.75(2.05)	0.61	0.52
	S5	6.45	8.06	355	348	1.85	25.2	88	4.25(2.18)	2.50(1.73)	0.57	0.34
M2- Delayed sowing by 30 days	S1	3.33	4.98	159	158	1.95	21.5	85	6.75(2.69)	5.25(2.40)	1.01	0.84
	S2	3.37	5.73	274	271	1.14	21.1	84	6.50(2.64)	4.25(2.18)	0.91	0.68
	S3	3.28	4.79	198	193	1.55	24.2	84	6.25(2.60)	4.00(2.11)	0.81	0.64
	S4	3.97	5.04	268	264	1.38	24.1	90	4.75(2.29)	3.25(1.93)	0.64	0.45
	S5	3.55	4.75	251	247	1.31	24.0	89	4.50(2.23)	2.75(1.80)	0.61	0.38
Interaction												
I and M		0.21	NS	5.89	4.32	0.05	0.03	NS	NS	NS	NS	NS
M and I		0.26	NS	5.75	4.02	0.05	0.02	NS	NS	NS	NS	NS
Mean of Main plot												
M1		6.36	8.58	324	319	2.07	24.2	85	5.70(2.48)	4.10(2.13)	0.79	0.63
M2		3.50	5.06	230	227	1.47	23.0	86	5.75(2.49)	3.90(2.08)	0.80	0.60
C.D. (0.05)		0.23	0.32	2.86	1.33	0.01	0.01	0.55	NS	NS	NS	NS
C.V. (%)		4.70	4.62	1.02	0.49	0.57	0.04	0.64	3.91	3.00	8.28	6.21
Method of Sub plots												
S1		4.68	6.72	192	188	2.35	22.0	84	7.13(2.76)	5.38(2.42)	1.07	0.86
S2		4.74	7.73	330	327	1.37	21.6	83	6.50(2.64)	4.38(2.21)	0.91	0.70
S3		4.63	6.46	239	233	1.87	24.8	83	6.00(2.55)	4.13(2.15)	0.78	0.66
S4		5.60	6.78	323	318	1.66	24.7	90	4.63(2.26)	3.50(1.99)	0.63	0.49
S5		5.00	6.41	303	298	1.58	24.6	89	4.38(2.21)	2.63(1.76)	0.59	0.36
CD (0.05)		0.15	0.22	4.17	3.06	0.04	0.02	0.52	0.11	0.17	0.07	0.10
C.V. (%)		2.93	3.14	1.46	1.09	1.94	0.08	0.58	4.21	7.61	9.10	16.43
Experimental Mean		4.93	6.82	277	273	1.77	23.6	86	2.48	2.11	0.80	0.61
Soil type		-										
pH		-										
Variety		KARJAT-3										
Available NPK kg/ha		-										

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S5:Normal transplanting

Table-4.2.3: Contd….

Treatment		MANDYA										
Main Plot	Sub-plot	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at active tillering (no/m2)	Weed population panicle initiation (no/m²)	Weed dry weight at active tillering (g/m2)	Weed dry weight at panicle initiation (g/m²)
M1- Normal sowing time	S1	5.02	12.82	388	375	4.63	22.9	80	8.25(2.93)	13.50(3.70)	1.67	2.86
	S2											
	S3	6.74	10.74	347	320	4.96	21.7	80	3.75(2.04)	5.50(2.43)	1.04	1.42
	S4											
	S5	6.90	10.14	341	326	5.22	23.3	84	2.50(1.73)	4.25(2.18)	0.56	0.90
M2- Delayed sowing by 30 days	S1	4.38	8.18	329	309	4.83	20.6	79	7.50(2.77)	12.25(3.55)	2.75	3.47
	S2											
	S3	5.38	9.32	344	332	4.96	20.8	78	4.50(2.22)	6.75(2.68)	0.97	1.80
	S4											
	S5	5.04	8.70	338	329	4.74	21.5	83	4.00(2.11)	4.50(2.21)	0.65	1.25
Interaction												
I and M		NS	1.42	NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		NS	1.45	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot												
M1		6.22	11.24	359	340	4.94	22.6	81	4.83(2.23)	7.75(2.77)	1.09	1.73
M2		4.94	8.73	337	323	4.84	20.9	80	5.33(2.37)	7.83(2.81)	1.46	2.17
C.D. (0.05)		0.64	1.09	NS	NS	NS	1.68	1.18	NS	NS	NS	NS
C.V. (%)		8.81	8.40	12.85	13.35	18.97	5.94	1.12	5.09	24.16	30.06	38.55
Method of Sub plots												
S1		4.70	10.50	358	342	4.73	21.7	80	7.88(2.85)	12.88(3.62)	2.21	3.16
S2												
S3		6.06	10.03	345	326	4.96	21.2	79	4.13(2.13)	6.13(2.56)	1.00	1.61
S4												
S5		5.97	9.42	340	327	4.98	22.4	83	3.25(1.92)	4.38(2.19)	0.61	1.07
CD (0.05)		0.57	NS	NS	NS	NS	NS	0.78	0.44	0.38	0.46	0.47
C.V. (%)		9.38	9.23	7.60	9.66	10.49	5.23	0.89	17.65	12.53	33.28	22.20
Experimental Mean		5.58	9.98	348	332	4.89	21.8	81	2.30	2.79	1.27	1.95
Soil type		Red Sandy loam										
pH		6.84										
Variety		KMP 175										
Available NPK kg/ha		334:110:265										

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		NAVSARI										
Main Plot	**Sub-plot**	**Grain yield (t/ha)**	**Straw yield (t/ha)**	**Tillers/m² (No.)**	**Panicle/m² (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Days for 50% flowering**	**Weed population at active tillering (no/m2)**	**Weed population panicle initiation (no/m²)**	**Weed dry weight at active tillering (g/m2)**	**Weed dry weight at panicle initiation (g/m²)**
M1- Normal sowing time	S1	5.03	5.04	237	163	4.52	29.9	93	22.25(4.77)	38.13(6.21)	36.85	56.01
	S2	5.08	5.18	233	178	4.26	30.6	93	21.75(4.72)	36.25(6.06)	37.05	54.10
	S3	5.22	5.29	245	178	4.82	32.1	91	19.75(4.50)	34.75(5.93)	35.74	54.29
	S4	5.62	5.30	256	199	5.02	32.8	92	17.75(4.27)	31.00(5.61)	34.19	53.36
	S5	5.61	5.34	246	188	4.83	32.2	93	19.25(4.44)	33.25(5.80)	34.26	53.58
M2- Delayed sowing by 30 days	S1	4.75	4.59	239	163	4.39	30.5	91	21.25(4.66)	36.88(6.11)	36.79	54.90
	S2	4.66	5.37	237	193	4.49	30.6	91	22.00(4.74)	35.00(5.95)	35.53	54.46
	S3	4.82	5.35	243	187	4.85	31.4	91	22.50(4.79)	34.50(5.92)	36.50	54.02
	S4	5.40	5.25	253	201	4.98	31.3	91	18.25(4.33)	31.00(5.61)	33.72	53.17
	S5	5.35	5.31	249	182	4.87	31.4	92	19.50(4.47)	33.00(5.79)	34.15	53.31
Interaction												
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot												
M1		5.31	5.23	243	181	4.69	31.5	92	20.15(4.54)	34.68(5.92)	35.62	54.27
M2		5.00	5.17	244	185	4.72	31.0	91	20.70(4.60)	34.08(5.88)	35.34	53.97
C.D. (0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. (%)		8.45	9.46	6.37	8.64	8.20	4.79	1.77	2.91	3.40	7.09	8.16
Method of Sub plots												
S1		4.89	4.81	238	163	4.46	30.2	92	21.75(4.71)	37.50(6.16)	36.82	55.46
S2		4.87	5.28	235	185	4.38	30.6	92	21.88(4.73)	35.63(6.01)	36.29	54.28
S3		5.02	5.32	244	182	4.84	31.8	91	21.13(4.64)	34.63(5.92)	36.12	54.15
S4		5.51	5.28	254	200	5.00	32.0	92	18.00(4.30)	31.00(5.61)	33.96	53.27
S5		5.48	5.32	247	185	4.85	31.8	93	19.38(4.45)	33.13(5.80)	34.20	53.44
CD (0.05)		0.38	NS	12.73	11.83	NS	1.37	NS	0.21	0.23	NS	NS
C.V. (%)		7.20	9.42	5.06	6.26	10.50	4.24	1.69	4.43	3.75	6.26	7.09
Experimental Mean		5.15	5.20	244	183	4.70	31.3	92	4.57	5.90	35.48	54.12
Soil type		Clay										
pH		7.84										
Variety		GNR 3										
Available NPK kg/ha		170:139:372										

S1: Broadcasting of seeds
S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)
S3: Mechanized line sowing of seeds (Dribbler, Happy seeder of any Drum Seeder: Spacing as per the equipment specifications)
S4:Any improved system in that particular location
S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		NAWAGAM										
Main Plot	**Sub-plot**	**Grain yield (t/ha)**	**Straw yield (t/ha)**	**Tillers/m² (No.)**	**Panicle/m² (No.)**	**Panicle wt (g)**	**Test wt (g)**	**Days for 50% flowering**	**Weed population at AT (no/m2)**	**Weed population PI (no/m²)**	**Weed dry weight at AT (g/m2)**	**Weed dry weight at PI (g/m²)**
M1- Normal sowing time	S1	4.00	4.58	179	143	14.61	17.4	74	41.00(6.39)	86.25(9.29)	15.65	34.59
	S2	4.79	4.97	106	85	15.43	18.5	73	37.25(6.05)	80.50(8.95)	15.36	33.79
	S3	4.94	5.08	136	109	17.09	18.4	73	33.75(5.84)	74.75(8.63)	13.28	29.88
	S4	5.66	6.38	275	231	18.28	18.5	72	38.25(6.20)	65.50(7.97)	14.80	31.18
	S5											
M2- Delayed sowing by 30 days	S1	2.99	3.22	163	130	11.06	17.5	63	56.50(7.52)	99.00(9.97)	21.81	38.64
	S2	2.06	2.26	103	83	10.19	16.1	63	38.25(6.17)	88.00(9.39)	14.82	35.96
	S3	2.29	2.86	108	86	11.61	15.9	63	43.00(6.59)	91.75(9.59)	16.78	35.81
	S4	3.04	3.40	205	165	15.38	17.8	63	35.50(5.99)	71.50(8.33)	13.71	31.13
	S5											
Interaction												
I and M		0.49	0.54	20.09	18.99	NS	0.78	NS	NS	NS	NS	NS
M and I		0.60	0.65	21.97	21.57	NS	0.80	NS	NS	NS	NS	NS
Mean of Main plot												
M1		4.85	5.25	174	142	16.35	18.2	73	37.56(6.12)	76.75(8.71)	14.77	32.36
M2		2.59	2.94	145	116	12.06	16.8	63	43.31(6.57)	87.56(9.32)	16.78	35.38
C.D. (0.05)		0.55	0.58	16.90	17.68	2.25	0.54	2.11	NS	NS	NS	NS
C.V. (%)		13.07	12.52	9.42	12.19	14.05	2.75	2.77	20.41	15.65	36.01	31.87
Method of Sub plots												
S1		3.50	3.90	171	137	12.84	17.4	68	48.75(6.95)	92.63(9.63)	18.73	36.62
S2		3.42	3.61	105	84	12.81	17.3	68	37.75(6.11)	84.25(9.17)	15.09	34.87
S3		3.62	3.97	122	97	14.35	17.2	68	38.38(6.21)	83.25(9.11)	15.03	32.84
S4		4.35	4.89	240	198	16.83	18.1	67	36.88(6.09)	68.50(8.15)	14.25	31.15
S5												
CD (0.05)		0.35	0.38	14.20	13.42	1.30	0.55	NS	NS	NS	NS	NS
C.V. (%)		8.85	8.81	8.48	9.91	8.71	3.00	2.54	10.50	12.30	21.17	24.07
Experimental Mean		3.72	4.09	159	129	14.21	17.5	68	6.34	9.01	15.78	33.87
Soil type		Clay loam										
pH		7.56										
Variety		Mahisagar										
Available NPK kg/ha		-										

S1: Broadcasting of seeds
S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)
S3: Mechanized line sowing of seeds (Dribbler, Happy seeder of any Drum Seeder: Spacing as per the equipment specifications)
S4:Any improved system in that particular location
S_5:Normal transplanting

Table-4.2.3: Contd….

Main Plot	Sub-plot	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at AT (no/m2)	Weed population at PI (no/m^2)	Weed dry weight at AT (g/m2)	Weed dry weight at PI (g/m^2)
Treatment		PUDUCHERRY										
M1- Normal sowing time	S1	5.79	7.23	336	318	3.06	15.6	91	40.16(6.38)	54.42(7.41)	14.16	16.84
	S2	6.01	7.52	362	339	3.23	16.2	89	36.26(6.06)	49.87(7.10)	13.10	16.57
	S3	6.35	7.94	388	362	3.35	16.4	89	28.03(5.34)	42.00(6.52)	9.89	12.99
	S4											
	S5	6.23	7.79	375	356	3.21	16.4	89	30.67(5.58)	45.40(6.77)	10.82	14.04
M2- Delayed sowing by 30 days	S1	5.44	6.80	342	314	3.02	15.6	91	39.53(6.33)	59.50(7.75)	14.28	19.77
	S2	5.74	7.17	347	323	3.17	15.8	90	32.40(5.74)	52.96(7.31)	11.43	16.39
	S3	5.92	7.40	366	337	3.34	16.4	90	29.01(5.43)	48.67(7.01)	10.48	16.17
	S4											
	S5	6.29	7.86	378	358	3.45	16.5	88	25.63(5.11)	44.40(6.70)	9.26	14.75
Interaction												
I and M		NS	NS	NS	NS	NS	NS	NS	0.12	0.15	0.51	0.69
M and I		NS	NS	NS	NS	NS	NS	NS	0.16	0.20	0.67	0.93
Mean of Main plot												
M1		6.10	7.62	365	344	3.21	16.2	89	33.78(5.84)	47.92(6.95)	11.99	15.11
M2		5.85	7.31	358	333	3.24	16.1	90	31.64(5.65)	51.38(7.19)	11.36	16.77
C.D. (0.05)		NS	NS	NS	NS	NS	NS	NS	0.16	0.20	NS	0.92
C.V. (%)		3.72	3.77	4.09	2.44	4.23	2.45	0.46	1.58	1.63	3.11	3.29
Method of Sub plots												
S1		5.61	7.02	339	316	3.04	15.6	91	39.85(6.35)	56.96(7.58)	14.22	18.30
S2		5.88	7.34	354	331	3.20	16.0	90	34.33(5.90)	51.41(7.20)	12.26	16.48
S3		6.14	7.67	377	350	3.34	16.4	89	28.52(5.39)	45.34(6.77)	10.18	14.58
S4												
S5		6.26	7.82	377	357	3.33	16.5	89	28.15(5.35)	44.90(6.74)	10.04	14.40
CD (0.05)		0.27	0.34	10.10	14.48	0.12	0.49	0.73	0.09	0.10	0.36	0.48
C.V. (%)		3.61	3.62	2.22	3.40	2.89	2.43	0.64	1.18	1.17	2.45	2.42
Experimental Mean		5.97	7.46	362	338	3.23	16.1	90	5.75	7.07	11.68	15.94
Soil type		Clay loam										
pH		6.19										
Variety		TKM 13										
Available NPK kg/ha		123:15:129										

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		ARI-RAJENDRANAGAR									RANCHI				
Main Plot	Sub-plots	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at at (no/m2)	Weed dry weight at at (g/m2)	Grain yield (t/ha)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Weed dry weight at active tillering (g/m2)
M1- Normal sowing time	S1	7.15	8.08	498	434	3.64	12.9	87	40.00(6.09)	1.97	4.65	246	3.13	24.2	30.2
	S2	6.78	7.58	376	402	3.55	13.3	87	33.50(5.72)	3.08	4.75	252	3.21	24.28	19.2
	S3	7.24	8.88	452	417	3.54	12.2	87	20.75(4.55)	1.72	5.21	275	3.15	24.31	27.2
	S4										4.12	220	2.81	24.23	36.2
	S5	5.82	8.67	341	339	3.75	12.1	90	36.75(6.10)	2.02	5.35	281	3.24	24.3	19.15
M2- Delayed sowing by 30 days	S1	6.12	14.83	475	363	2.64	13.4	73	56.25(7.52)	1.79	3.82	219	2.94	24.1	35.8
	S2	5.17	13.92	305	333	2.67	13.4	73	34.75(5.82)	1.94	4.05	225	3.03	24.14	25.2
	S3	6.86	13.75	394	380	3.33	13.0	72	41.75(6.48)	1.42	4.65	247	2.95	24.1	32.4
	S4										3.66	196	2.87	23.95	40.2
	S5	5.00	10.67	335	328	3.05	13.1	80	45.50(6.76)	1.73	4.68	252	3.07	24.17	24.2
Interaction															
I and M		NS	NS	NS	NS	NS	NS	0.56	NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	0.51	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot															
M1		6.74	8.30	416	398	3.62	12.6	88	32.75(5.62)	2.20	4.82	255	3.11	24.26	26.39
M2		5.79	13.29	377	351	2.92	13.2	75	44.56(6.65)	1.72	4.17	228	2.97	24.09	31.56
C.D. (0.05)		NS	2.48	NS	42.87	0.55	NS	0.20	NS	NS	0.29	11.47	0.11	0.08	3.3
C.V. (%)		20.69	20.39	12.23	10.18	15.04	6.99	0.22	21.92	40.15	6.42	4.72	3.45	0.34	11.32
Method of Sub plots															
S1		6.63	11.46	487	398	3.14	13.1	80	48.13(6.81)	1.88	4.24	233	3.03	24.15	33
S2		5.97	10.75	340	368	3.11	13.3	80	34.13(5.77)	2.51	4.4	239	3.12	24.21	22.2
S3		7.05	11.32	423	399	3.44	12.6	79	31.25(5.52)	1.57	4.93	261	3.05	24.21	29.8
S4											3.89	208	2.84	24.09	38.2
S5		5.41	9.67	338	333	3.40	12.6	85	41.13(6.43)	1.87	5.01	267	3.15	24.23	21.68
CD (0.05)		NS	NS	72.88	NS	NS	NS	0.40	NS	NS	0.42	16.97	0.14	0.09	6.91
C.V. (%)		21.62	16.77	17.47	15.82	13.94	7.67	0.47	18.40	43.74	8.99	6.82	4.4	0.36	23.12
Experimental Mean		6.27	10.80	397	374	3.27	12.9	81	6.13	1.96	4.49	241	3.04	24.18	28.98
Soil type		Clay loam									Clay Loam				
pH		7.60									6.10				
Variety		RNR 15048									IR 64 drt1				
Available NPK kg/ha		226:102:481									227:39:285				

S1: Broadcasting of seeds

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S_5:Normal transplanting

*S4- Rice + Sesbania was broadcasted (Sesbania was broadcasted at the rate of 40 kg/ha and then rice was sown in lines 20 cm apart.At 25th DAS sesbania was uprooted and placed in between rice rows.

Table-4.2.3: Contd….

Treatment		REWA								
Main Plot	Sub-plots	Grain yield (t/ha)	Straw yield (t/ha)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at active tillering (no/m2)	Weed population panicle initiation (no/m^2)	Weed dry weight at AT (g/m2)	Weed dry weight at PI (g/m^2)
M1- Normal sowing time	S1	3.98	4.65	2.43	24.75	72.8	26.48(5.19)	6.25(2.59)	9.60	3.42
	S2	4.38	4.95	2.67	25.45	77.5	25.28(5.08)	6.25(2.60)	9.30	3.95
	S3	4.57	5.15	2.93	24.98	80.8	26.03(5.15)	6.75(2.69)	10.77	3.80
	S4	5.38	5.63	3.45	26.35	84.5	11.30(3.43)	7.25(2.78)	4.55	2.72
	S5	4.82	5.48	3.15	25.50	81.5	24.03(4.94)	5.75(2.50)	11.32	3.33
M2- Delayed sowing by 30 days	S1	3.63	4.20	2.10	24.98	69.0	25.60(5.11)	4.75(2.28)	7.30	2.55
	S2	4.07	4.60	2.25	26.35	72.0	24.45(4.99)	4.50(2.23)	7.35	2.38
	S3	4.13	4.82	2.55	25.50	75.5	25.17(5.06)	5.00(2.34)	9.07	2.78
	S4	5.05	5.40	2.98	24.75	78.0	10.88(3.37)	5.25(2.39)	3.50	2.58
	S5	4.48	5.15	2.88	25.45	78.5	23.00(4.84)	4.50(2.23)	9.02	2.83
Interaction										
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Main plot										
M1		4.62	5.17	2.93	25.40	79.4	22.62(4.76)	6.45(2.63)	9.11	3.45
M2		4.27	4.83	2.55	25.41	74.6	21.82(4.68)	4.80(2.30)	7.25	2.62
C.D. (0.05)		0.09	0.03	0.05	NS	1.45	NS	0.06	0.80	0.39
C.V. (%)		2.04	0.61	1.73	0.45	1.87	2.87	2.28	9.73	12.84
Method of Sub plots										
S1		3.80	4.42	2.26	24.86	70.9	26.04(5.15)	5.50(2.44)	8.45	2.99
S2		4.22	4.78	2.46	25.90	74.8	24.86(5.03)	5.38(2.42)	8.33	3.16
S3		4.35	4.99	2.74	25.24	78.1	25.60(5.11)	5.88(2.52)	9.92	3.29
S4		5.21	5.51	3.21	25.55	81.3	11.09(3.40)	6.25(2.59)	4.02	2.65
S5		4.65	5.31	3.01	25.48	80.0	23.51(4.89)	5.13(2.37)	10.17	3.08
CD (0.05)		0.19	0.08	0.11	NS	2.30	0.17	NS	1.57	NS
C.V. (%)		4.19	1.52	3.76	3.38	2.90	3.43	6.81	18.60	15.69
Experimental Mean		4.45	5.00	2.74	25.41	77.0	4.72	2.46	8.18	3.03
Soil type		-								
pH		6.10								
Variety		RNR 15048								
Available NPK kg/ha		292:18:423								

S1: Broadcasting of seeds
S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)
S3: Mechanized line sowing of seeds (Dribbler, Happy seeder of any Drum Seeder: Spacing as per the equipment specifications)
S4:Any improved system in that particular location
S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		TITABAR						WARANGAL						Over all Mean	Rank
Main Plot	Sub-plots	Grain yield (t/ha)	Panicle/m² (No.)	Panicle wt (g)	Days for 50% flowering	Weed population at PI (no/m²)	Weed dry weight at PI (g/m²)	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)		
M1- Normal sowing time	S1	2.42	255	2.92	70	45.50(6.73)	78.55	5.80	6.70	388	263	14.67	12.60	4.65	7
	S2	2.53	265	3.56	65	36.50(6.00)	70.35	6.27	7.45	408	297	15.27	12.33	4.93	4
	S3	3.28	222	3.84	63	20.50(4.53)	42.03	6.60	7.63	454	350	15.80	12.58	5.42	3
	S4							6.70	7.80	473	357	16.13	12.43	5.57	1
	S5	4.41	306	4.19	71	11.50(3.41)	26.27	7.00	8.77	475	355	17.00	12.43	5.46	2
M2- Delayed sowing by 30 days	S1	2.11	188	3.01	76	53.50(7.32)	66.55	1.94	2.75	325	225	14.00	12.32	3.82	10
	S2	2.52	208	3.24	74	39.00(6.22)	49.45	3.95	6.40	327	219	14.33	12.21	4.05	9
	S3	2.93	212	3.48	72	25.75(5.08)	44.10	4.15	5.27	378	295	14.67	12.17	4.56	8
	S4							4.48	5.33	395	300	14.43	12.16	4.72	5
	S5	3.55	244	3.64	75	18.00(4.30)	24.35	5.54	6.43	399	305	15.43	12.38	4.65	6
Interaction															
I and M		NS	23.60	NS	1.29	NS	NS	NS	0.94	NS	NS	0.36	NS		
M and I		NS	27.31	NS	1.39	NS	NS	NS	1.12	NS	NS	0.82	NS		
Mean of Main plot															
M1		3.16	262	3.63	67	28.50(5.17)	54.30	6.47	7.67	440	325	15.77	12.48	5.22	1
M2		2.78	213	3.34	74	34.06(5.73)	46.11	4.01	5.24	365	269	14.57	12.25	4.36	2
C.D. (0.05)		0.14	23.01	NS	1.05	NS	NS	0.90	0.95	70.37	NS	1.00	NS		
C.V. (%)		4.19	8.62	8.16	1.32	16.08	50.24	10.90	9.38	11.13	25.19	4.18	2.23		
Method of Sub plots															
S1		2.26	222	2.97	73	49.50(7.03)	72.55	3.87	4.73	357	244	14.33	12.46	4.23	5
S2		2.52	236	3.40	69	37.75(6.11)	59.90	5.11	6.93	368	258	14.80	12.27	4.49	4
S3		3.11	217	3.66	68	23.13(4.81)	43.06	5.38	6.45	416	323	15.23	12.38	4.99	3
S4								5.59	6.57	434	329	15.28	12.30	5.14	1
S5		3.98	275	3.92	73	14.75(3.85)	25.31	6.27	7.60	437	330	16.22	12.41	5.05	2
CD (0.05)		0.41	16.69	0.22	0.91	0.53	14.36	1.28	0.66	42.35	36.32	0.25	NS		
C.V. (%)		13.10	6.69	6.11	1.23	9.34	27.21	19.95	8.40	8.60	10.00	1.37	1.69		
Experimental Mean		2.97	237	3.49	71	5.45	50.21	5.24	6.45	402	297	15.17	12.36	4.79	
Soil type		Clay loam						Clay Loam							
pH		5.20						7.30							
Variety		LUIT						WGL 962							
Available NPK kg/ha		302:19:321						276:80:360							

S1: Broadcasting of seeds

*S4 - Semi dry rice 20 x 15 cm

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location

S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		Cost of Cultivation (Rs./ha)						Total Water Input mm/ha	
Main Plot	**Sub-plots**	**COIMBATORE**	**MANDYA**	**NAVSARI**	**NAWAGAM**	**PUDUCHERRY**	**REWA**	**RAGOLU**	**NAVSARI**
M1- Normal sowing time	S1	35423	53822	29330	38884	43250	20500	1135	435
	S2	38224		31158	39890	43900	24300	1135	175
	S3	36032	55850	30710	38642	43125	22800	1135	150
	S4	37122		42750	42571		26800	1135	440
	S5	42321	59717	42505		46375	24200	1223	445
M2- Delayed sowing by 30 days	S1	35946	53166	29508	38785	43250	20500	1151	435
	S2	38878		31514	39782	43900	24300	1151	175
	S3	36325	54634	31066	38668	43125	22800	1151	150
	S4	37145		42928	42671		26800	1151	435
	S5	42978	58263	42683		46375	24200	1242	445
Interaction									
I and M									
M and I									
Mean of Main plot									
M1		37824.4	56463	35291	39996	44163	23720	1153	329
M2		38254.4	55354	35540	39976	44163	23720	1169	328
C.D. (0.05)									
C.V. (%)									
Method of Sub plots									
S1		35684.5	53494	29419	38834	43250	20500	1143	435
S2		38551		31336	39836	43900	24300	1143	175
S3		36178.5	55242	30888	38655	43125	22800	1143	150
S4		37133.5		42839	42621		26800	1143	438
S5		42649.5	58990	42594		46375	24200	1233	445
CD (0.05)									
C.V. (%)									
Experimental Mean		38039.4	55908.685	35415.1	39986.345	44162.5	23720	1160.9	328.5

S1: Broadcasting of seeds
S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)
S3: Mechanized line sowing of seeds (Dribbler, Happy seeder of any Drum Seeder: Spacing as per the equipment specifications)
S4:Any improved system in that particular location
S_5:Normal transplanting

Table-4.2.3: Contd….

Treatment		PUSA		
Main Plot-Irrigation management practices	Crop establishment methods	Grain yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)
M1- Normal sowing time	S1	3.55	296	2.99
	S2	3.98	311	2.94
	S3	4.00	314	2.91
	S4	4.17	323	2.77
	S5	4.32	320	2.89
Exp. mean		4.00	313	2.9
CD(0.05)		0.33	25.16	0.31
CV		6.23	6	7.93
res(t)		**	NS	NS
Soil type		Silty loam		
pH		7.80		
Variety		Abhishek		
Available NPK kg/ha		-		

S1: Broadcasting of seeds *S4 - Broad casting of seed (20% higher than S1)

S2: Manual line sowing of seeds (20-25 cm row spacing sown in solid row)

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

S4:Any improved system in that particular location (RANDOM TRANSPLANTING)

S_5:Normal transplanting

4.2.4. Evaluation of IRON coated seed for direct seeded rice for enhancing the crop establishment as well as productivity

Seed treatment of soaking, incubation, and drying increases the germination rate of rice even at low temperatures or under anoxia and that the treatment is effective not only in Japonica but also in Indica cultivars (Yamauchi, 2002; Mori et al., 2012). Andoh and Kobata (2002) reported that seeds that had been soaked and then dried have increased a-amylase activity and a high germination rate. Thus, the treatment of soaking, incubation, and drying is a useful priming method. Primed rice seeds could be utilized in direct seeding in view of pre-germinated seeds. The high density Fe-coated seeds are resistant to birds and seed borne diseases. Iron-coated seeds exhibit improved anchorage in water seeding in puddled fields. Hence, the field trial was initiated to study effect of Fe-coating on growth and yield parameters of rice in 2018 in AICRIP programme.The trial during 2019 was continued and laid out in split plot design at 5 locations (**ICAR-IIRR& JFE-India, Coimbatore, Chiplima, Karjat and Raipur**) with 4 date of sowings with one week interval as main plots and five establishment methods(T_1- Iron coated seed, seed rate 25 kg/ha, broadcasting in 1-2mm water level condition (Direct sowing) T_2- Iron coated seed, seed rate 25 kg/ha, broadcasting in wet Condition (Direct sowing) T_3 – Un-coated seed, seed rate 25 kg/ha, broadcasting in 1-2mm water level condition (Direct sowing) T_4 – Un-coated seed, seed rate 25 kg/ha, broadcasting in wet condition (Direct sowing) T_5 – Normal transplanting 21-25 days after sowing as subplots in 3 replications.

At **ICAR-IIRR**, Rajendranagar, 1st date of sowing (24.08.2019) recorded significantly higher grain yield (5.67 t/ha) over other delayed sowings. However, normal transplanting of rice (5.60 t/ha) out performed all the iron coated treatments. Among the seed coating treatments, Fe coated recorded significantly higher grain yield (4.71 to 5.02 t/ha) over uncoated seeds and yield improvement ranged to the tune of 12%. At **Coimbatore**, 1st date of sowing (09.08.2019) and 2nd date of sowing (16.08.2019) resulted the highest grain yield (5.23 & 5.27 t/ha) t/ha) than those of delayed sowings. There was significant reduction in grain yield due to delay of one week from 2nd sowing. However, transplanting method showed it superiority (5.60 t/ha) over all other treatments including iron coating treatment. However, Fe coating significantly increased grain yield (5.14 to 5.26 t/ha) over non-coating. At **Chiplima** also 1st date of sowing (29.06.2019) showed best result in terms of grain yield (6.21 t/ha) compared to those of other delayed date of sowings. Iron coating did not result in higher grain yield over without iron coating (normal transplanting). Similar effect of date of sowing on grain yield was also observed at **Karjat**. The highest grain yield was recorded at 1st date of sowing (3.81 t/ha). Iron coated and broadcasted on 1-2 cm water level resulted higher grain yield (3.29 t/ha) closely followed by transplanting method (3.19 t/ha). Similar yield trend was observed among date of sowing treatments at **Raipur**. The highest grain yield was 5.56 t/ha at 1st date of sowing (19.07.2019). Iron coated and broadcasted in wet condition resulted in the highest grain yield (5.55 t/ha).Over all mean grain yield across all the 5 locations revealed that **1st date of sowing was the best time of sowing for all the locations resulting the highest yield of rice (5.30 t/ha)** followed by 2nd(4.87 t/ha), 3rd (4.19 t/ha) and 4th (3.71 t/ha) date of sowing. Iron coated treatments performed better than without coated treatments with a yield advantage of 5.72 to 9.85%. Iron coated seed with seed rate of 25 kg/ha and broadcasted in 1-2cm water level condition and iron coated wet seeding recorded higher grain yield (4.59 & 4.58 t/ha) than (4.33 & 418 t/ha) uncoated seeds. **There is an increase of 5.72 to 9.55% grain yield due to iron coating of seeds**.

Major pest and diseases were listed below location wise (Table.10).

Material was also supplied to **Maruteru** center, Andhra Pradesh, but plant population was seriously affected by high rain fall and severe snail problem at this center. Hence not reported in this report.

In order to enhance the productivity of DSR, iron coating of seeds was done and evaluated at 5 locations consequently viz**., IIRR, Coimbatore, Karjat** and **Raipur** with 4 date of sowings with one week interval as main plots and five establishment methods(T_1- Iron coated seed, seed rate 25 kg/ha, broadcasting in 1-2mm water level condition (Direct sowing) T_2- Iron coated seed, seed rate 25 kg/ha, broadcasting in wet Condition (Direct sowing) T_3 – Un-coated seed, seed rate 25 kg/ha, broadcasting in 1-2mm water level condition (Direct sowing) T_4 – Un-coated seed, seed rate 25 kg/ha, broadcasting in wet condition (Direct sowing) T_5 – Normal transplanting 21-25 days after sowing as subplots in 3 replications. Among the date of the sowing, 1st date of sowing (6.21 t/ha at **Chiplima**, 5.67 t/ha at **IIRR** , 3.81 t/ha at **Karjat**) gave significantly higher grain yield and over 15 days delay reduced mean grain yield reduced yield by 8.1%, 21% and 30% respectively. There is an significant increase of grain yield to the tune of 5.72 to 9.85% due to iron coating of seeds which felicitated better system of establishment and growth. The results are inconformity with previous year.

Table 4.2.4: Enhancing the productivity of Direct seeded rice with Iron coating under different rice ecologies, Kharif-2019.

Main methods	Treatments	CHIPLIMA						% gy Increase over Non Coated
		No of panicles/m2	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Grain Yield (t/ha)	Straw Yield (t/ha)	
1st sowing	T1	264	5.78	27.33	108	5.86	6.60	-11.21
	T2	262	4.92	28.33	108	5.67	6.68	-13.83
	T3	276	5.33	27.00	107	6.60	7.51	
	T4	237	5.08	28.67	106	6.58	7.79	
	T5	316	5.17	26.67	109	6.35	6.18	
2nd sowing	T1	230	5.15	27.67	102	4.73	5.60	-28.01
	T2	244	4.83	27.67	103	5.67	5.78	-2.58
	T3	246	4.92	27.67	103	6.57	7.51	
	T4	265	4.33	28.67	103	5.82	6.82	
	T5	304	4.33	26.67	105	5.84	7.28	
3rd sowing	T1	224	5.00	27.67	103	4.39	5.38	-7.77
	T2	220	4.77	28.00	103	4.75	5.98	13.10
	T3	232	4.73	27.33	103	4.76	5.84	
	T4	247	5.83	27.33	102	4.20	5.00	
	T5	276	4.50	26.67	105	5.09	6.42	
4th sowing	T1	254	4.52	26.00	98	4.40	5.18	7.58
	T2	212	4.45	26.67	98	4.61	5.44	14.96
	T3	214	4.83	25.33	99	4.09	5.00	
	T4	236	5.42	26.00	97	4.01	4.87	
	T5	241	4.92	26.33	102	4.35	5.40	
Interaction								
M and T		27.91	NS	NS	1.1	NS	NS	
T and M		28.75	NS	NS	1.12	NS	NS	
Mean of Main methods								
M1		271	5.26	27.60	108	6.21	6.95	
M2		258	4.71	27.67	103	5.73	6.60	
M3		240	4.97	27.40	103	4.64	5.72	
M4		231	4.83	26.07	99	4.29	5.18	
CD(0.05)		18.47	NS	0.37	0.69	0.63	0.59	
CV(%)		8.27	11.72	1.53	0.75	13.48	10.80	
Mean of Sub methods								
T1-Fe coated 1-2 cm water level		243	5.11	27.17	103	4.85	5.69	-11.82
T2-Fe coated wet		234	4.74	27.67	103	5.18	5.97	0.58
T3-Non coated 1-2 cm water level		242	4.95	26.83	103	5.50	6.47	
T4-Non coated wet		246	5.17	27.67	102	5.15	6.12	
T5-NTP		285	4.73	26.58	105	5.41	6.32	
CD(0.05)		13.95	NS	0.84	0.55	0.44	NS	
CV(%)		6.76	9.77	3.75	0.64	10.20	10.85	
Experimental Mean		**250**	**4.94**	**27.18**	**103**	**5.22**	**6.11**	

DOS	**Rain fall for specific week**
29.06.19	-
07.07.19	-
13.07.19	-
21.07.19	-

Table 4.2.4: Contd…

Main methods	Treatments	COIMBATORE No of panicles/m2	Panicle wt (g)	Test wt (g)	Grain Yield (t/ha)	Straw Yield (t/ha)	% gy Increase over Non Coated
1st sowing	T1	353	2.64	19.43	5.52	7.33	14.29
	T2	338	2.48	19.33	5.34	7.24	12.42
	T3	328	2.27	19.47	4.83	6.43	
	T4	318	1.97	19.33	4.75	6.27	
	T5	356	2.72	19.57	5.69	7.59	
2nd sowing	T1	361	2.73	19.57	5.65	7.45	19.20
	T2	343	2.56	19.43	5.55	7.32	18.84
	T3	337	2.36	19.43	4.74	6.54	
	T4	319	2.04	19.37	4.67	6.37	
	T5	367	2.78	19.70	5.76	7.78	
3rd sowing	T1	327	2.29	19.40	5.04	7.05	11.26
	T2	323	2.17	19.33	4.89	6.84	11.90
	T3	314	2.10	19.27	4.53	6.43	
	T4	302	1.91	19.40	4.37	6.24	
	T5	336	2.59	19.53	5.59	7.45	
4th sowing	T1	318	2.17	19.43	4.84	6.77	10.50
	T2	316	2.10	19.30	4.77	6.54	13.57
	T3	310	1.88	19.27	4.38	6.33	
	T4	300	1.73	19.33	4.20	6.15	
	T5	328	2.42	19.57	5.35	7.33	
Interaction							
M and T		NS	NS	NS	0.11	0.15	
T and M		NS	NS	NS	0.14	0.15	
Mean of Main methods							
M1		339	2.42	19.43	5.23	6.97	
M2		345	2.49	19.50	5.27	7.09	
M3		320	2.21	19.39	4.88	6.80	
M4		314	2.06	19.38	4.71	6.62	
CD(0.05)		7.06	0.05	0.04	0.13	0.10	
CV(%)		2.40	2.63	0.25	2.88	1.63	
Mean of Sub methods							
T1-Fe coated 1-2 cm water level		340	2.46	19.46	5.26	7.15	13.85
T2-Fe coated wet		330	2.33	19.35	5.14	6.98	14.22
T3-Non coated 1-2 cm water level		322	2.15	19.36	4.62	6.43	
T4-Non coated wet		310	1.91	19.36	4.50	6.26	
T5-NTP		347	2.63	19.59	5.60	7.54	
CD(0.05)		5.37	0.06	0.06	0.06	0.08	
CV(%)		1.98	3.21	0.39	1.37	1.32	
Experimental Mean		**330**	**2.30**	**19.42**	**5.02**	**6.87**	

DOS	Rain fall for specific week
09.08.19	-
16.08.19	-
23.08.19	-
30.08.19	-

Table 4.2.4: Contd…

Main methods	Treatments	IIRR						% gy Increase over Non Coated
		No of panicles/m2	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Grain Yield (t/ha)	Straw Yield (t/ha)	
1st sowing	T1	543	3.17	22.20	102	5.95	7.14	11.21
	T2	567	3.14	22.03	102	5.68	6.67	13.83
	T3	490	2.67	20.70	103	5.35	6.27	
	T4	528	2.64	20.77	103	4.99	5.80	
	T5	603	2.92	22.20	109	6.37	7.38	
2nd sowing	T1	471	2.75	21.93	102	5.14	6.08	17.62
	T2	342	2.76	21.80	102	4.67	5.60	15.88
	T3	158	2.60	20.60	103	4.37	5.23	
	T4	212	2.65	20.67	103	4.03	4.82	
	T5	612	2.65	22.90	109	5.86	6.81	
3rd sowing	T1	420	2.68	21.60	103	4.66	5.42	9.65
	T2	506	2.47	20.67	102	4.54	5.37	9.66
	T3	356	2.33	19.87	102	4.25	5.10	
	T4	321	2.45	19.77	101	4.14	5.04	
	T5	532	2.60	22.57	106	5.34	6.41	
4th sowing	T1	477	2.39	20.80	101	4.34	5.20	12.44
	T2	394	2.55	20.97	101	3.95	4.85	8.82
	T3	279	2.39	19.80	101	3.86	4.74	
	T4	309	2.39	20.50	101	3.63	4.41	
	T5	531	2.46	22.67	105	4.83	5.73	
Interaction								
M and T		NS	NS	NS	NS	NS	NS	
T and M		NS	NS	NS	NS	NS	NS	
Mean of Main methods								
M1		546	2.91	21.58	104	5.67	6.65	
M2		359	2.68	21.58	104	4.82	5.71	
M3		427	2.50	20.89	103	4.59	5.47	
M4		398	2.44	20.95	102	4.12	4.99	
CD(0.05)		68.87	0.19	0.39	0.79	0.26	0.23	
CV(%)		17.82	8.02	2.05	0.86	6.06	4.52	
Mean of Sub methods								
T1-Fe coated 1-2 cm water level		477	2.75	21.63	102	5.02	5.96	12.56
T2-Fe coated wet		452	2.73	21.37	102	4.71	5.62	12.14
T3-Non coated 1-2 cm water level		321	2.50	20.24	102	4.46	5.34	
T4-Non coated wet		343	2.53	20.43	102	4.20	5.01	
T5-NTP		570	2.66	22.58	108	5.60	6.58	
CD(0.05)		85.79	0.13	0.62	0.81	0.34	0.37	
CV(%)		24.04	6.02	3.56	0.96	8.59	7.96	
Experimental Mean		**433**	**2.63**	**21.25**	**103**	**4.80**	**5.70**	

DOS	Rain fall for specific week
24.08.19	42.0
30.08.19	76.0
07.09.19	9.0
13.09.19	31.6

Table 4.2.4: Contd…

Main methods	Treatments	KARZAT						% gy Increase over Non Coated
		No of panicles/m2	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Grain Yield (t/ha)	Straw Yield (t/ha)	
1st sowing	T1	300	2.06	17.43	105	4.09	5.56	16.19
	T2	282	1.94	17.42	103	3.84	5.23	14.97
	T3	257	1.78	17.38	105	3.52	4.78	
	T4	240	1.69	17.37	104	3.34	4.55	
	T5	267	2.15	17.43	106	4.27	5.80	
2nd sowing	T1	244	1.90	17.40	103	3.77	5.28	18.93
	T2	224	1.81	17.40	105	3.57	5.00	21.02
	T3	200	1.60	17.36	108	3.17	4.44	
	T4	196	1.49	17.35	105	2.95	4.13	
	T5	241	1.60	17.40	108	3.16	4.42	
3rd sowing	T1	182	1.42	17.40	108	2.80	4.01	11.11
	T2	179	1.36	17.40	102	2.69	3.85	22.83
	T3	174	1.27	17.36	107	2.52	3.60	
	T4	168	1.10	17.35	108	2.19	3.12	
	T5	182	1.42	17.40	104	2.81	4.01	
4th sowing	T1	137	1.26	17.34	105	2.49	3.63	20.29
	T2	127	1.08	17.29	103	2.15	3.14	14.97
	T3	119	1.04	17.27	104	2.07	3.02	
	T4	112	0.94	17.25	103	1.87	2.72	
	T5	139	1.27	17.33	104	2.53	3.69	
Interaction								
M and T		9.62	0.08	NS	0.83	0.16	0.23	
T and M		8.79	0.08	NS	0.87	0.16	0.22	
Mean of Main methods								
M1		269	1.92	17.41	105	3.81	5.18	
M2		221	1.68	17.38	106	3.32	4.66	
M3		177	1.31	17.38	106	2.60	3.72	
M4		127	1.12	17.30	104	2.22	3.24	
CD(0.05)		2.31	0.04	0.01	0.6	0.08	0.11	
CV(%)		1.3	2.76	0.08	0.64	2.88	2.84	
Mean of Sub methods								
T1-Fe coated 1-2 cm water level		216	1.66	17.39	105	3.29	4.62	16.67
T2-Fe coated wet		203	1.55	17.38	104	3.06	4.31	18.15
T3-Non coated 1-2 cm water level		187	1.42	17.34	106	2.82	3.96	
T4-Non coated wet		179	1.31	17.33	105	2.59	3.63	
T5-NTP		207	1.61	17.39	106	3.19	4.48	
CD(0.05)		4.81	0.04	0.02	0.41	0.08	0.11	
CV(%)		2.94	3.32	0.15	0.48	3.25	3.29	
Experimental Mean		**198**	**1.51**	**17.37**	**105**	**2.99**	**4.20**	

DOS	Rain fall for specific week
03.07.19	0.0
10.07.19	70.0
17.07.19	18.8
24.07.19	531.4

Table 4.2.4: Contd…

Main methods	Treatments	RAIPUR						% gy Increase over Non Coated	Over all Mean	Rank	Mean % gy Increase over Non Coated
		No of panicles/m2	Panicle wt (g)	Test wt (g)	Days for 50% Flowering	Grain Yield (t/ha)	Straw Yield (t/ha)				
1st sowing	T1	349	2.94	20.33	104	5.55	5.95	6.73	5.39	2	5.76
	T2	356	3.02	20.90	104	5.94	6.29	15.34	5.29	3	6.69
	T3	332	2.72	21.13	104	5.20	5.58		5.10	5	
	T4	342	2.84	21.03	104	5.15	5.88		4.96	7	
	T5	298	2.92	20.70	111	5.94	6.11		5.72	1	
2nd sowing	T1	345	2.65	20.57	96	5.24	5.89	7.82	4.91	8	3.46
	T2	350	2.75	20.37	96	5.54	6.12	10.36	5.00	6	11.16
	T3	324	2.58	20.93	95	4.86	5.43		4.74	9	
	T4	332	2.61	20.67	96	5.02	5.56		4.50	11	
	T5	284	2.64	20.30	103	5.30	5.80		5.18	4	
3rd sowing	T1	281	2.35	19.73	93	4.06	4.72	2.78	4.19	13	4.70
	T2	318	2.55	20.27	93	4.53	5.22	2.03	4.28	12	10.65
	T3	278	2.27	20.17	93	3.95	4.49		4.00	15	
	T4	307	2.46	20.17	93	4.44	5.20		3.87	16	
	T5	263	2.41	19.57	99	4.28	5.01		4.62	10	
4th sowing	T1	264	2.18	19.43	90	3.05	3.90	0.99	3.82	17	9.76
	T2	287	2.22	19.97	90	3.50	4.58	6.71	3.80	18	11.71
	T3	260	2.09	20.03	90	3.02	4.04		3.48	19	
	T4	270	2.14	19.40	89	3.28	4.30		3.40	20	
	T5	252	2.19	20.00	95	3.16	4.17		4.04	14	
Interaction											
M and T		NS	NS	NS	NS	NS	NS				
T and M		NS	NS	NS	NS	NS	NS				
Mean of Main methods											
M1		335	2.89	20.82	105	5.56	5.96		5.30	1	
M2		327	2.64	20.57	97	5.19	5.76		4.87	2	
M3		290	2.41	19.98	94	4.25	4.93		4.19	3	
M4		267	2.17	19.77	91	3.20	4.20		3.71	4	
CD(0.05)		16.55	0.10	NS	0.7	0.28	0.46				
CV(%)		6.08	4.36	5.54	0.81	6.91	9.83				
Mean of Sub methods											
T1-Fe coated 1-2 cm water level		310	2.53	20.02	96	4.48	5.12	5.16	4.58	2	5.72
T2-Fe coated wet		328	2.64	20.38	96	4.88	5.55	9.17	4.59	3	9.85
T3-Non coated 1-2 cm water level		299	2.42	20.57	95	4.26	4.88		4.33	4	
T4-Non coated wet		313	2.51	20.32	96	4.47	5.24		4.18	5	
T5-NTP		274	2.54	20.14	102	4.67	5.27		4.89	1	
CD(0.05)		13.15	NS	NS	0.85	0.27	0.27				
CV(%)		5.23	7.04	4.51	1.06	7.06	6.31				
Experimental Mean		**305**	**2.53**	**20.28**	**97**	**4.55**	**5.21**		4.52		

DOS	**Rain fall for specific week**
19.07.19	26.1
26.07.19	8.4
02.08.19	99
09.08.19	185.6

Table 4.2.4: Contd…

Percent Grain Yield Increase in Iron coated over non coated treatments							
		Coimbatore	**Chiplima**	**IIRR**	**Karjat**	**Raipur**	**Mean over all locations**
1st sowing	T1	14.29	-11.21	11.21	16.19	6.73	**5.76**
	T2	12.42	-13.83	13.83	14.97	15.34	**6.69**
2nd sowing	T1	19.20	-28.01	17.62	18.93	7.82	**3.46**
	T2	18.84	-2.58	15.88	21.02	10.36	**11.16**
3rd sowing	T1	11.26	-7.77	9.65	11.11	2.78	**4.70**
	T2	11.90	13.10	9.66	22.83	2.03	**10.65**
4th sowing	T1	10.50	7.58	12.44	20.29	0.99	**9.76**
	T2	13.57	14.96	8.82	14.97	6.71	**11.71**
T1-Fe coated 1-2 cm water level		13.85	-11.82	12.56	16.67	5.16	**5.72**
T2-Fe coated wet		14.22	0.58	12.14	18.15	9.17	**9.85**

b) Effect of Iron seed coating on insect pest incidence (ESCP) (Collaborative: Agronomy and Entomology)

Seed priming and seed coating treatments which help to increase the germination rate and improve the anchorage are essential in direct seeding in puddle soils. The high density Fe coated seeds have also been reported to be resistant to bird damage and seed borne diseases. Keeping this in view, a collaborative trial with Agronomy (YET 4 – Enhancing the productivity of direct seeded rice with iron coating under different rice ecologies) was initiated with an objective to assess and generate useful information on the impact of iron seed coating on insect pest incidence.

During *Kharif* 2019, observations on insect pest incidence were recorded at 3 locations, *viz.,* **Raipur, Karjat and Chiplima**. The field trial was laid out , in split plot design with 4 dates of sowings at one week interval as main plots and 5 establishment methods (T1- Iron coated seed, seed rate 25 kg/ha, broadcasting in 1-2 mm water level condition (Direct sowing) T2- Iron coated seed, seed rate 25 kg/ha, broadcasting in wet Condition (Direct sowing) T3 – Un-coated seed, seed rate 25 kg/ha, broadcasting in 1-2 mm water level condition (Direct sowing) T4 – Uncoated seed, seed rate 25 kg/ha, broadcasting in wet condition (Direct sowing) T5 – Normal transplanting 21-25 days after sowing as subplots in 3 replications. Standard procedures were followed to record observations on insect pest incidence in all treatments. The results are summarized below.

At **Raipur**, there was low to moderate incidence of stem borer (5.2-16.7% DH & 8.4-3.3% WE) and low incidence of leaf folder (0.5–3.7% LFDL), whorl maggot (0.5-3.0% WMDL), case worm (0.0-4.0% CWDL), hispa (0.4–3.9% HDL), brown planthopper (3 – 9 hoppers/hill) and green leaf hopper (0 – 5 hoppers/hill) in Swarna variety grown in this trial. Dead heart and white ear damage by stem borer was at par in different dates of sowings whereas sub plot T1 (Iron coated seed, seed rate 25 kg/ha, broadcasting in 1-2 mm water level condition -Direct sowing) recorded significantly lowest dead heart damage (7.7% DH) compared to other sub plots. White ear damage was at par in all the sub plots. Interaction effects are almost at par with each other in different treatments. Observations on natural enemies were also recorded to know the impact of seed coating. Data revealed that Spiders (0-4/hill) and Coccinellids (0-4/hill) were relatively higher than Staphylinid and Rove beetles (0-3/hill).

At **Karjat,** only stem borer incidence was observed in different sowings and treatments in Swarna variety. Though the dead heart incidence was significantly high in first sowing starting from 15 DAT to 45 DAT (2.0-6.4% DH) and 7.1% WE at pre-harvest compared to other sowings, the stem borer damage did not reach ETL. Similarly, dead heart damage was at par in different sub-plot treatments while white ears were relatively high (7.1% WE) in T3 subplot (Broadcasting of uncoated seed in 1-2 mm water).

At **Chiplima**, stem borer, gall midge and brown planthopper incidence was observed in first sowing in different treatments in Swarna variety grown in this trial. Gall midge incidence was very high in normal transplanting (18.9-30.3% SS) and was at par with T3 (hydro primed flooded treatment – 20.3-24.8% SS) compared to other treatments during 55 to 75 DAT. Similarly, BPH incidence was significantly high in normal transplanting (26-39 hoppers/hill) which was at par with T3 (25-39 hoppers/hill). Stem borer incidence was low both at vegetative and reproductive stages in all the treatments.

Pest incidence data from only **Karjat** and **Raipur** were included for analysis of impact of sowing on pest occurrence. The stem borer damage across the sowings was not significant with dead heart damage of 0.1 to 10.8% and 4.1 to16.4% white ears across the treatments. Data from all three locations were considered for analysis of effect of iron coating on pest incidence. The different iron coated seed treatments across locations revealed no significant differences in dead heart damage of 0.5 to 10.6% and white ear damage of 3.9 to 16.6% across all the locations. Gall midge incidence recorded only at **Chiplim**a, was lowest in T2 treatment (9.2% SS) and significantly superior to remaining treatments. It was high in T5- normal transplanting (24.6% SS) on par with T3 treatment with uncoated seed (22.6% SS). Similarly, BPH population was lowest in T2 treatment (11 hoppers/hill) followed by other Iron seed coated treatments (19 hoppers/hill) compared to normal (33 hoppers/hill) transplanting and uncoated seed treatments (32 hoppers/hill). Incidence of other pests like leaf folder, whorl maggot, case worm and hispa was very low (<5%) to draw valid conclusions.

Across the locations, there were no significant differences with respect to stem borer damage (0.5 – 10.6% DH & 3.9 – 16.6% WE). However at Chiplima, T2 treatment (Fe coated seed in dry condition) showed significantly lower incidence of gall midge (9.2 – 13.9% SS) and BPH (11 – 19 hoppers/ hill).

Table…. Effect of Iron Seed Coating on Pest Incidence (ESCP) at Raipur, *Kharif* 2019

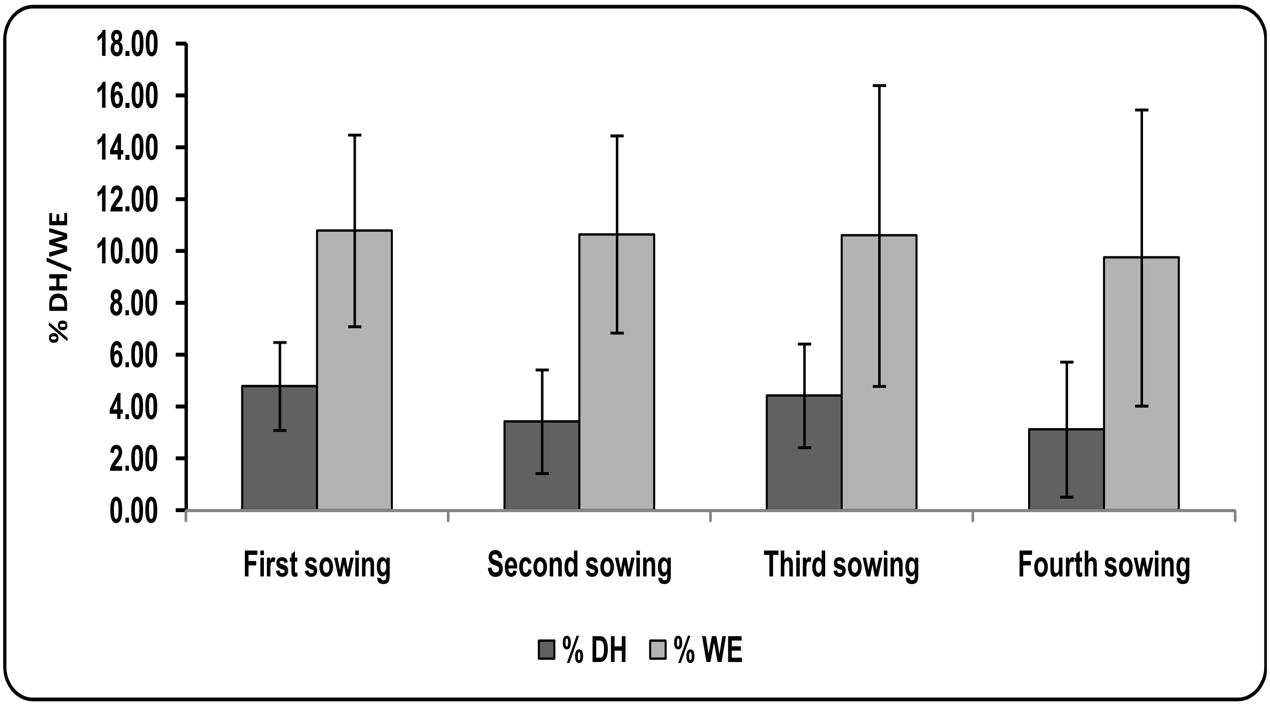
Main plots		**%DH**	**%WE**	**%LFDL**	**%WMDL**	**BPH (No./hill)**
1st sowing (19.07.2019)		8.7(3.0)a	14.5(3.9)a	1.3(1.3)b	1.5(1.4)b	5(2)ab
2nd sowing (26.07.2019)		8.7(3.0)a	14.4(3.8)a	1.9(1.5)a	1.5(1.4)b	6(2)a
3rd sowing (02.08.2019)		9.8(3.2)a	16.4(4.1)a	1.8(1.5)ab	1.8(1.5)a	5(2)b
4th sowing (09.08.2019)		10.8 (3.3)a	15.4(3.9)a	1.9(1.5)a	1.7(1.5)ab	6(2)a
LSD (0.05)	**Main plots**	**0.32**	**0.38**	**0.17**	**0.07**	**0.63**
CV(%)		**11.39**	**10.9**	**13.01**	**5.28**	**6.13**
Sub plots						
T1 = Broadcasting of Iron coated seed in 1-2 mm water level		7.7(2.8)b	15.0(3.9)a	1.6(1.4)a	1.3(1.3)b	5(2)ab
T2 = Broadcasting of Iron coated seed in wet soil condition		10.6(3.3)a	14.6(3.9)a	1.5(1.4)a	1.6(1.4)ab	5(2)ab
T3 = Broadcasting of un coated seed in 1-2 mm water level		9.5(3.1)ab	16.6(4.1)a	1.6(1.4)a	1.8(1.5)a	6(3)a
T4 = Broadcasting of un coated seed in wet soil condition		10.1(3.2)a	14.4(3.9)a	2.0(1.6)a	1.5(1.4)ab	5(2)b
T5 = Normal transplanting		9.6(3.1)ab	15.3(4.0)a	2.0(1.6)a	1.9(1.5)a	6(3)a
LSD (0.05)	**Sub plots**	**0.33**	**0.29**	**0.21**	**0.16**	**1.14**
CV(%)		**12.64**	**8.79**	**17.56**	**13.5**	**11.83**
1st sowing (19.07.2019)	T1	6.1(2.6)d	14.4(3.8)abc	1.1(1.2)de	1.2(1.3)b	5(2)abc
	T2	11.2(3.4)abc	14.1(3.8)abc	1.5(1.4)abcde	1.8(1.5)a	5(2)bc
	T3	8.9(3.0)abcd	14.7(3.9)abc	0.6(1.1)e	1.6(1.4)a	6(3)abc
	T4	7.9(2.9)bcd	15.5(4.0)abc	1.3(1.4)abcde	1.2(1.3)b	4(2)c
	T5	9.5(3.2)abcd	13.8(3.8)abc	2.1(1.6)abcd	1.9(1.5)a	6(2)abc
2nd sowing (26.07.2019)	T1	8.3(2.9)abcd	14.8(3.9)abc	1.1(1.3)cde	1.6(1.5)a	5(2)abc
	T2	9.5(3.2)abcd	15.6(4.0)abc	1.6(1.4)abcde	1.6(1.4)a	7(3)ab
	T3	8.9(3.0)abcd	15.6(4.0)abc	1.8(1.5)abcde	2.0(1.6)a	6(3)abc
	T4	7.8(2.9)bcd	13.7(3.8)abc	2.3(1.7)abc	1.0(1.2)b	4(2)c
	T5	9.0(3.1)abcd	12.5(3.6)bc	2.6(1.8)a	1.5(1.4)a	7(3)a
3rd sowing (02.08.2019)	T1	7.4(2.8)cd	15.7(4.0)abc	1.7(1.4)abcde	1.5(1.4)a	5(2)bc
	T2	10.3(3.3)abc	15.9(4.0)abc	1.6(1.4)abcde	1.6(1.4)a	5(2)abc
	T3	9.6(3.2)abcd	18.5(4.4)a	2.2(1.6)abcd	1.6(1.5)a	5(2)abc
	T4	12.1(3.5)ab	15.3(4.0)abc	2.1(1.6)abcd	1.8(1.5)a	5(2)bc
	T5	9.5(3.2)abcd	16.7(4.1)abc	1.5(1.4)abcde	2.2(1.6)a	5(2)abc
4th sowing (09.08.2019)	T1	9.0(3.1)abcd	14.9(3.9)abc	2.4(1.7)ab	1.0(1.2)b	6(2)abc
	T2	11.3(3.4)abc	13.0(3.6)c	1.2(1.3)bcde	1.4(1.3)b	5(2)abc
	T3	10.7(3.3)abc	17.7(4.3)ab	1.7(1.5)abcde	2.0(1.5)a	7(3)ab
	T4	12.5(3.6)a	13.3(3.7)bc	2.4(1.7)abcd	2.2(1.6)a	5(2)abc
	T5	10.3(3.3)abc	17.8(4.3)ab	1.8(1.5)abcd	1.9(1.5)a	5(2)abc
LSD (0.05)	**M in S**	**0.66**	**0.58**	**0.43**	**0.32**	**0.47**
	S in M	**0.67**	**0.64**	**0.42**	**0.3**	**0.44**

Table… Effect of Iron seed coating on pest incidence (ESCP) at Karjat, *Kharif* 2019

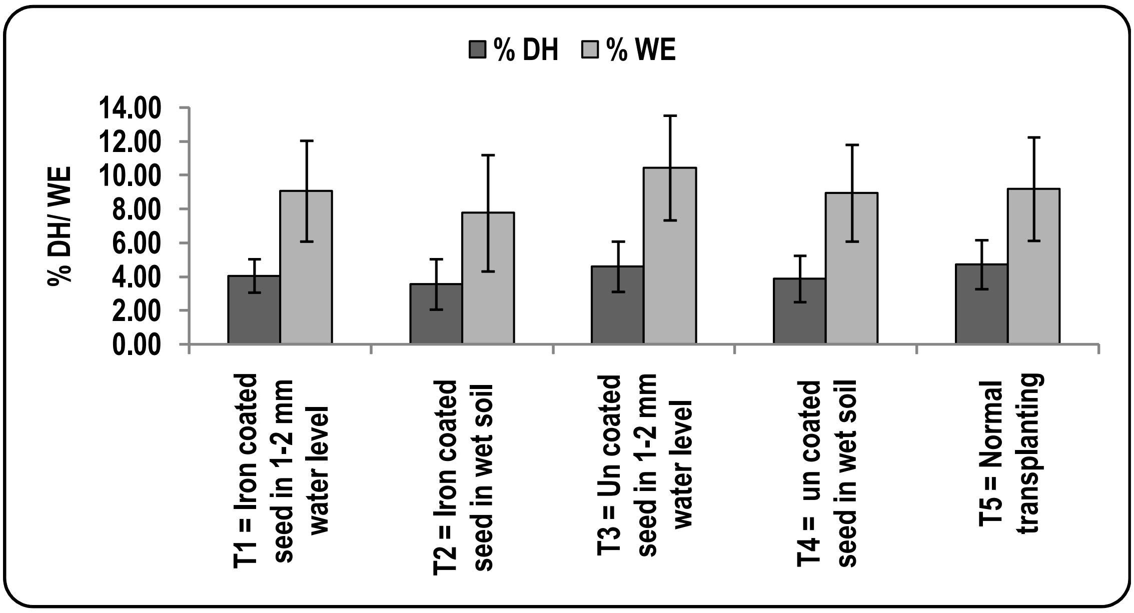
Main plots		% DH			% WE
		15 DAT	30 DAT	45 DAT	Pre har
1st sowing (03.07.2019)		6.4(2.5)a	2.0(1.4)a	2.1(1.5)a	7.1(2.7)a
2nd sowing (10.07.2019)		4.2(2.1)a	0.11(0.7)b	0.7(1.0)b	6.9(2.6)a
3rd sowing (17.07.2019)		4.9(2.1)a	1.7(1.4)a	1.3(1.3)ab	4.8(2.3)b
4th sowing (24.07.2019)		0.8(1.0)b	0.2(0.8)b	0.7(1.0)b	4.1(2.1)b
LSD (0.05)		**0.92**	**0.53**	**0.32**	**0.23**
CV(%)		**13.39**	**14.75**	**29.88**	**10.85**
Sub plots					
T1 = Broadcasting of Iron coated seed in 1-2 mm water level		4.8(2.1)a	1.4(1.2)a	1.9(1.5)a	6.0(2.5)ab
T2 = Broadcasting of Iron coated seed in wet soil		4.3(2.0)a	1.6(1.3)a	0.8(1.1)b	4.8(2.2)b
T3 = Broadcasting of un coated seed in 1-2 mm water level		3.7(1.7)a	0.5(0.9)a	0.7(1.1)b	7.1(2.7)a
T4 = Broadcasting of un coated seed in wet soil		3.2(1.8)a	0.9(1.1)a	1.5(1.3)ab	4.7(2.2)b
T5 = Normal transplanting		4.4(2.0)a	0.5(0.9)a	1.0(1.1)b	6.0(2.5)ab
LSD (0.05)		**0.57**	**0.36**	**0.30**	**0.42**
CV(%)		**15.36**	**10.15**	**30.53**	**20.74**
Interactions					
1st sowing (03.07.2019)	T1	4.6(2.2)abc	3.4(1.8)ab	3.1(1.9)a	6.2(2.6)abcd
	T2	5.3(2.4)abc	4.3(1.9)a	1.8(1.4)abc	4.6(2.2)bcd
	T3	10.3(3.2)a	0.8(1.0)cd	2.1(1.6)ab	9.6(3.1)a
	T4	4.9(2.2)abc	1.3(1.3)abcd	1.7(1.5)abc	6.4(2.6)abcd
	T5	6.6(2.5)abc	0.0(0.7)d	1.7(1.4)abc	8.3(2.9)ab
2nd sowing (10.07.2019)	T1	5.2(2.4)abc	0.0(0.7)d	1.0(1.2)bcd	6.5(2.6)abcd
	T2	4.6(2.2)abc	0.0(0.7)d	1.0(1.2)bcd	8.0(2.9)abc
	T3	3.1(1.9)abcd	0.0(0.7)d	0.0(0.7)d	8.8(3.0)ab
	T4	3.5(1.8)abcd	0.6(1.0)cd	0.5(1.0)cd	4.9(2.3)bcd
	T5	4.8(2.3)abc	0.0(0.7)d	1.1(1.2)bcd	6.2(2.5)abcd
3rd sowing (17.07.2019)	T1	8.4(2.8)a	2.2(1.6)abc	1.7(1.5)abc	6.0(2.5)abcd
	T2	5.5(2.2)abc	1.3(1.3)abcd	0.5(0.9)cd	3.3(1.9)d
	T3	1.2(1.1)cd	1.1(1.2)abcd	1.0(1.2)bcd	6.6(2.7)abcd
	T4	3.2(1.9)abcd	1.8(1.5)abc	2.6(1.7)ab	3.5(2.0)cd
	T5	6.1(2.5)ab	2.1(1.5)abcd	0.5(1.0)cd	4.7(2.3)bcd
4th sowing (24.07.2019)	T1	1.0(1.1)cd	0.0(0.7)d	2.0(1.6)abc	5.3(2.4)abcd
	T2	1.8(1.3)bcd	0.9(1.1)bcd	0.0(0.7)d	3.3(1.9)d
	T3	0.0(0.7)d	0.0(0.7)d	0.0(0.7)d	3.4(2.0)d
	T4	1.1(1.1)cd	0.0(0.7)d	1.0(1.2)bcd	3.8(2.1)cd
	T5	0.0(0.7)d	0.0(0.7)d	0.6(0.9)cd	4.8(2.3)bcd
LSD (0.05)	**M in S**	**1.14**	**0.72**	**0.62**	**0.84**
	S in M	**1.37**	**0.83**	**0.64**	**0.38**

Table…. Effect of Iron seed coating on insect pest incidence (ESCP) at Chiplima, *Kharif* 2019

Treatments	% DH		% WE	% SS		BPH	
	55 DAT	75 DAT	Pre har	55 DAT	75 DAT	55 DAT	75 DAT
T1: Fe coated flooded	3.0(1.9)b	5.5(2.4)b	6.2(2.6)a	16.0(4.0)b	11.8(3.5)b	17(4)bc	21(5)b
T2: Fe coated dry	2.4(1.7)b	1.6(1.4)c	3.9(2.1)b	11.0(3.4)c	7.4(2.8)c	9(3)d	12(3)c
T3: Hydro primed flooded	5.6(2.5)a	7.6(2.9)a	7.6(2.9)a	24.8(5.0)a	20.3(4.6)a	25(5)ab	39(6)a
T4: Hydro primed dry	2.6(1.7)b	5.0(2.3)b	7.8(2.9)a	14.8(3.9)b	10.5(3.3)b	16(4)cd	22(5)b
T5: Normal transplanting	7.4(2.8)a	5.5(2.4)b	6.3(2.6)a	30.3(5.5)a	18.9(4.4)a	26(5)a	39(6)a
LSD (0.05)	**0.56**	**0.47**	**0.38**	**0.54**	**0.46**	**0.84**	**1.03**
CV(%)	**14.01**	**10.83**	**7.84**	**6.6**	**6.63**	**10.16**	**10.81**



Fig… Effect of seed coating on pest incidence in different sowings across locations, *Kharif* 2019



Fig… Effect of seed coating on pest incidence across locations, *Kharif* 2019

Effect of iron seed coating on insect pest incidence (ESCP), initiated this year in collaboration with agronomy revealed, low pest incidence across the locations in different treatments. Stem borer incidence was at par in different seed coated treatments (0.5 – 10.6% DH & 3.9 – 16.6% WE) and also in different sowings (0.1 – 10.8% DH & 4.1 - 16.4% WE). However, gall midge (9.2 – 13.9% SS) and BPH incidence (11-19/hoppers hill) was found low in seed coated treatments compared to normal transplanting (24.6% SS & 33/hill) and T3 treatment with uncoated seed (22.6%SS & 32/hill).

4.2.5. Yield maximization in farmers' field using Nutrient Expert

To validate NE® tool, this collaborative trial was constituted along with IPNI during *kharif* 2014 and continued in *kharif* 2019 at 2 locations viz. **Chinsurah, and Titabar**. This year the trial was conducted in farmers' field. The treatments were as follows: T_1 – Recommended fertilizer recommendation of that region, T_2 – SSNM based on Nutrient Expert (Varies for each location), T_3 – Farmers fertilizer practice and T_4: Absolute control (Without NPK). SSNM based on Nutrient Expert treatment resulted in highest yield at Chinsurah (5.28 t/ha) and Titabar (5.76 t/ha).

4.2.5(R). Management practices for enhancing grain yield with green manure and nutrient management in rainfed upland rice

The present investigation was taken up to study the effect of phosphorus and green manure on productivity of rice at one locations (**Pattambi**). Experiment was laid out in factorial RBD design {M_1: Rice alone, M_2: Rice + GM (Sunhemp/Dhaincha/Green leaf manuring) and 5 subplots of phosphorus treatment (S_1: 0 kg P_2O_5/ha, S_2: 20 kg P_2O_5/ha, S_3: 40 kg P_2O_5/ha, S_4: Optional and S_5: Farmers practice.

In red lateritic soils of **Pattambi** the highest grain yield (5.08 t/ha) was observed under rice + green manure crop without phosphorus application to soil.

Table- 4.2.5.: Summary of data on grain yield and ancillary characters of rice from the trial on yield maximisation of rice through SSNM, Kharif-2019

Treatments	CHINSURAH				TITABAR					Over all mean	Rank
	Grain Yield (t/ha)	Tillers/m²	Panicle No./m²	Panicle wt (g)	Grain Yield (t/ha)	filled grains/ panicle	Panicle No./m²	Panicle wt (g)	Test wt (g)		
T1	5.19	352	308	3.08	5.22	257	240	5.09	21.53	5.21	2
T2	5.28	386	327	3.20	5.76	281	264	5.40	22.93	5.52	1
T3	4.66	345	276	2.93	4.26	220	219	4.41	18.63	4.46	3
T4	4.16	328	285	2.24	3.44	168	184	3.59	17.60	3.80	4
Expt. Mean	**4.82**	**353**	**299**	**2.86**	**4.67**	**231**	**227**	**4.62**	**20.18**	**4.75**	
CD(0.05)	0.3	51.1	27.84	0.39	0.35	27.44	14.63	0.4	1.33		
CV(%)	3.15	7.25	4.66	6.86	3.74	5.94	3.23	4.38	3.3		
Variety	-				Ranjit Sub-1						
Available NPK kg/ha	296:73.3: 280.4				405kg, 16kg, 222kg						
Fertilizer applied kglha	80:40:40(T1), 91:35:38(T2), 70:35:35(T3)				60:20:40(T1), 118:37:59(T2), 40:20:10(T3)						

T1 Recommended fertilizer recommendations of that region :

T2 SSNM based on Nutrient Expert (Varies for each location) :

T3 Farmers Fertilizer Practice

T4 Absolute control

Table 4.2.5: (Rabi YET-5)Management practices for enhancing grain yield with green manure and nutrient management in rainfed upland rice, Rabi - 2018-19.

Factor-I	Factor -II(NPK Schedules)	PATTAMBI					
		Grain Yield (t/ha)	Rank	Straw Yield (t/ha)	Panicle/m^2 (No.)	Test wt(g)	Filled grains/Panicle
M1 Rice alone	T1: 90-0-40	4.67	7	9.00	354	23.28	106
	T2: 90-23-45	5.01	2	8.77	361	22.38	104
	T3: 90-45-45	4.62	8	9.08	337	25.96	118
	T4: Optional	4.87	4	9.18	334	24.82	103
	T5: Farmer practice	4.77	5	8.67	340	22.40	118
M2- Rice+GM (Sunhemp/Dhaincha/Green leaf manuring)	T1: 90-0-40	5.08	1	10.60	365	24.31	74
	T2: 90-23-45	4.58	9	9.60	353	24.60	107
	T3: 90-45-45	4.77	5	10.77	344	25.72	97
	T4: Optional	4.93	3	9.82	360	27.72	105
	T5: Farmer practice	4.58	9	9.33	352	26.37	103
Interaction							
C.D.(0.05)		N/A		N/A	N/A	1.66	N/A
SE(m)		0.14		0.54	24	N/A	12.7
F1		4.79	2	8.94	345	23.77	110
F2		4.79	1	10.02	355	25.74	97
Mean of Factor I							
C.D.(0.05)		0.19		0.73	N/A	N/A	N/A
SE(m)		0.06		0.24	11	0.74	5.7
Mean of Factor II							
T1: 90-0-40		4.88	2	9.80	359	23.79	90
T2: 90-23-45		4.80	3	9.18	357	23.49	106
T3: 90-45-45		4.69	4	9.93	341	25.84	108
T4: Optional		4.90	1	9.50	347	26.27	104
T5: Farmer practice		4.68	5	9.00	346	24.38	110
C.D.(0.05)		N/A		N/A	N/A	N/A	N/A
SE(m)		0.10		0.39	17	1.17	8.9
Expt. Mean		**4.79**		**9.48**	**350**	**24.76**	**103**
Soil type		Red Lataritic					
pH		-					
Variety		-					
Available N:P:K of soil (kg/ha)		-					
	Optional:	Optional: PSB 2L/ha					

4.2.6. Water management for enhancing water use efficiency and weed control efficiency in different rice establishment methods

Increasing water scarcity is becoming real threat to rice cultivation. Hence water-saving technology needs to be developed which not only economically beneficial but also maintains soil health. Any approach that would lessen the amount of water use without compromising the rice yield would certainly be a welcome strategy. Introduction of SRI is an alternative practice to solve water crisis, and as a methodology for increasing the productivity of irrigated rice. AWD is also called 'intermittent irrigation' or 'controlled irrigation' which can reduce the water requirement by 30 % in irrigated rice system. To evaluate the suitable and promising irrigation management practices in different crop establishment methods a trial was formulated and conducted at 5 locations (**Chatha, Faizabad, Mandya, Pusa, and Varanasi**). Split plot design was adopted with 3 main plots of irrigation management {I_1: Flooding throughout crop growth (3 + / - 2 cm), I_2: Saturation maintenance up to PI and (3 + / - 2 cm) after PI and I_3: Alternate wetting and drying (irrigation at 5 -7 days interval with 5 cm/ha of water (5 cm irrigation at 3 DADPW) up to PI and (3 + / - 2 cm) after PI} and 6 subplots of crop establishment methods {T_1: Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice), T_2: Direct wet seeding on puddled soil (Use of Drum seeder/ dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice, T_3: Normal hand transplanting (20 x15 cm with flooding water management, 3-4 seedlings transplanted at 25-30 days old seedlings), T_4: Aerobic rice T_5: Direct broadcast dry seeding on well prepared unpuddled soil fb crop management practices for direct dry drill seeded rice and T_6: Optional- Location specific} and replicated thrice. The results were summarized and presented in **Table 4.2.3** and the salient findings are as followed.

At **Chatha**, Alternate wetting and drying recorded the highest grain yield (3.21 t/ha). Among establishment methods normal transplanting recorded the highest grain yield (3.23 t/ha). However, the lowest weed population and dry weight were observed under flooding throughout crop growth treatment and under normal transplanting method. In sandy loam soils of **Faizabad** Direct seeding (use of Drum seeder/dibbling of sprouted seed at 25 x 25 cm) long with saturation maintenance upto PI and (3 +/- 2 cm) after PI resulted the highest grain yield (5.44 t/ha). Among irrigation management treatments, saturation maintenance upto PI and (3 +/- 2 cm) after PI method resulted the highest grain yield (4.07 t/ha) than those of other treatments. Among establishment methods direct seeding (use of Drum seeder/dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice resulted the highest yield (4.65 t/ha). In red sandy loam soils of **Mandya**, interaction, main plots effect and sub plots effect were found to be non-significant. At **Pusa,** flooding throughout crop growth gave higher grain yield of 3.77 t/ha and normal transplanting was the best (4.13 t/ha) among all the establishment methods. In sandy loam soils of **Varanasi,** location specific wet broadcasting in puddle soil with alternate wet and drying gave the highest grain yield (5.1 t/ha). Weed population and dry weight were lower under flooding throughout crop growth treatment.

Higher cost of cultivation was recorded under flooding throughout crop growth at Mandya (Rs. 56717/-) and Varanasi (Rs. 32943/-). Similarly, input water was saved due to adoption of alternate wetting and drying was 49.0 cm at Varanasi and 66.9 cm at Mandya.

Grain yield across all the centers revealed that **alternate wetting and drying** resulted the highest grain yield among irrigation management treatments.

Table-4.2.6: Evaluation of Water management for enhancing Water use efficiency and Weed control efficiency in different rice establishment methods, Kharif-2019

Treatment		CHATHA										
Main Plot-Irrigation management practices	Crop establishment methods	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m² (No.)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at active tillering (no/m²)	Weed population panicle initiation (no/m²)	Weed dry weight at active tillering (g/m2)	Weed dry weight at panicle initiation (g/m²)
I 1- Flooding throughout crop growth (3 +/- 2cm)	M1	-	-	-	-	-	-	-	-	-	-	-
	M2	2.61	3.66	235	207	1.45	18.63	102	0.00(0.71)	24.67(5.02)	0.00	24.27
	M3	3.01	4.22	251	222	1.45	19.17	105	0.00(0.71)	20.67(4.60)	0.00	19.77
	M4	2.75	3.87	244	219	1.45	18.87	102	1.00(1.22)	23.33(4.88)	0.58	20.97
	M5	2.46	3.52	214	190	1.44	18.20	102	1.00(1.22)	20.33(4.56)	0.47	18.98
	M6	-	-	-	-	-	-	-	-	-	-	-
I 2- Saturation maintenance upto PI and (3 +/- 2 cm) after PI	M1	-	-	-	-	-	-	-	-	-	-	-
	M2	2.88	4.03	237	212	1.46	19.17	98	2.00(1.56)	49.33(7.06)	0.83	45.33
	M3	3.18	4.48	256	225	1.53	19.40	103	2.00(1.56)	45.67(6.79)	0.97	42.83
	M4	2.95	4.13	250	216	1.53	19.23	98	4.67(2.27)	45.67(6.79)	2.78	42.33
	M5	2.63	3.71	221	192	1.43	19.13	98	4.33(2.20)	46.67(6.87)	2.48	44.00
	M6	-	-	-	-	-	-	-	-	-	-	-
I 3- Alternate wetting and drying	M1	-	-	-	-	-	-	-	-	-	-	-
	M2	3.21	3.51	243	207	1.52	19.23	95	4.67(2.27)	51.67(7.22)	2.58	49.67
	M3	3.49	4.89	260	229	1.54	19.50	102	4.33(2.20)	46.00(6.82)	2.80	43.33
	M4	3.27	4.57	253	222	1.53	19.23	92	7.67(2.86)	48.00(6.96)	4.92	45.67
	M5	2.86	4.05	225	206	1.44	19.17	93	8.67(3.03)	51.33(7.20)	5.35	48.25
	M6	-	-	-	-	-	-	-	-	-	-	-
Interaction												
I and M		NS	NS	NS	5.31	0.02	0.12	0.86	NS	0.11	0.41	1.48
M and I		NS	NS	NS	5.11	0.02	0.11	0.83	NS	0.1	0.37	1.31
Mean of Irrigation												
I1		2.71	3.82	236	210	1.45	18.72	103	0.50(0.97)	22.25(4.77)	0.26	21.00
I2		2.91	4.09	241	211	1.49	19.23	99	3.25(1.90)	46.83(6.88)	1.77	43.62
I3		3.21	4.26	245	216	1.51	19.28	95	6.33(2.59)	49.25(7.05)	3.91	46.73
C.D. (0.05)		0.04	NS	2.21	NS	0.01	0.07	0.59	0.09	0.03	0.19	0.42
C.V. (%)		1.96	12.95	1.26	2.37	0.68	0.49	0.82	6.46	0.74	13.27	1.55
Method of Methods												
M1		-	-	-	-	-	-	-	-	-	-	-
M2		2.90	3.73	238	209	1.48	19.01	98	2.22(1.51)	41.89(6.43)	1.14	39.76
M3		3.23	4.53	256	225	1.51	19.36	103	2.11(1.49)	37.44(6.07)	1.26	35.31
M4		2.99	4.19	249	219	1.50	19.11	97	4.44(2.12)	39.00(6.21)	2.76	36.32
M5		2.65	3.76	220	196	1.44	18.83	98	4.67(2.15)	39.44(6.21)	2.77	37.08
M6		-	-	-	-	-	-	-	-	-	-	-
CD (0.05)		0.05	0.51	4.23	3.06	0.01	0.07	0.5	0.17	0.06	0.24	0.86
C.V. (%)		1.64	12.67	1.77	1.46	0.70	0.36	0.5	9.27	1.03	12.06	2.33
Experimental Mean		**2.94**	**4.05**	**241**	**212**	**1.48**	**19.08**	**99**	**1.82**	**6.23**	**1.98**	**37.12**
Soil type		-										
Variety		Basmathi - 370										
Available NPK kg/ha		-										

M1- Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice)

M2- Direct seeding (Use of Drum seeder/dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice

M3- Normal Transplanting (20 x 15 cm with flooding water management, transplanting of 3-4 seedlings of 25-30 days old

M4-Aerobic rice

M5- Direct broadcast dry seeding on well prepared unpuddled soil fb crop management practices for direct dry drill seeded rice (semi dry)

M6- Optional - Location specific

Table-4.2.6: Contd.

Treatment		FAIZABAD									
Main Plot-Irrigation management practices	Crop establishment methods	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2 (No.)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Weed population at active tillering (no/m2)	Weed population panicle initiation (no/m^2)	Weed dry weight at active tillering (g/m2)	Weed dry weight at panicle initiation (g/m^2)
I 1- Flooding throughout crop growth (3 +/- 2cm)	M1	3.73	12.13	208	180	3.39	24.95	5.25(2.39)	33.75(5.85)	4.38	10.10
	M2	4.24	11.77	287	212	3.46	25.40	1.50(1.40)	24.50(4.99)	1.17	4.65
	M3	2.53	7.95	205	162	3.69	24.45	6.25(2.59)	35.00(5.95)	5.22	12.75
	M4	2.23	7.13	201	133	3.46	24.60	8.25(2.96)	42.75(6.57)	5.63	13.55
	M5	2.68	8.70	178	118	3.26	24.72	12.25(3.56)	55.00(7.43)	5.02	14.10
	M6	-	-	-	-	-	-	-	-	-	-
I 2- Saturation maintenance upto PI and (3 +/- 2 cm) after PI	M1	4.38	13.82	199	180	3.71	25.25	4.25(2.17)	32.50(5.60)	2.57	8.23
	M2	5.44	14.67	298	274	3.38	26.15	0.50(0.97)	16.50(4.12)	0.47	3.45
	M3	3.62	11.48	213	171	3.63	25.35	5.50(2.44)	45.00(6.74)	5.02	10.30
	M4	3.40	10.52	227	165	3.46	25.40	8.25(2.95)	55.75(7.50)	4.25	12.20
	M5	3.54	11.14	207	143	3.49	25.02	8.25(2.95)	60.00(7.77)	4.10	13.32
	M6	-	-	-	-	-	-	-	-	-	-
I 3- Alternate wetting and drying	M1	4.27	12.90	225	178	3.57	24.33	12.75(3.63)	55.75(7.50)	3.73	12.80
	M2	4.28	13.42	294	210	3.53	74.97	8.25(2.95)	27.50(5.26)	1.70	3.88
	M3	2.92	9.10	198	175	3.16	24.13	9.50(3.15)	65.75(8.14)	4.13	13.77
	M4	3.68	9.26	208	139	3.56	24.17	14.25(3.84)	73.25(8.58)	5.85	15.10
	M5	3.79	10.44	185	140	3.36	24.40	16.50(4.12)	85.00(9.24)	5.47	14.92
	M6	-	-	-	-	-	-	-	-	-	-
Interaction											
I and M		0.26	NS	16.47	12.29	NS	NS	0.26	0.72	NS	NS
M and I		0.29	NS	16.58	11.96	NS	NS	0.27	0.73	NS	NS
Mean of Irrigation											
I1		3.08	9.53	216	161	3.45	24.82	6.70(2.58)	38.20(6.16)	4.28	11.03
I2		4.07	12.33	229	186	3.53	25.44	5.35(2.29)	41.95(6.35)	3.28	9.50
I3		3.79	11.02	222	168	3.44	34.40	12.25(3.54)	61.45(7.74)	4.18	12.09
C.D. (0.05)		0.22	0.39	9.81	6.04	NS	NS	0.17	0.46	NS	0.75
C.V. (%)		7.73	4.59	5.71	4.54	6.27	90.55	7.8	8.77	40.34	8.88
Method of Methods											
M1		4.12	12.95	211	179	3.56	24.84	7.42(2.73)	40.67(6.32)	3.56	10.38
M2		4.65	13.29	293	232	3.46	42.17	3.42(1.77)	22.83(4.79)	1.12	3.99
M3		3.02	9.51	205	169	3.50	24.64	7.08(2.73)	48.58(6.94)	4.79	12.27
M4		3.10	8.97	212	146	3.49	24.72	10.25(3.25)	57.25(7.55)	5.24	13.62
M5		3.33	10.09	190	133	3.37	24.72	12.33(3.54)	66.67(8.15)	4.87	14.12
M6		-	-	-	-	-	-	-	-	-	-
CD (0.05)		0.15	0.6	9.51	7.1	NS	NS	0.15	0.41	0.74	0.93
C.V. (%)		5.05	6.6	5.19	5.01	8.14	91.75	6.49	7.43	22.91	10.35
Experimental Mean		**3.65**	**10.96**	**222**	**172**	**3.47**	**28.22**	**2.80**	**6.75**	**3.92**	**10.88**
Soil type		Sandy loam									
pH		7.60									
Variety		NDR 2065									
Available NPK kg/ha		200:24:234									

M1- Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice)

M2- Direct seeding (Use of Drum seeder/dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice

M3- Normal Transplanting (20 x 15 cm with flooding water management, transplanting of 3-4 seedlings of 25-30 days old

M4-Aerobic rice

M5- Direct broadcast dry seeding on well prepared unpuddled soil fb crop management practices for direct dry drill seeded rice (semi dry)

M6- Optional - Location specific

Table-4.2.6: Contd…

Treatment		MANDYA									
Main Plot-Irrigation management practices	Crop establishment methods	Grain yield (t/ha)	Straw yield (t/ha)	Panicle/m² (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at active tillering (no/m2)	Weed population panicle initiation (no/m²)	Weed dry weight at active tillering (g/m2)	Weed dry weight at panicle initiation (g/m²)
I 1- Flooding throughout crop growth (3 +/- 2cm)	M1	7.31	8.19	407	3.01	27.09	96	3.33(1.93)	7.00(2.67)	0.75	1.33
	M2	7.14	8.70	337	3.15	27.30	93	7.00(2.73)	7.33(2.78)	1.47	1.99
	M3	7.01	7.93	321	3.67	26.44	96	2.67(1.65)	6.33(2.59)	0.38	1.68
	M4	-	-	-	-	-	-	-	-	-	-
	M5	-	-	-	-	-	-	-	-	-	-
	M6	6.52	6.35	331	2.96	27.38	92	9.33(3.09)	9.00(3.02)	1.51	1.68
I 2- Saturation maintenance upto PI and (3 +/- 2 cm) after PI	M1	7.11	8.31	408	3.08	28.11	96	5.00(2.34)	7.00(2.72)	0.64	1.64
	M2	6.78	7.97	349	3.28	27.62	93	8.67(3.00)	11.67(3.48)	0.98	2.43
	M3	7.69	8.89	375	3.71	27.70	95	6.33(2.60)	6.67(2.68)	0.88	1.46
	M4	-	-	-	-	-	-	-	-	-	-
	M5	-	-	-	-	-	-	-	-	-	-
	M6	6.58	7.76	355	2.31	28.30	92	7.67(2.82)	10.33(3.29)	1.52	2.45
I 3- Alternate wetting and drying	M1	6.69	8.29	409	2.89	27.57	95	6.33(2.59)	8.00(2.90)	0.98	1.48
	M2	7.41	8.31	375	3.81	26.99	92	7.67(2.81)	12.00(3.51)	1.29	2.53
	M3	6.83	8.71	353	3.64	27.48	96	5.33(2.40)	9.00(3.08)	0.72	1.43
	M4	-	-	-	-	-	-	-	-	-	-
	M5	-	-	-	-	-	-	-	-	-	-
	M6	7.33	8.72	380	2.87	28.76	93	7.00(2.69)	11.33(3.42)	1.27	2.86
Interaction											
I and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
M and I		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean of Irrigation											
I1		6.99	7.79	349	3.20	27.05	94	5.58(2.35)	7.42(2.76)	1.03	1.67
I2		7.04	8.23	372	3.10	27.93	94	6.92(2.69)	8.92(3.04)	1.01	2.00
I3		7.06	8.51	379	3.30	27.70	94	6.58(2.62)	10.08(3.23)	1.07	2.07
C.D. (0.05)		NS	0.27	13.47	NS	NS	NS	NS	NS	NS	NS
C.V. (%)		8.23	4.57	5.07	11.63	3.65	0.52	23.62	17.41	53.5	17.64
Method of Methods											
M1		7.04	8.26	408	2.99	27.59	96	4.89(2.29)	7.33(2.76)	0.79	1.48
M2		7.11	8.33	354	3.41	27.31	93	7.78(2.85)	10.33(3.26)	1.25	2.32
M3		7.18	8.51	350	3.68	27.21	96	4.78(2.22)	7.33(2.78)	0.66	1.52
M4		-	-	-	-	-	-	-	-	-	-
M5		-	-	-	-	-	-	-	-	-	-
M6		6.81	7.61	355	2.71	28.15	92	8.00(2.87)	10.22(3.24)	1.43	2.33
CD (0.05)		NS	NS	44.01	0.43	NS	0.67	0.46	0.43	0.44	0.56
C.V. (%)		13.96	13.92	12.11	13.71	2.69	0.72	18.11	14.45	43.06	29.51
Experimental Mean		**7.03**	**8.18**	**367**	**3.20**	**27.56**	**94**	**2.56**	**3.01**	**1.03**	**1.91**
Soil type		Red Sandy loam									
pH		6.93									
Variety		MTU 1001									
Available NPK kg/ha		367:106:262									

M1- Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice)

M2- Direct seeding (Use of Drum seeder/dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice

M3- Normal Transplanting (20 x 15 cm with flooding water management, transplanting of 3-4 seedlings of 25-30 days old

M4-Aerobic rice

M5- Direct broadcast dry seeding on well prepared unpuddled soil fb crop management practices for direct dry drill seeded rice (semi dry)

M6- Optional - Location specificLocation specific (Sprouted rice or wet direct seeded rice- broadcasting of sprouted seed in puddled soil fb crop management practices as per direct wet seeded rice)

Table-4.2.6: Contd…

Treatment		VARANASI							
Main Plot- Irrigation management practices	Crop establishment methods	Grain yield (t/ha)	Straw yield (t/ha)	Panicle/m^2 (No.)	Panicle wt (g)	Test wt (g)	Days for 50% flowering	Weed population at active tillering (no/m2)	Weed dry weight at active tillering (g/m2)
I 1- Flooding throughout crop growth (3 +/- 2cm)	M1	4.71	6.35	244	3.72	21.0	94.08	7.55(2.84)	8.35
	M2	4.73	6.38	249	3.74	21.3	94.08	7.50(2.83)	8.31
	M3								
	M4	4.48	6.11	242	3.58	20.7	92.77	10.14(3.26)	11.24
	M5	4.76	6.82	215	3.25	20.1	93.1	8.99(3.08)	10.37
	M6	3.99	5.6	223	3.54	19.5	92.45	8.46(2.99)	9.46
I 2- Saturation maintenance upto PI and (3 +/- 2 cm) after PI	M1	4.86	6.64	260	3.71	21.4	92.45	8.97(3.08)	10.83
	M2	5.04	6.91	233	3.52	21.1	89.83	7.77(2.87)	8.95
	M3								
	M4	4.71	6.52	236	3.64	20.2	91.14	11.47(3.46)	13.21
	M5	4.18	6	243	3.67	19.3	91.14	9.13(3.10)	10.76
	M6	4.09	5.8	248	3.32	21.7	91.79	8.23(2.95)	10.09
I 3- Alternate wetting and drying	M1	5.08	6.91	291	3.74	22.3	91.47	6.90(2.72)	7.79
	M2	4.76	6.43	291	3.85	21.1	90.16	7.51(2.83)	8.81
	M3								
	M4	4.75	6.52	253	3.71	21.5	89.18	10.35(3.29)	12
	M5	4.02	5.7	220	3.29	21.6	91.14	8.79(3.05)	9.96
	M6	5.1	7.28	252	3.65	20.4	90.49	8.34(2.97)	10.09
Interaction									
I and M		0.14	0.15	17.61	0.23	0.5	NS	0.09	0.55
M and I		0.14	0.14	16.92	0.31	0.46	NS	0.08	0.51
Mean of Irrigation									
I1		4.54	6.25	235	3.56	20.5	93.3	8.53(3.00)	9.54
I2		4.58	6.38	244	3.57	20.7	91.27	9.11(3.09)	10.77
I3		4.74	6.57	262	3.65	21.4	90.49	8.38(2.97)	9.73
C.D. (0.05)		0.07	0.08	10.1	NS	0.14	0.87	0.04	0.22
C.V. (%)		2.28	1.86	6.31	14.94	1.05	1.47	1.98	3.41
Method of Methods									
M1		4.88	6.63	265	3.72	21.5	92.66	7.81(2.88)	8.99
M2		4.85	6.57	258	3.7	21.2	91.36	7.59(2.84)	8.69
M3									
M4		4.64	6.39	244	3.65	20.8	91.03	10.65(3.34)	12.15
M5		4.32	6.17	226	3.4	20.3	91.79	8.97(3.08)	10.36
M6		4.4	6.23	241	3.5	20.5	91.58	8.34(2.97)	9.88
CD (0.05)		0.08	0.09	10.17	0.13	0.29	NS	0.05	0.32
C.V. (%)		1.85	1.41	4.23	3.78	1.43	1.23	1.69	3.25
Experimental Mean		4.62	6.4	247	3.59	20.9	91.68	3.02	10.01
Soil type		Sandy loam							
pH		7.32							
Variety		HUR 4-3							
Available NPK kg/ha		239:19:186							

M1- Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice)
M2- Direct seeding (Use of Drum seeder/dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice
M3- Normal Transplanting (20 x 15 cm with flooding water management, transplanting of 3-4 seedlings of 25-30 days old
M4-Aerobic rice
M5- Direct broadcast dry seeding on well prepared unpuddled soil fb crop management practices for direct dry drill seeded rice (semi dry)
M6- Optional * M6- Wet Broad casting

Table-4.2.6: Contd…

Treatment		PUSA			Over all Mean	Rank	Cost of Cultivation Rs/ha		Water input mm/ha	
Main Plot-Irrigation management practices	Crop establishment methods	Grain yield (t/ha)	Panicle/m2 (No.)	Panicle wt (g)			MANDYA	VARANASI	MANDYA	VARANASI
I 1- Flooding throughout crop growth (3 +/- 2cm)	M1				5.25	6	56966	37985	1800.4	1450
	M2	3.83	219	2.91	4.51	10	55734	32472	1829.29	1450
	M3	4.24	231	2.89	4.20	12	59526		1929.29	
	M4	3.72	221	2.91	3.30	18		31385		1450
	M5	3.32	212	3.03	3.31	17		29985		1450
	M6				5.26	5	54641	32885	1894.29	1450
I 2- Saturation maintenance upto PI and (3 +/- 2 cm) after PI	M1				5.45	2	56009	37645	1331.51	1210
	M2	3.53	214	2.93	4.73	7	54652	32132	1400.96	1210
	M3	4.15	223	2.92	4.66	8	59265		1505.96	
	M4	3.44	215	2.93	3.63	14		31045		1210
	M5	3.04	200	2.95	3.35	16		29645		1210
	M6				5.34	4	53894	32545	1410.4	1210
I 3- Alternate wetting and drying	M1				5.35	3	55279	37305	1092.62	960
	M2	3.41	212	2.93	4.61	9	54742	31792	1186.18	960
	M3	4.02	220	2.91	4.32	11	58188		1292.62	
	M4	3.34	210	2.94	3.76	13		30705		960
	M5	3.04	202	2.96	3.43	15		29305		960
	M6				6.22	1	54081	32205	1203.73	960
Interaction										
I and M		NS	NS	NS						
M and I		NS	NS	NS						
Mean of Irrigation										
I1		3.77	220.75	2.94	4.22	3	56717	32943	1863.32	1450
I2		3.54	213	2.93	4.43	2	55955	32603	1412.21	1210
I3		3.45	211.08	2.93	4.45	1	55573	32263	1193.79	960
C.D. (0.05)		0.13	NS	NS						
C.V. (%)		4.89	4.9	0.99						
Method of Methods										
M1					5.35	2	56085	37645	1408.18	1207
M2		3.59	215	2.92	4.62	3	55043	32132	1472.14	1207
M3		4.13	224.67	2.91	4.39	4	58993		1575.96	
M4		3.5	215.44	2.93	3.56	5		31045		1207
M5		3.13	204.67	2.98	3.36	6		29645		1207
M6					5.61	1	54206	32545	1502.81	1207
CD (0.05)		0.19	12.39	NS						
C.V. (%)		5.28	5.82	7.25						
Experimental Mean		3.59	214.94	2.93	4.37		56081	32603	1489.77	1207
Soil type		-								
pH		-								
Variety		Abhishek								
Available NPK kg/ha		-								

M1- Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice)
M2- Direct seeding (Use of Drum seeder/dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice
M3- Normal Transplanting (20 x 15 cm with flooding water management, transplanting of 3-4 seedlings of 25-30 days old
M4-Aerobic rice
M5- Direct broadcast dry seeding on well prepared unpuddled soil fb crop management practices for direct dry drill seeded rice (semi dry)
M6- Optional

4.2.6(Rabi) Water management for enhancing water use efficiency and weed control efficiency in different rice establishment methods (Rabi 2018-19)

Increasing water scarcity is becoming real threat to rice cultivation. Hence water-saving technology needs to be developed which not only economically beneficial but also maintains soil health. Any approach that would lessen the amount of water use without compromising the rice yield would certainly be a welcome strategy. Introduction of SRI is an alternative practice to solve water crisis, and as a methodology for increasing the productivity of irrigated rice. AWD is also called ‘intermittent irrigation’ or ‘controlled irrigation’ which can reduce the water requirement by 30 % in irrigated rice system. To evaluate the suitable and promising irrigation management practices in different crop establishment methods a trial was formulated and conducted at **Puducherry** during both *Kharif* 2018 and continued in *Rabi* 2018-19. Split plot design was adopted with 3 main plots of irrigation management {I_1: Flooding throughout crop growth (3 + / - 2 cm), I_2: Saturation maintenance upto PI and (3 + / - 2 cm) after PI and I_3: Alternate wetting and drying (irrigation at 5 -7 days interval with 5 cm/ha of water (5 cm irrigation at 3 DADPW) up to PI and (3 + / - 2 cm) after PI} and 4 subplots of crop establishment methods {T_1: Mechanical Transplanting method on puddled soil (crop management methods same as for puddled transplanted rice), T_2: Direct wet seeding on puddled soil (Use of Drum seeder/ dibbling of sprouted seed at 25 x 25 cm) fb crop management practices as per direct wet seeded rice, T_3: Normal hand transplanting (20 x15 cm with flooding water management, 3-4 seedlings transplanted at 25-30 days old seedlings), and T_4: Optional- Location specific} and replicated thrice. The results were summarized and presented in **Table 4.2.6(R)** and the salient findings are as followed.

In **Puducherry,** alternate wetting and drying and mechanical transplanting resulted in the highest grain yield of 6.21 and 6.17 t/ha, respectively. Similarly, during *Rabi* also alternate wetting and drying method and mechanical transplanting recorded the highest grain yield of 7.06 t/ha and 7.24 t/ha respectively. Total rice production was highest (K+R with AWD method (13.27 t/ha) over saturation (12.67) and normal flooding (12.25). Among the crop establishment methods, mechanical transplanting recorded as significant. Water input was significantly reduced in AWD method 1593 mm/ha as compared to saturation and flooding throughout crop growth 1603 and 1613 mm/ha respectively. Lower weed population and dry weight were observed in alternate wetting and drying treated plots. Mechanical transplanted plots also registered the lowest weed population and dry weight.

Higher cost of cultivation was recorded in normal transplanting method 46375 Rs/ha as compared to DSR in puddle (43755 Rs/ha) and mechanical transplanting (44425 Rs/ha). There is a saving of 5% cost of cultivation due to mechanical transplanting.

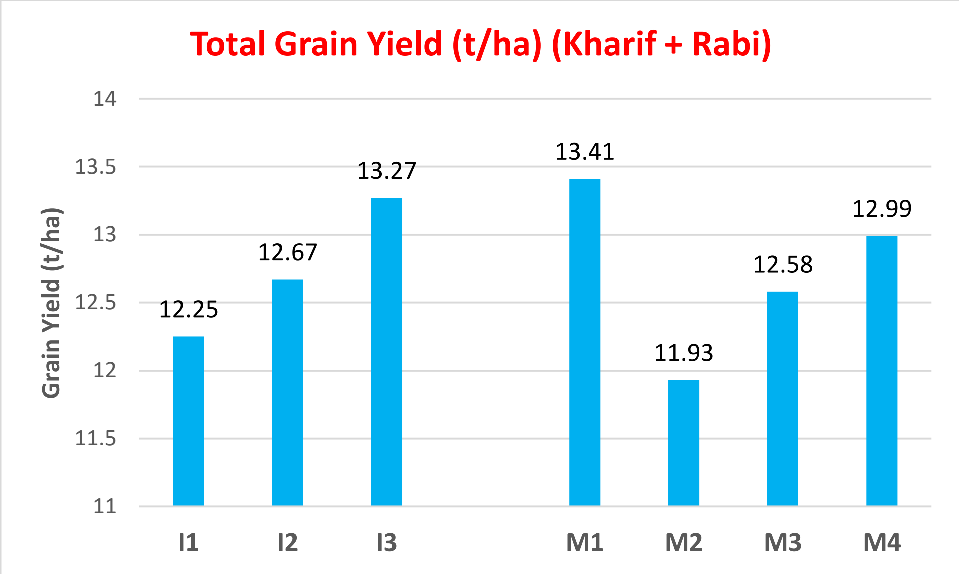


Fig. Mean rice grain yield as affected by irrigation management and crop establishment methods

Over all mean grain yield of the trial revealed that **alternate wetting and drying** resulted the highest grain yield (7.06 t/ha) among irrigation management treatments. At **Puducherry**, mean grain yield of 13.41 t/ha over other methods (11.93 t/ha to 12.99 t/ha) was recorded with mechanical transplanting,. Higher grain yield was recorded with different crop establishment methods (6.79 to 7.36 t/ha) under alternate wetting and drying method over other irrigation methods. Similarly, among crop establishment methods **mechanical transplanting** resulted the highest grain yield (7.24t/ha) and 6.17 t/ha and an average grain yield increase was to the tune of 7 % over normal transplanting method.

Table-4.2.6: (Rabi) Evaluation of Water management for enhancing Water use efficiency and Weed control efficiency in different rice establishments methods, Rabi-2018-19

Treatment		PUDUCHERRY										
Main Plot-Irrigation management practices	Crop establishment methods	Kharif 2018 Grain yield (t/ha)	Rabi 2018-19 Grain yield (t/ha)	Straw yield (t/ha)	REY	Panicle wt (g)	Weed population (no/m²) Grasses	Sedges	BLW	Weed dry weight (g/m2)	Cost of Cultivation Rs/ha	Water input mm/ha
I 1- Flooding throughout crop growth (3 +/- 2cm)	M1	5.82	7.09	12.07	12.91	4.02	9.36(3.14)	16.11(4.07)	10.57(3.33)	34.35	44425	1552
	M2	5.21	6.26	10.65	11.47	3.56	10.60(3.33)	22.22(4.77)	14.04(3.81)	41.88	43755	1530
	M3	5.43	6.55	11.15	11.98	3.69	10.03(3.24)	19.25(4.44)	13.38(3.72)	38.85	46375	1617
	M4	5.72	6.88	11.72	12.60	3.84	9.82(3.21)	17.40(4.23)	12.59(3.62)	36.74	50450	1753
I 2- Saturation maintenance upto PI and (3 +/- 2 cm) after PI	M1	6.22	7.26	12.36	13.48	4.34	6.99(2.74)	14.19(3.83)	9.99(3.24)	32.05	44425	1542
	M2	5.32	6.37	10.84	11.69	3.84	8.86(3.06)	17.88(4.29)	12.68(3.63)	39.01	43755	1520
	M3	5.73	6.84	11.65	12.57	4.05	7.93(2.90)	16.27(4.09)	11.72(3.50)	37.45	46375	1607
	M4	6.02	6.92	11.79	12.94	4.15	7.47(2.82)	15.15(3.96)	10.86(3.37)	34.86	50450	1743
I 3- Alternate wetting and drying	M1	6.46	7.36	12.52	13.82	4.44	5.57(2.46)	11.15(3.41)	8.31(2.97)	28.68	44425	1532
	M2	5.86	6.79	11.54	12.65	4.12	7.01(2.74)	17.28(4.22)	11.08(3.40)	35.92	43755	1510
	M3	6.19	7.01	11.94	13.20	4.21	6.77(2.70)	15.15(3.96)	10.50(3.32)	34.13	46375	1597
	M4	6.32	7.10	12.76	13.42	4.26	6.26(2.60)	13.13(3.69)	9.90(3.22)	32.95	50450	1733
Interaction												
I and M		NS	NS	NS		NS	0.04	0.05	0.05	0.81		
M and I		NS	NS	NS		NS	0.04	0.05	0.04	0.75		
Mean of Irrigation												
I1		5.55	6.70	11.40	12.25	3.77	9.96(3.23)	18.74(4.38)	12.64(3.62)	37.96	46251	1613
I2		5.82	6.85	11.66	12.67	4.09	7.81(2.88)	15.87(4.04)	11.31(3.43)	35.84	46251	1603
I3		6.21	7.06	12.19	13.27	4.26	6.40(2.63)	14.18(3.82)	9.95(3.23)	32.92	46251	1593
C.D. (0.05)		0.11	0.08	0.34		0.03	0.02	0.02	0.02	0.42		
C.V. (%)		2.57	1.52	3.93		1.16	1.02	0.78	0.92	1.62		
Method of Methods												0
M1		6.17	7.24	12.31	13.41	4.27	7.31(2.78)	13.81(3.77)	9.62(3.18)	31.69	44425	1542
M2		5.46	6.47	11.01	11.93	3.84	8.83(3.04)	19.13(4.42)	12.60(3.62)	38.94	43755	1520
M3		5.78	6.80	11.58	12.58	3.98	8.24(2.95)	16.89(4.16)	11.87(3.51)	36.81	46375	1607
M4		6.02	6.97	12.09	12.99	4.08	7.85(2.88)	15.23(3.96)	11.11(3.40)	34.85	50450	1743
CD (0.05)		0.17	0.09	0.34		0.05	0.02	0.03	0.03	0.47		
C.V. (%)		2.86	1.37	2.96		1.26	0.76	0.73	0.79	1.33		
Experimental Mean		**5.86**	6.87	11.75	12.73	4.04	2.91	4.08	3.43	35.57	46251	1603
Soil type		Clay loam	-									
pH		6.62	8.02									
Variety		CO-52	ADT-53									
Available NPK kg/ha		324.8:36.3:200	134:37:205									

M1:Mechanical Transplanting method on puddled soil (Crop management methods same as for puddled transplanted rice)

M2:Direct wet seeding on puddled soil (Drum seeder /dibbling of sprouted seed at 25x25)fb crop management practices as per direct wet seeded rice

M3:Normal hand Transplanting (20X15 cm with flooding water management, 3-4 seedlings transplanted at 25-30 days old seedlings)

M4:Optional -Location Specific

WEED MANAGEMENT TRIALS

WEED MANAGEMENT TRIAL

Among the various constraints, weed competition is going to be the major factor limiting higher productivity. In transplanted conditions, the yield loss due to weeds range from 15 to 30%. Most of the farmers in the intensive cropping areas are shifting to direct seeding practices, due to shortage of labour or scarcity of water, energy, electricity etc. Additionally, the late onset of monsoon and unpredictable rainfall patterns (which are indirectly due to global warming) during recent years are also prompting farmers to go for dry direct seeding or wet direct seeding under puddled conditions. In drill seeded or direct seeded rice under puddled conditions, the weeds grow vigorously and the level of infestation and competitiveness are going to be the major challenges to farmers and researchers alike and the grain yield losses in these rice ecosystems are much more (30-91%). Therefore, it is necessary to incorporate the chemical methods aimed at inhibiting the metabolic processes, in integrated weed management practices. A total of four weed management studies were carried out during Kharif 2019 to assess the performance of new herbicides, long term weed dynamics in different crop establishment methods, identifying weed resistant cultivars and Integrated Pest Management (a collaboration trial).

4.3.1: Evaluation of Bio efficiency of Thiobencarb in wet direct sown rice

Thiobencarb is a systemic, pre emergence herbicide that acts by inhibiting shoots of emerging weed seedlings. It controls many annual grasses and some selected broad leaves, with good selectivity between rice and weeds, with the objective of evaluating the bio efficiency of thiobencarb at different doses in wet direct sown rice in comparison to the promising pre and post emergence herbicides at different locations viz**., ICAR-Indian Institute of Rice Research- Hyderabad, Malan, Puducherry** and **Raipur** during *kharif* 2019, The results of second consecutive season are presented in the table 4.3.1 and discussed here under.

The dominant weed flora of the test locations comprised *Echinochloa colona, E.crusgalli, Dinebra retroflexa, Panicum sps., Cyperus rotundus, Cyperus difformis, Fimbristylis miliaceae, Eclipta alba, Ammania baccifera etc.*

At all the test locations, the treatment of two hand weedings has recorded highest grain yield followed by standard check of bispyribacsodium application, test herbicide Thiobencarb @ 5 lit/ha (higher dose), and superior over other treatments. The higher dose of thiobencarb statistically on par with standard check of post emergence herbicide and hand weeding twice at all the test locations except **Malan**. The result of data analysis on straw yield showed that hand weeding twice recorded was superior followed by the test herbicide thiobencarb @ 5 lit/ha, post emergence herbicide bispyribacsodium application. The results of data analysis on yield attributes viz., no. of panicles per m^2, panicle weight, filled grain percentage, test weight have clearly indicated the trend of grain yield and straw yield and contributed to the yield performance.

The grain yield loss (%) by different locations ranged from 15.36 to 41.16% in unweeded control plots. The treatments showed minimum loss of 2.13% & 2.98% at **Puducherry** with thiobencarb @ 5 lit/ha, post-emergence herbicide bispyribacsodium application respectively. The test herbicide thiobencarb @ 5 lit/ha recorded minimum yield loss at all the locations and comparable with standard post-emergence check.

The data on weed population indicated the dominance of broad leaf weeds followed by grasses at IIRR Hyderabad; dominance of grasses followed by broad leaf weeds at Malan and Puducherry; dominance of sedges followed by grasses at **Raipur**. The weed population before herbicide application was considerably higher at **ICAR-IIRR, Hyderabad; Malan, Puducherry** and **Raipur**. The weed population at 10-15 days after herbicide application showed reduction in weed population of all the groups. The weed population before herbicide application at 45-50 days after planting/sowing also recorded lower weed population than the population of all groups. This result has indicated that the herbicides tested have residual effect for nearly 1 month after application. The data on weed biomass exhibited similar trend as that of weed population before herbicide application, 10-15 days after herbicide application and 45-50 days after herbicide application.

Among the herbicide treatments at **ICAR-IIRR**, standard pre-emergence check and Thiobencarb @ 5 lit/ha recorded lower no of brad lead weeds & sedges at 10-15 days after herbicide application; lower no. of grasses and sedges at **Puducherry** whereas at **Malan** and **Raipur** standard post-emergence check and Thiobenarb @ 5 lit/ha recorded lower population of grasses and sedges. At 45-50 days after sowing/planting, standard post emergence check and thiobencarb @ 5 lit/ha recorded lower weed population and weed biomass which are statistically on par with hand weeding twice.

The results of weed control efficiency showed highest with hand weeding twice at all the test locations. Among the herbicide treatments, standard post-emergence check herbicide followed by thiobencarb @ 5 lit/ha at **ICAR-IIRR**, **Malan** and **Raipur**. Whereas, at **Puducherry**, thiobencarb @ 5 lit/ha followed by standard pre-emergence check herbicide recorded higher weed control efficiency.

Pooled analysis of the multi locational data indicated that the loss of grain yield due to weeds was lowest (4.97%) with standard check post emergence herbicide bispyribacsodium @ 300ml/ha and highest (31.79%) with unweeded control. Among the dosages of thiobencarb, 5l/ha has contributed to higher grain yield of 5.30 t/ha resulting in lower grain yield loss of 5.86% and was statistically on par with standard check herbicide bispyribacsodium. Thiobencarb@ 4 l/ha and pre emergence standard check herbicide Pyrazosulfuron-ethyl @ 200g/ha were on par and inferior to higher dose i.e., 5 l/ha. The hand weeding twicesignificantly out yielded other treatment combinations. Straw yield was significantly higher with hand weeding twice and post emergence standard check herbicide bispyricbacsodium @ 300 ml/ha.

The data on weed population showed that standard check pre-emergence herbicide pyrazosulfuron resulted in significant low weed population and weed biomass before post emergence herbicides application. The data on weed population and weed biomass at 15 days after herbicide application showed that among the post-emergence herbicides, thiobencarb @ 5 lit/ha.

Based on the second season (kharif 2019) multi-location study at **ICAR-IIRR Hyderabad,Malan, Puducherry and Raipur**, the systemic post emergence herbicide thiobencarb @5 l/ha was found superior resulting in higher weed control efficiency; higher grain yields;and the performance was comparable to hand weeding twice and standard post emergence herbicide bispyribacsodium@ 300 ml/ha.

Based on the multi-locational two consecutive season study (kharif 2018 and kharif 2019), the results showed that, the systemic post emergence herbicide thiobencarb @5 l/ha was found superior resulting in higher weed control efficiency; higher grain yields;and the performance was comparable to hand weeding twice and standard post emergence herbicide bispyribacsodium@ 300 ml/ha.

Table-4.3.1: Summary of data on grain yield, yield attributes, weed parameters & weed control efficiency in the trial on "Evaluation of bioefficacy of Thiobencarb 80 EC in puddled DSR", Kharif - 2019.

Treatments	Grain Yield (t/ha)				Straw Yield (t/ha)				No. of panicles/m2			
	ICAR-IIRR	Malan	Puducherry	Raipur	ICAR-IIRR	Malan	Puducherry	Raipur	ICAR-IIRR	Malan	Puducherry	Raipur
T1	6.08	2.20	6.56	3.80	6.83	3.02	8.69	5.07	379	231	347	226
T2	6.20	2.21	6.65	4.60	7.03	3.09	8.72	5.61	384	250	351	244
T3	6.68	2.74	6.88	4.91	7.59	3.84	8.87	5.61	400	299	374	270
T4	6.29	2.46	6.45	4.55	7.74	3.44	8.41	5.48	363	265	331	235
T5	6.9	2.95	6.82	4.74	7.79	4.03	8.91	5.48	389	301	357	262
T6	4.17	1.94	5.95	3.32	5.23	2.63	7.62	4.65	277	173	313	215
T7	7.15	3.06	7.03	5.31	8.22	4.13	9.07	5.91	421	303	388	279
Exp. mean	**6.21**	**2.51**	**6.62**	**4.46**	**7.21**	**3.45**	**8.61**	**5.4**	**373**	**260**	**352**	**247**
CD(0.05)	0.63	0.23	0.23	0.32	0.7	0.36	0.33	0.53	32.29	13.92	14.65	33.43
Applied fertilizer doses (N-P-K-Zn kg/ha)	120:50:60	90:40:40	120:40:40	100:60:40								
Name of the variety	DRR Dhan 52	HPR 2880	DRR Dhan 52	IGKV R1								
Soil type	Clay	Slity clay loam	Clay	Clay loam								
pH	7.2	5.7	6.62	7.19								
EC	-		0.2	0.21								

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	Panicle weight(g)				Filled grains % per panicle				Test weight (g)				Grain yield loss %			
	ICAR-IIRR	Malan	Puducherry	Raipur	ICAR-IIRR	Malan	Puducherry	Raipur	ICAR-IIRR	Malan	Puducherry	Raipur	ICAR-IIRR	Malan	Puducherry	Raipur
T1	3.99	1.73	4.95	2.55	92.81	82.43	93.46	88.63	27.41	24.20	27.00	33.13	14.96	28.10	6.68	28.43
T2	4.63	1.80	5.57	2.73	92.92	85.33	94.43	89.20	27.86	24.87	27.68	33.25	13.28	27.77	5.40	13.37
T3	4.88	1.88	5.62	3.26	94.39	91.50	95.13	89.50	27.88	26.37	27.96	33.56	6.57	10.45	2.13	7.53
T4	3.90	1.80	4.60	2.67	93.51	86.93	90.39	89.70	26.30	25.77	26.53	33.14	12.02	19.60	8.25	14.31
T5	3.95	2.00	5.69	3.07	93.38	93.33	94.91	89.07	29.02	26.60	27.86	33.35	3.49	3.59	2.98	10.73
T6	3.79	1.67	4.25	2.43	88.11	78.47	87.41	85.00	25.92	22.70	25.35	32.95	41.16	36.60	15.36	37.47
T7	4.96	2.04	5.79	3.40	95.21	93.70	96.20	90.17	30.64	26.80	28.77	33.76	-	-		-
Exp. mean	**4.3**	**1.85**	**5.21**	**2.87**	**92.9**	**87.39**	**93.13**	**88.75**	**27.86**	**25.33**	**27.31**	**33.31**				
CD(0.05)	0.82	0.09	0.22	0.32	3.58	1.9	3.82	1.88	1.74	0.54	1.01	1.1				

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS

T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS

T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS

T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application

T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application

T6- Control (weedy)

T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	ICAR-IIRR									
	Weed population before herbicide spraying no/m^2				Weed population at 10-15 DAHA no/m^2					
	Grasses	Sedges	BLW	Total weeds	Grasses		Sedges	BLWs	Total weeds
	Echinocloa colona	Cyperus rotundus	Eclipta alba		Echinocloa colona	Dinebra	Cyperus rotundus	Eclipta alba	G+S+Blw
T1	28.00(5.32)	9.67(3.15)	56.67(7.55)	94.33(9.73)	15.33(3.97)	0.00(0.71)	8.67(3.02)	47.33(6.91)	71.33(8.47)
T2	17.00(4.17)	5.33(2.31)	48.00(6.95)	70.33(8.40)	11.33(3.41)	0.00(0.71)	4.00(1.91)	44.67(6.70)	60.00(7.76)
T3	19.00(4.39)	10.67(2.92)	47.00(6.88)	76.67(8.78)	10.67(3.34)	0.00(0.71)	2.67(1.44)	41.33(6.47)	54.67(7.42)
T4	-	-	-	-	21.33(4.60)	4.00(1.65)	2.67(1.44)	30.67(5.58)	58.67(7.65)
T5	21.00(4.62)	7.00(2.02)	34.67(5.86)	62.67(7.94)	6.00(2.29)	4.67(2.06)	8.67(3.02)	32.67(5.69)	52.00(7.23)
T6	20.00(4.47)	12.00(3.43)	28.00(5.28)	60.00(7.73)	29.33(5.45)	15.33(3.89)	21.33(4.56)	66.00(8.15)	132.00(11.47)
T7	14.67(3.89)	4.00(2.06)	26.00(5.15)	44.67(6.72)	2.00(1.47)	0.00(0.71)	2.00(1.32)	4.00(1.91)	8.00(2.83)
Exp. mean	4.48	2.65	6.28	8.22	3.5	1.49	2.39	5.92	7.55
CD(0.05)	**0.89**	**1.76**	**1.04**	**1.05**	**1.15**	**1.41**	**1.82**	**1.24**	**1.4**

***Values in parentheses are transformed figures.**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	ICAR-IIRR						
	Weed population at 45-50 DAS no/m^2						
	Grasses		Sedges		BLWs		Total weeds
	(Echinocloa colona)	Denibra	Cyperus rotundus	Fimbristylis acuminata	Alternanthera	Eclipta alba	G+S+Blw
T1	18.67(4.34)	0.00(0.71)	17.33(4.18)	0.00(0.71)	4.00(1.91)	49.33(7.04)	89.33(9.47)
T2	14.67(3.89)	0.00(0.71)	6.67(2.39)	0.00(0.71)	1.33(1.18)	48.00(6.96)	70.67(8.44)
T3	12.00(3.39)	0.00(0.71)	4.00(1.91)	1.33(1.18)	0.00(0.71)	42.67(6.56)	60.00(7.78)
T4	24.00(4.90)	5.33(2.12)	6.67(2.39)	2.67(1.44)	8.00(2.86)	28.00(5.25)	74.67(8.65)
T5	6.67(2.39)	4.00(1.91)	16.00(3.99)	6.67(2.39)	1.33(1.18)	26.67(5.17)	61.33(7.82)
T6	32.00(5.67)	18.67(4.31)	46.67(6.81)	12.00(3.10)	10.67(2.94)	66.67(8.06)	186.67(13.66)
T7	4.00(1.91)	2.67(1.44)	4.00(1.91)	5.33(1.83)	0.00(0.71)	5.33(1.83)	21.33(4.45)
Exp. mean	3.79	1.7	3.37	1.62	1.64	5.84	8.61
CD(0.05)	**1.76**	**1.67**	**1.81**	**2.47**	**1.34**	**2.12**	**1.7**

***Values in parentheses are transformed figures.**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	ICAR-IIRR											
	Weed population at before herbicide spraying no/m²				Weed population at 10-15 DAHA no/m²				Weed population at 45-50 DAS no/m²			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	28.00(5.32)	9.67(3.15)	56.67(7.55)	94.33(9.73)	15.33(3.97)	8.67(3.02)	47.33(6.91)	71.33(8.47)	18.67(4.34)	17.33(4.18)	53.33(7.32)	89.33(9.47)
T2	17.00(4.17)	5.33(2.31)	48.00(6.95)	70.33(8.40)	11.33(3.41)	4.00(1.91)	44.67(6.70)	60.00(7.76)	14.67(3.89)	6.67(2.39)	49.33(7.06)	70.67(8.44)
T3	19.00(4.39)	10.67(2.92)	47.00(6.88)	76.67(8.78)	10.67(3.34)	2.67(1.44)	41.33(6.47)	54.67(7.42)	12.00(3.39)	5.33(2.39)	42.67(6.56)	60.00(7.78)
T4	-	-	-	-	25.33(4.93)	2.67(1.44)	30.67(5.58)	58.67(7.65)	29.33(5.38)	9.33(2.77)	36.00(6.00)	74.67(8.65)
T5	21.00(4.62)	7.00(2.02)	34.67(5.86)	62.67(7.94)	10.67(3.32)	8.67(3.02)	32.67(5.69)	52.00(7.23)	10.67(3.24)	22.67(4.76)	28.00(5.30)	61.33(7.82)
T6	20.00(4.47)	12.00(3.43)	28.00(5.28)	60.00(7.73)	44.67(6.69)	21.33(4.56)	66.00(8.15)	132.00(11.47)	50.67(7.14)	58.67(7.57)	77.33(8.76)	186.67(13.66)
T7	14.67(3.89)	4.00(2.06)	26.00(5.15)	44.67(6.72)	2.00(1.47)	2.00(1.32)	4.00(1.91)	8.00(2.83)	6.67(2.65)	9.33(2.72)	5.33(1.83)	21.33(4.45)
Exp. mean	4.48	2.65	6.28	8.22	3.87	2.39	5.92	7.55	4.29	3.82	6.12	8.61
CD(0.05)	**0.89**	**1.76**	**1.04**	**1.05**	**1.03**	**1.82**	**1.24**	**1.4**	**1.54**	**2.24**	**1.9**	**1.7**

***Values in parentheses are transformed figures.**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	MALAN											
	Weed population at before herbicide spraying no/m^2				Weed population at 10-15 DAHA no/m^2				Weed population at 45-50 DAS no/m^2			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	32.33(5.70)	23.67(4.91)	29.67(5.48)	85.67(9.28)	16.00(4.02)	13.67(3.73)	21.00(4.61)	50.67(7.11)	17.00(4.17)	16.33(4.07)	24.00(4.95)	57.33(7.60)
T2	32.33(5.72)	23.00(4.83)	33.33(5.80)	88.67(9.42)	16.00(4.06)	13.67(3.75)	20.33(4.55)	50.00(7.10)	19.33(4.45)	17.67(4.25)	19.67(4.48)	56.67(7.56)
T3	33.33(5.80)	23.33(4.85)	38.33(6.21)	95.00(9.76)	13.67(3.76)	11.33(3.42)	14.33(3.84)	39.33(6.31)	16.00(4.06)	16.00(4.06)	15.33(3.97)	47.33(6.92)
T4	35.33(5.97)	24.33(4.96)	31.33(5.64)	91.00(9.56)	19.00(4.41)	13.67(3.75)	14.00(3.80)	46.67(6.87)	22.67(4.80)	19.00(4.41)	13.00(3.66)	54.67(7.42)
T5	31.33(5.61)	21.33(4.65)	32.33(5.72)	85.00(9.22)	10.67(3.33)	8.33(2.93)	6.67(2.62)	25.67(5.07)	15.00(3.92)	10.67(3.31)	10.33(3.22)	36.00(5.99)
T6	36.67(6.08)	21.33(4.62)	26.67(5.20)	84.67(9.20)	53.00(7.30)	32.67(5.72)	38.00(6.19)	123.67(11.11)	64.33(8.04)	43.33(6.58)	45.33(6.76)	153.00(12.36)
T7	30.67(5.58)	19.67(4.48)	23.67(4.86)	74.00(8.60)	3.67(2.00)	2.00(1.56)	4.33(2.12)	10.00(3.18)	5.00(2.34)	5.67(2.46)	8.67(3.01)	19.33(4.45)
Exp. mean	5.78	4.76	5.56	9.29	4.13	3.55	3.96	6.68	4.54	4.16	4.29	7.47
CD(0.05)	1.02	1.14	0.98	1.4	0.74	0.98	1.01	1.31	0.64	0.91	0.85	0.93

***Values in parentheses are transformed figures.**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	PUDUCHERRY											
	Weed population at before herbicide spraying no/m^2				Weed population at 10-15 DAHA no/m^2				Weed population at 45-50 DAS no/m^2			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	26.48(5.19)	11.18(3.42)	13.12(3.69)	50.78(7.16)	8.46(2.99)	4.04(2.13)	4.37(2.21)	16.87(4.17)	16.01(4.06)	6.06(2.56)	5.80(2.51)	27.86(5.33)
T2	25.13(5.06)	10.75(3.35)	12.33(3.58)	48.21(6.98)	7.30(2.79)	3.86(2.09)	4.11(2.15)	15.26(3.97)	15.30(3.97)	5.79(2.51)	5.04(2.35)	26.13(5.16)
T3	23.24(4.87)	9.56(3.17)	11.05(3.40)	43.85(6.66)	5.26(2.40)	3.50(2.00)	3.32(1.95)	12.08(3.55)	12.71(3.64)	4.73(2.29)	4.19(2.17)	21.64(4.71)
T4	12.54(3.61)	5.26(2.40)	6.19(2.59)	23.99(4.95)	4.21(2.17)	1.91(1.55)	7.32(2.80)	13.44(3.73)	26.49(5.19)	9.90(3.22)	8.99(3.08)	45.37(6.77)
T5	25.35(5.08)	10.78(3.36)	12.50(3.61)	48.63(7.01)	6.87(2.71)	3.88(2.09)	3.74(2.06)	14.49(3.87)	13.43(3.73)	5.09(2.36)	4.66(2.27)	23.18(4.87)
T6	30.81(5.59)	13.09(3.69)	15.35(3.98)	59.25(7.73)	37.88(6.19)	4.71(2.28)	9.60(3.18)	52.18(7.26)	34.74(5.94)	13.11(3.69)	12.99(3.67)	60.85(7.83)
T7	20.33(4.56)	8.59(3.01)	10.08(3.25)	39.00(6.28)	5.13(2.37)	3.10(1.90)	2.07(1.60)	10.31(3.29)	10.27(3.28)	3.89(2.09)	3.56(2.02)	17.72(4.27)
Exp. mean	4.85	3.2	3.44	6.68	3.09	2.01	2.28	4.26	4.26	2.68	2.58	5.56
CD(0.05)	0.07	0.04	0.05	0.09	0.07	0.03	0.04	0.08	0.08	0.05	0.06	0.11

***Values in parentheses are transformed firgures.**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	RAIPUR							
	Weed population at before herbicide spraying no/m^2				Weed population at 10-15 DAHA no/m^2			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	37.53(6.14)	167.43(12.94)	9.27(3.11)	214.23(14.64)	32.93(5.76)	121.10(11.02)	11.70(3.48)	165.73(12.89)
T2	36.93(6.11)	169.73(13.04)	10.10(3.23)	216.77(14.74)	26.53(5.20)	87.67(9.33)	5.73(2.47)	119.93(10.94)
T3	40.90(6.41)	169.13(13.02)	9.40(3.12)	219.43(14.82)	6.13(2.55)	88.40(9.43)	4.17(2.15)	98.70(9.96)
T4	-	-	-	-	28.67(5.38)	79.97(8.95)	0.90(1.07)	109.53(10.48)
T5	38.53(6.24)	167.47(12.95)	9.60(3.16)	215.60(14.69)	11.97(3.52)	138.23(11.75)	9.17(3.10)	159.37(12.63)
T6	-	-	-	-	34.23(5.87)	190.80(13.83)	12.20(3.56)	237.23(15.41)
T7	-	-	-	-	20.23(4.53)	26.77(5.18)	3.13(1.90)	50.13(7.11)
Exp. mean	6.75	12.99	3.16	14.72	4.69	9.93	2.53	11.35
CD(0.05)	1.17	1.29	0.92	1.31	0.89	1.49	0.66	1.16

***Values in parentheses are transformed figures.**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	IIRR															
	Weed dry biomass at before herbicide spraying g/m^2				Weed dry biomass at 10-15 DAHA g/m^2					Weed dry biomass at 45-50 DAS g/m^2						
	Grasses	Sedges	BLW	Total weeds	Grasses		Sedges	BLWs	Total weeds	Grasses		Sedges		BLWs		Total weeds
	Echinocloa colona	Cyperus rotundus	Eclipta alba		Echinocloa colona	Dinebra	Cyperus rotundus	Eclipta alba	G+S+Blw	(Echinocloa colona)	Denibra	Cyperus rotundus	Fimbristylis acuminata	Alternanthera	Eclipta alba	G+S+Blw
T1	0.47	2.04	0.16	2.67	2.11	0.00	1.21	4.84	8.16	12.23	0.00	15.83	0.00	4.32	46.26	78.63
T2	0.49	0.61	0.30	1.40	2.07	0.00	0.74	4.22	7.04	11.48	0.00	12.35	0.00	2.07	41.27	67.16
T3	0.74	0.92	0.30	1.96	1.82	0.00	0.72	3.68	6.22	10.04	0.00	11.30	0.28	0.00	16.28	37.90
T4	-	-	-	-	6.87	0.29	1.23	1.34	9.74	11.03	2.63	12.00	0.17	4.59	19.71	50.12
T5	0.77	0.53	0.40	1.70	1.43	0.45	1.41	2.50	5.79	4.25	2.49	4.37	4.87	1.49	10.14	27.63
T6	0.83	1.40	0.33	2.56	15.16	3.48	4.89	8.12	31.65	16.40	7.33	21.33	17.32	15.52	44.55	122.45
T7	0.28	0.31	0.21	0.80	0.45	0.00	0.56	1.65	2.67	2.71	2.07	2.67	0.00	0.00	1.61	9.05
Exp. mean	0.6	0.97	0.28	1.85	4.27	0.60	1.54	3.76	10.18	9.73	2.07	11.41	3.23	4.00	25.69	56.13
CD(0.05)	**0.57**	**1.01**	**0.43**	**1.15**	**3.65**	**1.04**	**2.03**	**1.83**	**4.84**	**5.68**	**6.71**	**6.60**	**6.80**	**9.06**	**14.06**	**16.97**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	IIRR											
	Weed dry biomass at before herbicide spraying g/m^2				Weed dry biomass at 10-15 DAHA g/m^2				Weed dry biomass at 45-50 DAS g/m^2			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	0.47	2.04	0.16	2.67	2.11	1.21	4.84	8.16	12.23	15.83	50.58	78.63
T2	0.49	0.61	0.30	1.40	2.07	0.74	4.22	7.04	11.48	12.35	43.33	67.16
T3	0.74	0.92	0.30	1.96	1.82	0.72	3.68	6.22	10.04	11.58	16.28	37.90
T4	-	-	-	-	7.17	1.23	1.34	9.74	13.65	12.17	24.29	50.12
T5	0.77	0.53	0.40	1.70	1.88	1.41	2.50	5.79	6.75	9.25	11.63	27.63
T6	0.83	1.40	0.33	2.56	18.64	4.89	8.12	31.65	23.73	38.65	60.07	122.45
T7	0.28	0.31	0.21	0.80	0.45	0.56	1.65	2.67	4.77	2.67	1.61	9.05
Exp. mean	0.6	0.97	0.28	1.85	4.88	1.54	3.76	10.18	11.81	14.64	29.69	56.13
CD(0.05)	**0.57**	**1.01**	**0.43**	**1.15**	**4.46**	**2.03**	**1.83**	**4.84**	**8.87**	**9.28**	**18.63**	**16.97**

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	MALAN											
	Weed dry biomass at before herbicide spraying g/m²				Weed dry biomass at 10-15 DAHA g/m²				Weed dry biomass at 45-50 DAS g/m²			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	29.27	20.70	26.83	76.80	11.90	11.27	18.33	41.50	13.80	13.77	20.67	48.23
T2	28.37	20.90	30.67	79.93	13.03	10.93	17.40	41.37	16.07	14.87	16.50	47.43
T3	33.27	21.03	35.60	89.90	10.43	8.47	11.10	30.00	13.33	13.60	12.77	39.70
T4	32.13	20.73	28.63	81.50	16.47	10.80	11.43	38.70	19.37	15.97	10.07	45.40
T5	24.80	18.77	29.83	73.40	8.03	5.87	4.27	18.17	13.40	7.87	7.37	28.63
T6	32.47	18.90	23.83	75.20	47.50	29.90	35.13	112.53	59.87	40.53	42.23	142.63
T7	27.03	16.93	20.63	64.60	1.97	1.17	2.47	5.60	4.17	3.27	5.60	13.03
Exp. mean	29.62	19.71	28	77.33	15.62	11.20	14.30	41.12	20	15.70	16.46	52.15
CD(0.05)	11.77	11	10.84	25.44	7.13	8.09	7.51	19.63	7.06	9.99	6.44	18.38

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	PUDUCHERRY											
	Weed dry biomass at before herbicide spraying g/m^2				Weed dry biomass at 10-15 DAHA g/m^2				Weed dry biomass at 45-50 DAS g/m^2			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	7.84	3.61	5.56	17.01	2.83	1.48	1.53	5.84	5.00	2.29	2.28	9.58
T2	7.49	3.47	5.22	16.18	2.44	1.42	1.51	5.37	4.78	2.19	1.99	8.97
T3	6.79	3.08	4.68	14.55	1.71	1.26	1.2	4.17	3.97	1.76	1.61	7.34
T4	3.7	3.69	2.62	10.01	1.39	0.69	2.6	4.68	8.28	3.70	3.52	15.50
T5	7.53	3.37	5.3	16.2	2.3	1.42	1.43	5.15	4.20	1.93	1.79	7.91
T6	9.15	4.22	6.51	19.88	12.63	1.73	3.49	17.85	10.86	4.95	5.11	20.91
T7	6.02	2.77	4.27	13.06	1.63	1.14	0.67	3.44	3.21	1.47	1.40	6.08
Exp. mean	6.93	3.46	4.88	15.27	3.56	1.31	1.78	6.64	5.76	2.61	2.53	10.90
CD(0.05)	0.22	0.14	0.16	0.49	0.33	0.04	0.18	0.49	0.29	0.13	0.18	0.59

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	RAIPUR							
	Weed dry biomass at before herbicide spraying g/m^2				Weed dry biomass at 10-15 DAHA g/m^2			
	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
T1	3.04	2.15	0.98	6.17	48.87	28.99	1.28	79.14
T2	3.00	2.09	0.94	6.03	34.41	14.89	0.72	50.02
T3	3.11	2.06	0.97	6.14	25.91	7.14	0.43	33.48
T4	-	-	-	-	33.2	11.44	0.19	44.83
T5	3.12	2.10	0.96	6.17	15.42	14.83	0.82	31.07
T6	-	-	-	-	59.68	34.92	1.95	96.55
T7	-	-	-	-	2.64	6.52	0.76	9.92
Exp. mean	3.07	1.2	0.55	6.13	31.45	16.96	0.88	49.29
CD(0.05)	0.54	0.34	0.15	0.72	8.06	5.72	0.46	6.16

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Contd.

Treatments	Weed Control Efficiency 10-15 DAHA				Weed Control Efficiency 45-50 DAS		
	IIRR	Malan	Puducherry	Raipur	IIRR	Malan	Puducherry
T1	74.21	63.12	67.28	18.03	35.78	66.18	54.18
T2	77.75	63.23	69.91	48.19	45.15	66.74	57.10
T3	80.34	73.34	76.63	65.32	69.04	72.16	64.89
T4	69.22	65.6	73.78	53.56	59.06	68.16	25.87
T5	81.7	83.85	71.14	67.81	77.43	79.92	62.17
T6	-	-	-	-	-	-	-
T7	91.56	95.02	80.72	89.72	92.60	90.86	70.92

T1-Thiobencarb @ 4.00 L/ha post-emergence application at 20 DAS
T2-Thiobencarb @ 4.50 L/ha post-emergence application at 20 DAS
T3-Thiobencarb @ 5.00 L/ha post-emergence application at 20 DAS
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application
T6- Control (weedy)
T7- Hand weeding twice

Table-4.3.1: Effect of different post-emergence herbicides on weed population, dry weight and yield of rice

Treatments	Total weed population at before herbicide application no/m²	Total weed biomass at before herbicide application g/m²	Total weed population 15 days after herbicide application no/m²	Total weed dry biomass 15 days after herbicide application g/m²	Weed control efficiency	Panicles no/m²	Grain yield t/ha	Straw yield t/ha	Grain yield loss %
T1-Thiobencarb @ 4.00 L/ha with 500 L water/ha post-emergence application at 20 DAS	76.92 a	32.15 a	76.15 b	33.66 b	47.92	295 c	4.66 c	5.90 d	17.22
T2-Thiobencarb @ 4.50 L/ha with 500 L water/ha post-emergence application at 20 DAS	69.06 a	32.50 a	61.30 b	25.94 c	59.87	307 bc	4.91 c	6.11 cd	12.78
T3-Thiobencarb @ 5.00 L/ha with 500 L water/ha post-emergence application at 20 DAS	71.83 a	35.47 a	51.20 c	18.46 de	71.44	335 a	5.30 b	6.47 abc	5.86
T4-Standard check(Recommended herbicide)pyrazosulfuron ethyl 10 % @ 200 g/ha. Pre-emergence application	38.33 c	30.50 a	57.08 c	24.48 cd	62.12	298 c	4.93 c	6.26 bcd	12.43
T5-Standard check(Recommended herbicide) Bispyribacsodium 10 % @ 300 ml/ha. Post-emergence application	65.43 ab	30.43 a	62.88 bc	15.04 e	76.73	327 ab	5.35 ab	6.55 ab	4.97
T6- Control (weedy)	67.97 a	32.54 a	136.27 a	64.64 a	-	244 d	3.84 d	5.03 e	31.79
T7- Hand weeding twice	52.55 b	26.15 a	19.61 d	5.40 f	91.64	347 a	5.63 a	6.83 a	-
LSD(P =0.05)	**13.51**	**11.90**	**14.06**	**7.09**		**23.17**	**0.3**	**0.43**	

4.3.2: Long term trial on weed dynamics in mono or double cropped rice system under different establishment methods

With the objective of assessing the weed dynamics in different establishment methods on a long term basis of minimum five years, the trial was initiated during kharif 2019. The trial was conducted at 12 locations viz., **Aduthurai, Chiplima, Gangavathi, Ghaghraghat, Jadgalpur, Malan, Moncompu, Nawagam, Pantnagar, Puducheery, Varanasi** and **Titabar** in replicated split plot design. Though allotted, the trial was not conducted by **Chinsurah, Cuttack, Karaikal, Kota, Nagina, Prabhani, Pattambi, Pusa, Ranchi, Rewa, Tuljapur.** The treatments consisted of 3 main plots M1 – Mechanised planting/transplanting, M2 – Puddled direct seeding, M3 – Unpuddled dry direct seeding and four sub plots T1 – Weed free, T2 – Weedy check, T3 – Mechanical weeding using weeder and T4 – Chemical weed control of pre and post emergence herbicide application. The results of data on growth parameters, yield attributes, grain yield, weed parameters recorded by the locations are presented in **table 4.3.2.**

The results revealed that the grain yield loss due to weeds ranged from 7.14% at **Puducherry** to 65.26% at **Chiplima** depending on the weed intensity and weed flora distribution. The crop establishment methods did not show any significant difference in grain yield at **Ghaghraghat, Moncompu, Puducherry** and **Varanasi.** At **Jagdalpur, Nawagam** and **Pudducherry** mechanical transplanting and puddle direct seeding performed on par. At **Aduthurai** and **Gangavathi**, puddle direct seeding out yielded other systems. At **Chiplima, Malan, Pantnagar** and **Titabar**, mechanical transplanting was found superior. Among the weed control treatments, weed free condition recorded highest grain yield at all the locations and significantly superior at five locations. Chemical weed control (pre & post emergence herbicide application) and weed free condition showed equal effectiveness at two locations. Both mechanical weeding and chemical weed control exhibited higher grain yields and on par at seven locations. Mechanical weeding was superior over chemical weed control at two locations. The interaction effect of establishment methods and weed control treatments were significant at four locations and non-significant at seven locations. At **Aduthurai** and **Moncompu**, chemical weed control and mechanical weeding were statistically on par under mechanical transplanting or puddle or unpuddled direct seeding.**(Table: 4.3.2)**

The mean grain yield ranged from 2.75 t/ha at Malan with HPR 1068 to 6.81 t/ha at **Gangavathi** with GNV 10-89 variety. Three locations have recorded mean grain yield of above 5 t/ha. Only three locations have recorded grain yield between 4-5 t/ha and other locations less than 4 t/ha indicating the need to increase productivity by adopting improved agronomic technologies. **(Table: 4.3.2)**

The results of straw yield was reported by seven locations viz., **Chiplima, Gangavathi, Jagdalpur, Malan, Moncompu, Nawagam** and **Puducherry**. The highest mean straw yield was by GNV 10-89 at Gangavathi 8.3 t/ha followed by **Jagdalpur** and **Puducherry** 7.5 t/ha. The straw yield followed similar trend as that of grain yield. The data on one of the growth parameters i.e. plant height was reported by two locations viz., **Aduthurai** and **Nawagam**. The plant height was significantly low in weedy check, whereas weed free and chemical weed control treatments were statistically on par. The establishment method of mechanical transplanting recorded maximum and un-puddled direct seeding minimum. **(Table: 4.3.2)**

The data on important growth parameters i.e. no. of tillers per m^2 at maximum tillering stage and panicle initiation stage were reported by five locations viz., **Jagdalpur, Malan, Moncompu, Pantnagar** and **Puducherry** and eight locations viz., **Aduthurai, Gangavathi, Jagdalpur Malan, Moncompu, Nawagam, Pantnagar** and **Puducherry** respectively. The important finding was, at Jagdalpur puddled direct seeding has contributed to highest tiller number, whereas, mechanical transplanting at **Malan.** At **Moncomu** and **Pantnagar** un-puddled direct seeding recorded highest tiller number. At Aduthurai, Malan, Moncompu and Nawagam, mechanical transplanting has resulted in highest tiller no. at panicle initiation stage. Whereas, at **Gangavathi** and **Jagdalpur**, puddled direct seeding resulted in highest tiller no. and at **Pantnagar**, un-puddled dry direct seeding has contributed to highest tiller number. Among the weed control treatments, no significant difference was recorded at **Gangavathi** and **Jagdalpur**. At **Puducherry**, mechanical weeding resulted in highest no. of tillers, but, at other locations, weed free condition and chemical weed control were statistically on par. **(Table: 4.3.2)**

The data on yield attributes were reported by all the test locations. The results of data analysis on no. of panicles per sq. metre showed that highest mean panicle no. (500) was reported by **Gangavathi** and lowest of 134 by **Moncompu** followed by **Ghaghraghat**. Establishment methods didnot have significant differences at **Ghaghraghat, Moncompu** and **Puducherry**. Each system has contributed to highest number at two test locations and at **Varanasi,** unpuddled dry direct seeding has resulted in significantly higher no. of panicles. Among the weed control treatments, majority of the locations recorded superiority of weed free condition and chemical weed control. At **Puducherry, Pantnagar**, mechanical weeding was superior. At **Ghaghraghat, Jaddalpur, Nawagam, Pantnagar , Varanasi** and **Titabar**, Chemical weed control and mechanical weeding were comparable.

The results of multi-locational data on panicle weight showed that at **Chiplima, Gangavathi, Jagdalpur, Moncompu** and **Puducherry,** establishment methods had no significant differences. At **Ghaghraghat, Malan, Pantnagar, Varanasi** and **Titabar** mechanical transplanting recorded maximum values of panicle weight. At **Aduthurai**, puddle direct seeding and at **Nawagam**, mechanical transplanting and puddle direct seeding were found comparable and superior over others. **(Table: 4.3.2).** Most of the locations reported comparable panicle weight with mechanical weeding and chemical weed control.

Among the weed control treatments, weed free condition and mechanical weeding were comparable at **Ghaghraghat, Malan, Moncompu, Nawagam**. Mechanical weeding and chemical weed control were comparable at **Aduthurai**, **Malan**. Chemical weed control and weed free condition were superior at **Chiplima**.

The data on test weight was reported by nine locations viz., **Aduthurai, Chiplima, Gangavathi, Jagdalpur, Malan, Moncomopu, Nawagam, Pantnagar** and **Puducherry**. At majority of the test locations, establishment methods did not influence the test weight significantly except **Chiplima, Jagdalpur** and **Malan**. But significant differences among weed control treatments were reported by five locations with significantly low test weight under weedy check treatment. **(Table: 4.3.2)**

The data on one of the weed parameters i.e., weed population (group wise) at three stages viz., vegetative stage, panicle initiation stage and heading stage was reported by all the locations. The results revealed that at **Aduthurai,** grasses were dominant group followed by sedges followed by BLW; **at Gangavathi, Jagdalpur, Moncompu** sedges were dominant group followed by BLW followed by grasses; at **Varanasi** sedges were dominant group followed by grasses and BLW; at **Malan** and **Puducherry** grasses were dominant group followed by BLW followed by grasses; at **Nawagam**, three groups of grasses, sedges and BLW were equally infested the crop. Weed population at all the three critical crop growth stages were reported by **Chiplima, Ghaghraghar, Jagdalpur, Malan, Moncompu, Nawagam, Puducherry and Varanasi. Aduthurai** and **Titabar** locations reported the data of crop vegetative stage only; **Gangavathi** and **Pantnagar** reported the data of vegetative stage and panicle initiation stage. At **Chiplima, Gangavathi, Ghaghraghat**, grasses group; at **Moncompu** and **Pantnagar,** all the weed groups population showed increased trend from vegetative to heading stageof the crop. At **Moncompu,** sedges and BLW population decreased with crop growth stages. At **Nawagam,** results showed lowest weed population at crop vegetative stage and highest at panicle initiation stage, whereas, at **Puducherry and Varanasi** the weed population decreased with advancement in crop growth stages. At **Aduthurai**, grass weed population was significantly low under mechanical transplanting and the sedges, BLWs were not significantly different under different establishment methods. However relatively higher weed population was reported under puddle direct seeding. Among the weed control treatments, chemical weed control recorded lowest population. At **Chiplima**, total weed population was lowest under mechanical transplanting and highest under un-puddled dry direct seeding. At **Gangavathi**, puddle direct seeding and mechanical weeding or chemical weed control recorded lowest weed population of sedges and total. At **Aduthurai, Chiplima, Gangavathi, Ghaghraghat, Jagdalpur, Malan, Nawagam, Pantnagar, Varanasi** and **Titabar**, mechanical transplanting recorded lowest weed population. At **Moncompu**, un-puddled direct seeding recorded lowest weed population followed by puddle direct seeding. At **Aduthurai, Chiplima, Jagdalpur, Malan, Moncompu, Pantnagar** and **Varanasi**, chemical weed control was found superior with lowest weed population. At **Gangavathi, Ghaghraghat, Nawagam** and **Titabar**, both mechanical weeding and chemical weed control were equally effective and statistically on par. At **Puducherry** alone, mechanical weeding was superior over others and reduced weed population. **(Table: 4.3.2)**

The results of weed biomass data was reported by all locations viz., **Aduthurai, Chiplima, Gangavathi, Ghaghraghat, Jagdalpur, Malan, Moncomou, Nawagam,**

Pantnagar, Puducherry and **Titabar.** With advancement in crop growth stage, similar trend of increase in weed population was reflected at **Chiplima, Ghaghraghat, Moncompu Pantnagar** and **Varanasi**. At **Gangavathi**, **Nawagam and Varanasi,** weed biomass was highest at panicle initiation stage. At **Jagdalpur** and **Malan,** all the crop growth stages showed no major changes in total weed biomass. At **Puducherry**, the weed biomass decreased with advancement of crop growth stages. At majority of the locations, mechanical transplanting resulted in lowest weed biomass except **Gangavathi** where lowest weed biomass was recorded under puddle direct seeding and **Moncompu** with lowest weed biomass in un-puddled direct seeding. Among the weed control treatments, at **Aduthurai, Chiplima, Malan, Moncompu, Pantnagar** and **Varanasi** chemical weed control has contributed to reduce weed biomass. At **Gangavathi, Ghaghraghat, Jagdalpur, Nawagam** and **Titabar**, mechanical weeding and chemical weed control were statistically on par and have contributed to lower weed biomass. Only at **Puducherry,** mechanical weeding significantly reduced weed biomass and was superior over others. **(Table: 4.3.2)**

The first season study of long term trial reveals that at ten out of twelve locations, mechanical transplanting recorded lower weed population, dry weed biomass at maximum tillering, panicle initiation and heading stages of rice crop which in turn reflected in increased crop growth parameters, yield attributes and yield of rice. At two locations, puddle/un-puddled direct seeding has contributed to lower weed population and biomass. Among the weed control treatments, six out of twelve locations reported superiority of chemical weed control by pre and post emergence herbicide application and effective in controlling weeds and more resources were made available for improved crop growth and yield. At four locations, the performance of mechanical weeding using weeder and chemical weed control were comparable. At two locations, mechanical weeding using weeder resulted in significantly higher crop growth, yield attributes and grain yield. The results clearly indicate the necessity of adopting improved agronomic management technologies for reducing weed problems and for improving production potential of puddled and un-puddled direct seeding systems. The performance of mechanical weeding in different establishment methods is indicating the scope and potential of mechanical weeding methods and can be further exploited in view of scarce resources and changing climate.

Table 4.3.2: Summary of data on grain yield, yield attributes & weed parameters from the trial on "Evaluation of long term trial on weed dynamics in mono or double cropped rice system under different establishment methods", Kharif – 2019

Main Plot	Sub Plots	Grain yield (t/ha)							
		ADT	**CHP**	**GNG**	**GGT**	**JDP**	**MLN**	**MNC**	**NWG**
M1	T1	5.54	5.84	7.79	4.08	6.73	3.91	3.47	6.13
	T2	1.91	2.40	3.89	2.63	5.47	1.84	0.55	3.90
	T3	5.81	3.59	6.11	3.92	6.52	2.94	3.06	5.05
	T4	5.31	5.12	5.74	3.22	6.15	3.71	2.16	5.13
M2	T1	5.30	4.69	8.71	3.57	7.01	3.34	4.60	5.62
	T2	2.32	1.53	6.92	1.72	5.19	1.81	2.90	3.87
	T3	6.15	3.01	8.59	3.61	6.29	2.73	2.93	4.88
	T4	5.67	4.32	8.38	3.12	6.16	3.17	2.05	4.30
M3	T1	2.83	4.50	7.38	3.50	5.40	2.85	3.93	4.36
	T2	1.89	1.28	4.09	1.58	4.63	1.61	2.63	3.34
	T3	3.08	3.36	7.22	3.27	5.39	2.33	3.75	4.26
	T4	2.65	4.00	6.84	3.06	5.45	2.76	4.03	4.42
Mean of Factor-1									
1		4.64	4.24	5.88	3.46	6.22	3.10	2.31	5.05
2		4.86	3.39	8.15	3.00	6.16	2.76	3.12	4.67
3		2.61	3.29	6.38	2.85	5.22	2.39	3.59	4.10
CD(0.05)		0.18	0.20	**0.30**	NS	0.26	0.14	NS	0.44
Mean of Factor-2									
1		4.56	5.01	7.96	3.72	6.38	3.37	4.00	5.37
2		2.04	1.74	4.97	1.98	5.10	1.75	2.03	3.71
3		5.01	3.32	7.31	3.60	6.07	2.66	3.25	4.73
4		4.54	4.48	6.99	3.13	5.92	3.21	2.75	4.62
CD(0.05)		0.34	0.34	**0.36**	0.50	0.60	0.13	0.79	0.56
Interaction									
M and T		0.59	NS	0.63	NS	NS	0.23	NS	NS
T and M		0.52	NS	0.57	NS	NS	0.22	NS	NS
Experimental Mean		4.04	3.64	**6.81**	3.11	5.87	2.75	3.01	4.61
Name of the variety		ADT 53	MTU-1156	GNV-10-89	NDR 359	Durgeswari	HPR 1068	UMA	GAR 14
Soil type					Sandy loam	Alfisols	Slity clay loam		clay loam
pH				8.24	8.06	6.4	5.6		7.63
EC				1.12		0.42			
Applied NPK kg/ha					120-60-40	120-60-40	90:40:40 & 60:30:30		
Available NPK kg/ha						245;14.5;312	264;52.6:235	90:45:45	

M1- Mechanized transplanting

M2 - Puddled direct seeding

M3 - Un puddled dry direct seeding

T1 – Weed free

T2 – Weedy check

T3 – Mechanical weeding using weeder

T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	Grain yield (t/ha)			
		PNT	**PDC**	**TTB**	**VAR**
M1	T1	5.48	5.97	5.60	3.39
	T2	3.55	5.62	3.00	2.65
	T3	5.11	6.28	4.68	2.94
	T4	5.21	6.05	4.86	3.72
M2	T1	4.84	5.8	3.58	3.58
	T2	2.82	5.3	2.08	0.9
	T3	4.48	6.19	2.68	2.9
	T4	4.23	6.02	3.87	3.57
M3	T1	5.34	-	2.66	3.31
	T2	2.62	-	1.37	1.44
	T3	5.29	-	2.36	2.93
	T4	5.04	-	2.41	3.21
Mean of Factor-1					
1		4.84	5.98	4.54	3.18
2		4.09	5.83	3.05	2.74
3		4.57	-	2.20	2.72
CD(0.05)		0.10	NS	0.32	NS
Mean of Factor-2					
1		5.22	3.92	3.95	3.42
2		2.99	3.64	2.15	1.66
3		4.96	4.16	3.24	2.92
4		4.82	4.02	3.71	3.5
CD(0.05)		0.23	0.17	0.54	0.22
Interaction					
M and T		0.40	NS	NS	0.38
T and M		0.35	NS	NS	0.41
Experimental Mean		4.50	5.9	3.26	2.88
Name of the variety			TKM 13	Swarna Sub-1	HUR-3022
Soil type		Silt Loam	Clay	Clay loam	Sandy Loam
pH		7.8	6.04	5.2	7.32
EC					
Applied NPK kg/ha		120:60:40	120:40:40		120:60:60
Available NPK kg/ha		239:21.07:219	123.2:9.18:122	403:18:231	241.153:18.22:189.05

M1- Mechanized transplanting

M2 - Puddled direct seeding

M3 - Un puddled dry direct seeding

T1 – Weed free

T2 – Weedy check

T3 – Mechanical weeding using weeder

T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	Straw yield (t/ha)							Plant height (cm)		No of Tillers /m^2 at Max. tillering stage				
		CHP	GNG	JDP	MLN	MNC	NWG	PDC	ADT	NWG	JDP	MLN	MNC	PNT	PDC
M1	T1	6.44	9.46	8.21	5.28	7.47	7.05	7.58	155.80	120.93	397	230	52	134	351
	T2	3.10	4.73	6.68	2.48	1.17	4.39	7.14	84.73	107.05	339	152	41	108	357
	T3	4.17	7.42	7.95	3.97	5.99	5.81	7.98	143.73	115.20	375	208	51	132	375
	T4	5.29	6.98	7.51	5.00	4.30	5.90	7.68	150.33	114.53	364	224	61	136	358
M2	T1	5.52	10.58	8.97	4.51	5.22	6.24	7.37	144.47	109.27	404	214	148	156	354
	T2	1.98	8.40	6.64	2.45	3.20	4.27	6.73	78.53	102.03	348	144	98	135	329
	T3	3.35	10.44	8.05	3.68	3.77	5.41	7.86	139.27	106.99	391	205	80	161	383
	T4	4.94	10.14	7.88	4.29	2.58	4.78	7.64	145.80	106.58	397	206	148	155	368
M3	T1	4.97	8.97	7.24	3.88	4.90	4.80	-	78.13	108.76	351	207	182	160	-
	T2	1.79	4.97	6.20	2.17	3.87	3.68	-	64.20	91.13	288	140	148	184	-
	T3	3.96	8.77	7.23	3.17	4.95	4.68	-	72.00	97.07	321	199	109	186	-
	T4	4.69	8.28	7.31	3.73	4.83	4.86	-	72.87	103.22	335	204	175	184	-
Mean of Factor-1															
1		4.75	7.15	7.59	4.18	4.73	5.79	7.6	133.65	114.43	369	204	51	127	360
2		3.95	9.89	7.89	3.73	3.69	5.17	7.4	127.02	106.22	385	192	118	152	359
3		3.85	7.75	6.99	3.24	4.64	4.51	-	71.80	100.04	324	188	153	179	-
CD(0.05)		0.25	**0.46**	0.33	0.21	NS	0.54	NS	2.56	6.78	17	2	30	3	NS
Mean of Factor-2															
1		5.64	9.67	8.14	4.56	5.86	6.03	7.47	126.13	112.99	384	217	127	150	352
2		2.29	6.03	6.51	2.37	2.75	4.11	6.94	75.82	100.07	325	145	96	142	343
3		3.83	8.88	7.75	3.61	4.90	5.30	7.92	118.33	106.42	362	204	80	159	379
4		4.97	8.46	7.57	4.34	3.90	5.18	7.66	123.00	108.11	365	212	128	158	363
CD(0.05)		0.45	**0.42**	0.77	0.17	1.07	0.61	0.22	2.88	5.13	NS	5	25	8	11
Interaction															
M and T		NS	0.72	NS	0.30	1.86	NS	NS	4.99	NS	NS	NS	NS	13.88	14.88
T and M		NS	0.69	NS	0.29	1.75	NS	NS	4.57	NS	NS	NS	NS	12.15	21.33
Experimental Mean		4.18	**8.26**	7.49	3.72	4.35	5.16	7.5	110.82	106.90	359	195	108	152	359

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	No of Tillers /m² at panicle initiation stage								Panicle no/m²											
		ADT	GNG	JDP	MLN	MNC	NWG	PNT	PDC	ADT	CHP	GNG	GGT	JDP	MLN	MNC	NWG	PNT	PDC	TTB	VAR
M1	T1	341	439	391	230	125	292	287	385	329	250	431	162	367	226	149	228	269	360	236	232
	T2	245	433	363	151	96	233	190	383	220	191	302	106	322	149	67	182	167	353	185	256
	T3	354	380	387	208	144	243	243	410	342	220	380	155	360	206	113	190	241	378	233	278
	T4	334	461	387	223	131	275	259	393	324	238	393	156	358	221	108	215	249	365	226	329
M2	T1	334	913	438	212	95	172	371	380	325	230	504	148	395	211	144	134	308	342	272	337
	T2	216	897	399	142	41	139	231	363	204	164	473	98	358	141	104	109	228	336	198	226
	T3	334	849	443	203	33	160	288	409	324	195	471	140	378	202	115	125	285	368	234	316
	T4	322	805	442	204	87	158	292	394	307	204	469	144	395	203	103	123	273	352	246	374
M3	T1	273	616	379	205	111	147	378	-	253	213	392	156	340	205	183	101	333	-	260	393
	T2	185	553	318	138	96	129	232	-	157	156	325	84	295	137	171	89	213	-	155	390
	T3	245	740	362	196	104	157	364	-	224	173	371	153	334	196	160	108	326	-	233	360
	T4	215	644	348	203	85	149	347	-	193	202	404	147	320	202	189	103	308	-	249	429
Mean of Factor-1																					
1		319	428	382	203	124	261	245	393	304	225	376	145	352	200	109	204	232	364	220	274
2		301	866	431	190	64	157	296	387	290	198	479	133	381	189	116	123	273	349	238	313
3		229	638	352	186	99	145	330	-	207	186	373	135	322	185	176	100	295	-	224	393
CD(0.05)		11	18	26	3	7	16	15	NS	9	4	10	NS	22	2	NS	13	11	NS	6	1
Mean of Factor-2																					
1		316	656	403	216	110	204	345	383	302	231	442	155	367	214	159	155	303	351	256	321
2		215	627	360	144	78	167	218	373	194	170	367	96	325	142	114	126	203	344	179	290
3		311	657	398	202	94	187	298	410	297	196	407	149	358	201	129	141	284	373	233	318
4		291	637	392	210	101	194	299	394	275	215	422	149	358	209	133	147	276	358	240	377
CD(0.05)		10	NS	NS	5	22	21	15	11	8	8	22	12	NS	5	NS	16	21	13	14	10
Interaction																					
M and T		16.8	42.81	NS	NS	NS	NS	25.94	NS	14.62	NS	38.04	NS	NS	NS	NS	NS	NS	NS	NS	16.47
T and M		15.91	38.39	NS	NS	NS	NS	24.17	NS	13.93	NS	33.4	NS	NS	NS	NS	NS	NS	NS	NS	14.27
Experimental Mean		283	644	388	193	96	188	290	390	267	203	410	138	352	191	134	142	267	356	227	327

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	Panicle weight (g)												Test weight (g)								
		ADT	CHP	GNG	GGT	JDP	MLN	MNC	NWG	PNT	PDC	TTB	VAR	ADT	CHP	GNG	JDP	MLN	MNC	NWG	PNT	PDC
M1	T1	2.43	7.00	3.28	3.88	3.42	4.88	2.47	3.62	2.39	3.31	5.11	2.53	5.47	27.33	18.26	28.38	27.79	25.00	18.47	25.94	16.26
	T2	1.90	6.04	3.36	2.53	3.17	2.96	0.87	2.91	2.45	3.2	3.08	2.57	5.17	23.67	17.65	26.82	24.76	24.00	17.27	25.3	16.09
	T3	2.48	6.93	3.68	3.58	3.42	4.71	2.87	3.47	2.62	3.62	4.63	2.64	5.60	25.00	18.29	27.70	26.79	23.67	18.00	24.74	16.68
	T4	2.36	7.31	3.75	3.50	3.27	4.77	1.40	3.08	2.41	3.46	4.80	2.52	5.70	25.00	17.82	27.60	26.91	24.33	18.27	25.14	16.44
M2	T1	2.35	7.18	3.03	3.15	3.54	4.64	5.33	3.37	1.92	3.27	4.52	3.17	5.50	25.33	18.86	26.84	26.65	25.33	18.07	26.21	16.19
	T2	2.25	5.07	2.93	1.80	3.23	2.53	2.00	3.02	1.88	3.08	2.21	1.94	5.03	23.00	18.77	25.22	22.66	24.33	16.60	25.84	15.62
	T3	2.34	5.86	3.27	2.96	3.68	4.44	2.73	2.96	1.93	3.59	4.20	2.24	5.47	25.00	18.61	26.23	25.90	26.00	17.07	25.49	16.59
	T4	2.37	6.97	3.19	2.58	3.61	4.58	2.53	2.90	1.7	3.44	4.37	2.13	5.67	25.00	18.86	26.19	27.22	26.33	16.87	25.42	16.37
M3	T1	2.08	6.15	3.66	3.11	3.43	4.42	2.93	2.79	1.97	-	4.19	2.14	5.33	25.00	18.42	24.75	26.63	24.67	17.80	25.9	-
	T2	1.96	4.96	3.69	2.23	3.17	2.24	3.87	2.46	1.78	-	2.17	1.44	5.00	21.67	18.75	23.83	22.98	23.33	15.20	26.7	-
	T3	2.16	5.87	3.32	2.65	3.42	4.28	2.80	2.98	1.9	-	3.24	1.82	5.37	23.33	18.87	24.38	25.33	25.33	16.94	24.92	-
	T4	2.17	6.30	3.42	2.73	3.32	4.37	2.75	2.79	2.05	-	3.78	2.02	5.80	24.33	18.61	24.42	26.41	26.33	16.47	25.24	-
Mean of Factor-1																						
1		2.29	6.82	3.52	3.37	3.32	4.33	1.90	3.27	2.47	3.4	4.41	2.57	5.48	25.25	18.01	27.62	26.56	24.25	18.00	25.28	16.37
2		2.33	6.27	3.10	2.62	3.52	4.05	3.15	3.06	1.85	3.34	3.82	2.37	5.42	24.58	18.77	26.12	25.61	25.50	17.15	25.74	16.19
3		2.09	5.82	3.52	2.68	3.34	3.83	3.09	2.75	1.93	-	3.35	1.86	5.38	23.58	18.66	24.35	25.34	24.92	16.60	25.69	-
CD(0.05)		0.02	NS	NS	0.17	NS	0.14	NS	0.24	0.13	NS	0.19	0.3	NS	0.51	NS	1.01	0.36	NS	NS	NS	NS
Mean of Factor-2																						
1		2.28	6.78	3.32	3.38	3.47	4.65	3.58	3.26	2.09	3.29	4.61	2.61	5.43	25.89	18.51	26.66	27.02	25.00	18.11	26.02	16.22
2		2.03	5.35	3.32	2.19	3.19	2.58	2.24	2.80	2.04	3.14	2.49	1.98	5.07	22.78	18.39	25.29	23.47	23.89	16.36	25.95	15.85
3		2.33	6.22	3.42	3.06	3.51	4.48	2.80	3.13	2.15	3.6	4.03	2.24	5.48	24.44	18.59	26.10	26.01	25.00	17.33	25.05	16.64
4		2.30	6.86	3.45	2.94	3.40	4.57	2.23	2.92	2.05	3.45	4.32	2.22	5.72	24.78	18.43	26.07	26.85	25.67	17.20	25.27	16.41
CD(0.05)		0.05	0.43	NS	0.27	NS	0.24	0.92	0.32	NS	0.2	0.23	0.35	NS	0.89	NS	0.84	0.45	NS	0.90	0.73	0.48
Interaction																						
M and T		0.09	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		0.08	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		2.24	6.30	3.38	2.89	3.39	4.07	2.71	3.03	2.08	3.37	3.86	2.26	5.43	24.47	18.48	26.03	25.84	24.89	17.25	25.57	16.28

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	Grain yield loss %											
		ADT	CHP	GNG	GGT	JDP	MLN	MNC	NWG	PNT	PDC	TTB	VAR
	T_1 – Weed free	-	-	-	-	-	-	-	-	-	-	-	-
	T_2 – Weedy check	55.26	65.26	37.56	46.77	20.06	48.07	49.25	30.91	42.72	7.14	45.56	51.46
	T_3 – Mechanical weeding using weeder	-9.86	33.73	8.16	3.22	4.85	21.06	18.75	11.91	4.98	-6.12	17.97	14.62
	T_4 – Chemical weed control (pre & post emergence herbicide application)	0.43	10.57	12.18	15.86	7.21	4.74	31.25	13.96	6.89	-2.55	6.07	-2.34

M1- Mechanized transplanting

M2 - Puddled direct seeding

M3 - Un puddled dry direct seeding

T1 – Weed free

T2 – Weedy check

T3 – Mechanical weeding using weeder

T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	ADUTHURAI				CHIPLIMA		
		Weed population at vegetative stage no/m^2				Weed population no/m^2		
		Grasses	Sedges	BLWs	Total	Vegetative stage(Grasses+Sedges+BLWs)	Panicle initiation stage(Grasses+Sedges+BLWs)	Heading stage(Grasses+Sedges+BLWs)
M1	T1	4.33(2.18)	7.67(2.85)	3.33(1.93)	15.33(3.97)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	T2	38.33(6.21)	27.67(5.29)	21.00(4.61)	87.00(9.33)	36.53(6.08)	51.33(7.19)	94.38(9.72)
	T3	14.33(3.84)	10.67(3.34)	7.00(2.72)	32.00(5.70)	16.03(4.06)	26.03(5.13)	41.63(6.47)
	T4	9.33(3.12)	10.33(3.27)	5.33(2.40)	25.00(5.04)	10.93(3.38)	17.20(4.17)	24.47(4.98)
M2	T1	5.00(2.32)	11.00(3.38)	6.33(2.58)	22.33(4.77)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	T2	46.33(6.84)	37.00(6.11)	25.33(5.06)	108.67(10.43)	77.35(8.77)	128.17(11.34)	162.80(12.77)
	T3	19.33(4.45)	13.67(3.75)	11.67(3.47)	44.67(6.72)	44.78(6.70)	61.77(7.86)	79.44(8.87)
	T4	11.00(3.38)	12.33(3.56)	8.67(3.02)	32.00(5.69)	17.03(4.16)	30.85(5.56)	44.01(6.65)
M3	T1	11.67(3.47)	7.67(2.83)	6.00(2.53)	25.33(5.05)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	T2	40.67(6.41)	31.33(5.63)	25.33(5.06)	97.33(9.88)	91.67(9.57)	142.43(11.95)	190.67(13.81)
	T3	14.33(3.84)	10.67(3.34)	7.00(2.72)	32.00(5.70)	55.45(7.46)	72.40(8.51)	96.17(9.82)
	T4	16.00(4.04)	9.33(3.12)	7.33(2.79)	32.67(5.76)	24.44(4.96)	38.68(6.24)	53.33(7.31)
Mean of Factor-1								
1		16.58(3.84)	14.08(3.69)	9.17(2.92)	39.83(6.01)	15.87(3.56)	23.64(4.30)	40.12(5.47)
2		20.42(4.25)	18.50(4.20)	13.00(3.53)	51.92(6.90)	34.79(5.09)	55.20(6.37)	71.56(7.25)
3		20.67(4.44)	14.75(3.73)	11.42(3.27)	46.83(6.60)	42.89(5.67)	63.38(6.85)	85.04(7.91)
CD(0.05)		0.2	NS	NS	NS	0.36	0.31	0.58
Mean of Factor-2								
1		7.00(2.66)	8.78(3.02)	5.22(2.35)	21.00(4.60)	0.00(0.71)	0.00(0.71)	0.00(0.71)
2		41.78(6.49)	32.00(5.68)	23.89(4.91)	97.67(9.88)	68.52(8.14)	107.31(10.16)	149.28(12.10)
3		16.00(4.05)	11.67(3.48)	8.56(2.97)	36.22(6.04)	38.75(6.07)	53.40(7.17)	72.41(8.39)
4		12.11(3.51)	10.67(3.32)	7.11(2.74)	29.89(5.50)	17.47(4.17)	28.91(5.32)	40.60(6.32)
CD(0.05)		0.39	0.33	0.43	0.36	0.57	0.45	0.58
Interaction								
M and T		NS	NS	NS	NS	0.99	0.79	1
T and M		NS	NS	NS	NS	0.88	0.7	0.93
Experimental Mean		4.18	3.87	3.24	6.5	4.77	5.84	6.88

(Values in parentheses are original)

M1- Mechanized transplanting

M2 - Puddled direct seeding

M3 - Un puddled dry direct seeding

T1 – Weed free

T2 – Weedy check

T3 – Mechanical weeding using weeder

T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	GANGAVATHI								GHAGHRAGHAT		
		Weed population at vegetative stage no/m²				Weed population at panicle initiation stage no/m²				Weed population no/m²		
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Active Vegetative stage	Panicle initiation stage	Heading stage
M1	T1	0.67(1.05)	8.33(2.94)	16.33(4.10)	25.33(5.07)	2.00(1.58)	18.49(4.36)	23.17(4.83)	43.65(6.63)	-	-	34.67(5.91)
	T2	3.33(1.88)	37.67(6.14)	38.00(6.19)	79.00(8.88)	2.93(1.85)	101.10(10.08)	50.97(7.16)	154.99(12.47)	18.33(4.33)	49.00(7.01)	73.00(8.55)
	T3	0.33(0.88)	22.33(4.76)	26.00(5.11)	48.67(6.98)	9.19(3.05)	52.67(7.22)	40.77(6.24)	102.63(10.06)	22.33(4.76)	32.33(5.58)	56.33(7.53)
	T4	3.67(2.03)	7.67(2.84)	3.67(2.02)	15.00(3.93)	1.85(1.44)	43.67(6.61)	1.00(1.22)	46.52(6.84)	21.33(4.66)	38.33(6.22)	51.33(7.19)
M2	T1	0.67(1.05)	4.67(2.24)	8.33(2.96)	13.67(3.76)	2.93(1.85)	31.33(5.57)	64.01(7.93)	98.27(9.82)	-	-	45.33(6.76)
	T2	3.33(1.90)	29.67(5.48)	25.67(5.08)	58.67(7.67)	8.34(2.91)	126.00(11.23)	58.20(7.66)	192.54(13.88)	27.33(5.25)	77.33(8.81)	79.33(8.93)
	T3	1.33(1.34)	7.33(2.67)	6.00(2.53)	14.67(3.81)	6.49(2.47)	24.08(4.96)	66.67(8.12)	97.23(9.84)	25.67(5.08)	46.33(6.83)	57.00(7.57)
	T4	2.00(1.58)	10.67(3.29)	6.67(2.58)	19.33(4.44)	1.00(1.22)	62.09(7.90)	43.00(6.57)	106.09(10.30)	26.00(5.13)	42.00(6.51)	59.67(7.75)
M3	T1	2.00(1.58)	4.33(2.15)	9.33(3.13)	15.67(4.00)	1.93(1.54)	30.45(5.56)	52.94(7.29)	85.32(9.25)	-	-	47.67(6.93)
	T2	8.00(2.90)	40.00(6.36)	7.00(2.68)	55.00(7.45)	38.92(6.16)	106.67(10.34)	41.75(6.44)	187.34(13.69)	30.00(5.50)	75.33(8.70)	78.00(8.85)
	T3	2.67(1.77)	10.67(3.33)	7.33(2.79)	20.67(4.60)	7.41(2.73)	20.39(4.50)	22.23(4.72)	50.03(7.07)	35.67(6.00)	56.00(7.50)	61.00(7.82)
	T4	10.33(3.27)	27.00(5.24)	2.00(1.52)	39.33(6.31)	18.30(4.31)	76.13(8.74)	6.49(2.59)	100.92(10.06)	28.00(5.29)	56.67(7.54)	63.67(8.00)
Mean of Factor-1												
1		2.00(1.46)	19.00(4.17)	21.00(4.35)	42.00(6.21)	3.99(1.98)	53.98(7.07)	28.98(4.86)	86.95(9.00)	20.67(4.59)	39.89(6.27)	53.83(7.30)
2		1.83(1.47)	13.08(3.42)	11.67(3.29)	26.58(4.92)	4.69(2.11)	60.88(7.42)	57.97(7.57)	123.53(10.96)	26.33(5.15)	55.22(7.38)	60.33(7.75)
3		5.75(2.38)	20.50(4.27)	6.42(2.53)	32.67(5.59)	16.64(3.69)	58.41(7.29)	30.85(5.26)	105.90(10.02)	31.22(5.60)	62.67(7.91)	62.58(7.90)
CD(0.05)		0.26	0.31	0.16	0.25	0.37	NS	0.84	0.92	0.23	0.67	NS
Mean of Factor-2												
1		1.11(1.23)	5.78(2.44)	11.33(3.40)	18.22(4.28)	2.28(1.66)	26.76(5.16)	46.71(6.68)	75.75(8.57)	-	-	42.56(6.53)
2		4.89(2.23)	35.78(5.99)	23.56(4.65)	64.22(8.00)	16.73(3.64)	111.26(10.55)	50.31(7.09)	178.29(13.35)	25.22(5.03)	67.22(8.18)	76.78(8.78)
3		1.44(1.33)	13.44(3.59)	13.11(3.48)	28.00(5.13)	7.70(2.75)	32.38(5.56)	43.22(6.36)	83.30(8.99)	27.89(5.28)	44.89(6.63)	58.11(7.64)
4		5.33(2.29)	15.11(3.79)	4.11(2.04)	24.56(4.89)	7.05(2.33)	60.63(7.75)	16.83(3.46)	84.51(9.07)	25.11(5.03)	45.67(6.76)	58.22(7.65)
CD(0.05)		0.35	0.59	0.54	0.62	0.79	0.57	0.96	0.75	NS	0.65	0.55
Interaction												
M and T		NS	1.02	0.94	1.07	1.36	0.98	1.66	1.29	NS	NS	NS
T and M		NS	0.9	0.82	0.93	1.2	0.88	1.52	1.26	NS	NS	NS
Experimental Mean		1.77	3.95	3.39	5.58	2.59	7.26	5.9	9.99	5.11	7.19	7.65

(Values in parentheses are original)

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	JAGDALPUR											
		Weed population at vegetative stage/m^2				Weed population at panicle initiation stage no/m^2				Weed population at heading stage no/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	4.33(2.16)	4.67(2.22)	4.33(2.15)	13.33(3.68)	3.33(1.93)	5.67(2.47)	3.67(2.00)	12.67(3.59)	3.33(1.93)	5.67(2.40)	5.33(2.38)	14.33(3.78)
	T2	14.67(3.81)	8.33(2.95)	15.00(3.91)	38.00(6.17)	19.67(4.43)	13.67(3.76)	18.67(4.34)	52.00(7.21)	23.33(4.81)	17.00(4.18)	22.00(4.70)	62.33(7.87)
	T3	6.33(2.60)	4.67(2.22)	5.33(2.38)	16.33(4.09)	5.00(2.32)	7.67(2.82)	5.67(2.40)	18.33(4.32)	6.33(2.60)	9.67(3.18)	5.67(2.47)	21.67(4.70)
	T4	6.67(2.67)	5.33(2.38)	8.67(3.01)	20.67(4.58)	4.67(2.22)	5.00(2.34)	5.33(2.40)	15.00(3.92)	4.67(2.24)	7.00(2.72)	5.67(2.45)	17.33(4.22)
M2	T1	5.33(2.40)	7.00(2.73)	6.33(2.59)	18.67(4.38)	3.67(2.02)	4.00(2.06)	6.33(2.56)	14.00(3.81)	4.33(2.18)	8.00(2.86)	6.00(2.54)	18.33(4.34)
	T2	15.67(3.98)	16.67(4.11)	15.33(3.96)	47.67(6.90)	21.33(4.65)	18.00(4.28)	20.00(4.52)	59.33(7.71)	20.67(4.59)	22.00(4.74)	24.33(4.98)	67.00(8.21)
	T3	8.33(2.95)	11.00(3.38)	8.67(3.02)	28.00(5.32)	6.33(2.58)	5.00(2.32)	11.00(3.38)	22.33(4.75)	6.67(2.65)	5.67(2.46)	8.33(2.95)	20.67(4.58)
	T4	9.00(3.06)	12.33(3.57)	7.33(2.77)	28.67(5.37)	6.67(2.66)	7.33(2.73)	7.00(2.71)	21.00(4.60)	7.00(2.68)	6.33(2.56)	5.33(2.34)	18.67(4.30)
M3	T1	7.33(2.79)	10.67(3.33)	8.00(2.84)	26.00(5.13)	7.67(2.85)	6.33(2.60)	8.33(2.93)	22.33(4.78)	8.33(2.95)	7.00(2.73)	6.33(2.58)	21.67(4.69)
	T2	31.67(5.67)	24.33(4.95)	19.67(4.49)	75.67(8.71)	37.00(6.12)	26.00(5.13)	26.67(5.20)	89.67(9.50)	28.00(5.31)	31.33(5.64)	33.00(5.78)	92.33(9.63)
	T3	9.33(3.13)	13.00(3.64)	11.33(3.37)	33.67(5.84)	10.00(3.23)	9.33(3.13)	9.00(3.07)	28.33(5.37)	10.67(3.34)	9.33(3.06)	8.33(2.94)	28.33(5.36)
	T4	8.33(2.96)	13.67(3.73)	8.67(2.96)	30.67(5.58)	11.33(3.43)	12.67(3.62)	7.67(2.81)	31.67(5.66)	6.67(2.65)	8.33(2.93)	5.00(2.34)	20.00(4.51)
Mean of Factor-1													
1		8.00(2.81)	5.75(2.44)	8.33(2.86)	22.08(4.63)	8.17(2.72)	8.00(2.85)	8.33(2.79)	24.50(4.76)	9.42(2.90)	9.83(3.12)	9.67(3.00)	28.92(5.14)
2		9.58(3.10)	11.75(3.45)	9.42(3.09)	30.75(5.49)	9.50(2.98)	8.58(2.85)	11.08(3.29)	29.17(5.22)	9.67(3.02)	10.50(3.16)	11.00(3.20)	31.17(5.36)
3		14.17(3.64)	15.42(3.91)	11.92(3.42)	41.50(6.32)	16.50(3.91)	13.58(3.62)	12.92(3.50)	43.00(6.33)	13.42(3.56)	14.00(3.59)	13.17(3.41)	40.58(6.05)
CD(0.05)		0.32	0.3	NS	0.53	0.34	0.37	NS	0.4	NS	NS	NS	0.43
Mean of Factor-2													
1		5.67(2.45)	7.44(2.76)	6.22(2.53)	19.33(4.40)	4.89(2.27)	5.33(2.38)	6.11(2.50)	16.33(4.06)	5.33(2.35)	6.89(2.67)	5.89(2.50)	18.11(4.27)
2		20.67(4.49)	16.44(4.00)	16.67(4.12)	53.78(7.26)	26.00(5.06)	19.22(4.39)	21.78(4.69)	67.00(8.14)	24.00(4.90)	23.44(4.85)	26.44(5.15)	73.89(8.57)
3		8.00(2.90)	9.56(3.08)	8.44(2.92)	26.00(5.09)	7.11(2.71)	7.33(2.76)	8.56(2.95)	23.00(4.81)	7.89(2.86)	8.22(2.90)	7.44(2.79)	23.56(4.88)
4		8.00(2.89)	10.44(3.23)	8.22(2.92)	26.67(5.18)	7.56(2.77)	8.33(2.90)	6.67(2.64)	22.56(4.73)	6.11(2.52)	7.22(2.74)	5.33(2.37)	18.67(4.34)
CD(0.05)		0.39	0.52	0.43	0.48	0.41	0.4	0.53	0.49				
Interaction										13.96	13.77	15.15	9.23
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		3.18	3.27	3.12	5.48	3.2	3.11	3.19	5.43	3.16	3.29	3.2	5.52

(Values in parentheses are original)

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	MALAN											
		Weed population at vegetative stage no/m^2				Weed population at panicle initiation stage no/m^2				Weed population at heading stage no/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	T2	31.33(5.64)	14.00(3.80)	18.00(4.29)	63.33(7.99)	32.33(5.73)	15.00(3.93)	17.67(4.26)	65.00(8.09)	27.00(5.24)	13.67(3.76)	15.67(4.02)	56.33(7.54)
	T3	18.00(4.30)	7.00(2.73)	10.00(3.24)	35.00(5.96)	23.67(4.91)	8.67(3.01)	13.67(3.75)	46.00(6.81)	23.67(4.90)	9.00(3.04)	14.00(3.80)	46.67(6.84)
	T4	3.00(1.86)	3.00(1.86)	3.00(1.86)	9.00(3.08)	5.33(2.40)	6.33(2.59)	5.00(2.28)	16.67(4.12)	6.00(2.53)	6.67(2.65)	5.33(2.35)	18.00(4.29)
M2	T1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	T2	48.00(6.96)	31.67(5.66)	53.67(7.36)	133.33(11.57)	45.67(6.79)	29.00(5.41)	32.33(5.72)	107.00(10.36)	48.33(6.98)	27.33(5.27)	28.67(5.40)	104.33(10.24)
	T3	23.67(4.91)	18.67(4.37)	26.00(5.15)	68.33(8.29)	23.00(4.83)	22.33(4.77)	18.00(4.29)	63.33(7.96)	23.67(4.90)	22.33(4.77)	18.00(4.28)	64.00(8.01)
	T4	8.33(2.96)	4.67(2.26)	6.33(2.59)	19.33(4.44)	7.67(2.80)	4.67(2.21)	3.67(2.00)	16.00(4.04)	8.33(2.96)	5.67(2.47)	5.00(2.32)	19.00(4.40)
M3	T1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	T2	55.67(7.49)	67.00(8.21)	62.67(7.94)	185.33(13.63)	55.33(7.47)	55.67(7.49)	66.00(8.15)	177.00(13.32)	57.33(7.60)	56.67(7.56)	68.00(8.27)	182.00(13.51)
	T3	34.33(5.90)	31.33(5.64)	30.33(5.55)	96.00(9.82)	34.67(5.93)	30.33(5.55)	28.67(5.40)	93.67(9.70)	37.67(6.18)	33.00(5.78)	30.00(5.52)	100.67(10.06)
	T4	12.67(3.61)	6.67(2.67)	9.33(3.13)	28.67(5.40)	9.33(3.13)	7.33(2.78)	10.67(3.33)	27.33(5.25)	8.00(2.91)	5.33(2.39)	9.33(3.05)	22.67(4.76)
Mean of Factor-1													
1		13.08(3.13)	6.00(2.28)	7.75(2.52)	26.83(4.43)	15.33(3.44)	7.50(2.56)	9.08(2.75)	31.92(4.93)	14.17(3.34)	7.33(2.54)	8.75(2.72)	30.25(4.85)
2		20.00(3.88)	13.75(3.25)	21.50(3.95)	55.25(6.25)	19.08(3.78)	14.00(3.27)	13.50(3.18)	46.58(5.77)	20.08(3.89)	13.83(3.31)	12.92(3.18)	46.83(5.84)
3		25.67(4.43)	26.25(4.31)	25.58(4.33)	77.50(7.39)	24.83(4.31)	23.33(4.13)	26.33(4.40)	74.50(7.25)	25.75(4.35)	23.75(4.11)	26.83(4.39)	76.33(7.26)
CD(0.05)		0.19	0.16	0.13	0.17	0.23	0.22	0.16	0.23	0.13	0.1	0.23	0.11
Mean of Factor-2													
1		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
2		45.00(6.70)	37.56(5.89)	44.78(6.53)	127.33(11.06)	44.44(6.66)	33.22(5.61)	38.67(6.04)	116.33(10.59)	44.22(6.61)	32.56(5.53)	37.44(5.90)	114.22(10.43)
3		25.33(5.04)	19.00(4.25)	22.11(4.64)	66.44(8.02)	27.11(5.22)	20.44(4.44)	20.11(4.48)	67.67(8.16)	28.33(5.33)	21.44(4.53)	20.67(4.53)	70.44(8.30)
4		8.00(2.81)	4.78(2.26)	6.22(2.53)	19.00(4.31)	7.44(2.78)	6.11(2.53)	6.44(2.54)	20.00(4.47)	7.44(2.80)	5.89(2.50)	6.56(2.57)	19.89(4.48)
CD(0.05)		0.25	0.23	0.26	0.21	0.26	0.3	0.36	0.34	0.22	0.26	0.42	0.35
Interaction													
M and T		0.43	0.4	0.45	0.36	0.45	0.52	0.63	0.58	0.38	0.44	0.73	0.61
T and M		0.39	0.36	0.4	0.33	0.41	0.47	0.55	0.52	0.34	0.39	0.65	0.53
Experimental Mean		3.81	3.28	3.6	6.02	3.84	3.32	3.44	5.98	3.86	3.32	3.43	5.98

(Values in parentheses are original)

M1- Mechanized transplanting

M2 - Puddled direct seeding

M3 - Un puddled dry direct seeding

T1 – Weed free

T2 – Weedy check

T3 – Mechanical weeding using weeder

T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	MONCOMPU											
		Weed population at vegetative stage no/m²				Weed population at panicle initiation stage no/m²				Weed population at heading stage no/m²			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	9.33(3.12)	2.67(1.65)	6.67(2.39)	18.67(4.37)	20.00(4.53)	6.67(2.30)	14.67(3.89)	41.33(6.46)	129.33(11.15)	0.00(0.71)	0.00(0.71)	129.33(11.15)
	T2	20.00(3.87)	137.33(11.54)	65.33(8.05)	222.67(14.92)	28.00(5.18)	70.67(8.42)	16.00(2.79)	114.67(10.61)	238.67(15.26)	0.00(0.71)	16.00(2.79)	254.67(15.89)
	T3	28.00(3.93)	36.00(5.47)	52.00(6.73)	116.00(10.05)	40.00(6.26)	20.00(3.87)	34.67(4.93)	94.67(9.72)	124.00(11.00)	0.00(0.71)	10.67(2.37)	134.67(11.55)
	T4	54.67(6.69)	44.00(6.36)	13.33(2.59)	112.00(9.78)	37.33(5.84)	20.00(4.27)	6.67(1.98)	64.00(7.78)	153.33(12.25)	0.00(0.71)	10.67(2.37)	164.00(12.75)
M2	T1	5.33(1.83)	13.33(3.68)	29.33(5.00)	48.00(6.57)	5.33(2.18)	8.00(2.12)	13.33(3.57)	26.67(5.21)	4.00(1.65)	8.00(2.12)	12.00(3.39)	24.00(4.86)
	T2	25.33(4.30)	150.67(12.12)	117.33(10.79)	293.33(17.11)	48.00(6.67)	146.67(11.93)	57.33(7.40)	252.00(15.83)	50.67(6.06)	98.67(8.34)	34.67(4.97)	184.00(13.21)
	T3	10.67(3.19)	84.00(8.26)	61.33(7.85)	156.00(12.33)	88.00(9.40)	133.33(11.44)	34.67(4.97)	256.00(15.87)	104.00(10.18)	125.33(11.11)	21.33(3.91)	250.67(15.71)
	T4	18.67(4.16)	45.33(6.23)	10.67(2.37)	74.67(8.17)	28.00(5.20)	38.67(6.07)	8.00(2.56)	74.67(8.39)	10.67(2.92)	42.67(6.25)	8.00(2.12)	61.33(7.63)
M3	T1	1.33(1.18)	26.67(3.46)	12.00(3.50)	40.00(5.74)	5.33(2.18)	6.67(2.59)	12.00(3.42)	24.00(4.88)	0.00(0.71)	9.33(2.92)	5.33(1.83)	14.67(3.73)
	T2	5.33(1.83)	82.67(8.99)	72.00(8.24)	160.00(12.63)	18.67(3.71)	77.33(8.55)	32.00(5.65)	128.00(11.32)	29.33(4.56)	90.67(9.42)	22.67(4.14)	142.67(11.95)
	T3	6.67(2.65)	65.33(7.69)	62.67(7.84)	134.67(11.44)	12.00(3.10)	48.00(5.88)	22.67(4.78)	82.67(8.72)	13.33(3.24)	34.67(4.73)	12.00(3.33)	60.00(7.37)
	T4	5.33(2.18)	32.00(5.62)	8.00(2.92)	45.33(6.70)	13.33(3.68)	14.67(3.80)	9.33(2.25)	37.33(5.92)	13.33(3.68)	14.67(3.31)	5.33(1.83)	33.33(5.73)
Mean of Factor-1													
1		28.00(4.40)	55.00(6.26)	34.33(4.94)	117.33(9.78)	31.33(5.45)	29.33(4.71)	18.00(3.40)	78.67(8.64)	161.33(12.42)	0.00(0.71)	9.33(2.06)	170.67(12.84)
2		15.00(3.37)	73.33(7.57)	54.67(6.50)	143.00(11.05)	42.33(5.86)	81.67(7.89)	28.33(4.63)	152.33(11.32)	42.33(5.21)	68.67(6.95)	19.00(3.60)	130.00(10.35)
3		4.67(1.96)	51.67(6.44)	38.67(5.63)	95.00(9.13)	12.33(3.17)	36.67(5.20)	19.00(4.03)	68.00(7.71)	14.00(3.05)	37.33(5.09)	11.33(2.78)	62.67(7.19)
CD(0.05)		NS	NS	NS	NS	0.62	NS	NS	1.23	1.24	2.17	NS	2.12
Mean of Factor-2													
1		5.33(2.04)	14.22(2.93)	16.00(3.63)	35.56(5.56)	10.22(2.96)	7.11(2.34)	13.33(3.62)	30.67(5.51)	44.44(4.50)	5.78(1.92)	5.78(1.98)	56.00(6.58)
2		16.89(3.33)	123.56(10.88)	84.89(9.03)	225.33(14.88)	31.56(5.19)	98.22(9.63)	35.11(5.28)	164.89(12.59)	106.22(8.63)	63.11(6.15)	24.44(3.97)	193.78(13.68)
3		15.11(3.26)	61.78(7.14)	58.67(7.47)	135.56(11.28)	46.67(6.25)	67.11(7.06)	30.67(4.90)	144.44(11.43)	80.44(8.14)	53.33(5.51)	14.67(3.20)	148.44(11.54)
4		26.22(4.34)	40.44(6.07)	10.67(2.63)	77.33(8.22)	26.22(4.91)	24.44(4.71)	8.00(2.26)	58.67(7.36)	59.11(6.28)	19.11(3.42)	8.00(2.11)	86.22(8.70)
CD(0.05)		NS	2.63	1.67	2.7	1.58	2.41	NS	1.75	2.61	2.77	NS	2.01
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	3.49
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	3.28
Experimental Mean		3.24	6.76	5.69	9.98	4.83	5.94	4.02	9.22	6.89	4.25	2.81	10.13

(Values in parentheses are original)

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	NAWAGAM											
		Weed population at vegetative stage no/m^2				Weed population at panicle initiation stage no/m^2				Weed population at heading stage no/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	4.00(2.00)	4.67(2.26)	4.67(2.26)	13.33(3.70)	36.00(5.98)	31.33(5.59)	35.00(5.91)	102.33(10.10)	21.33(4.66)	13.67(3.73)	19.33(4.41)	54.33(7.36)
	T2	12.67(3.60)	9.00(3.01)	11.00(3.32)	32.67(5.68)	59.33(7.71)	61.33(7.80)	66.33(8.16)	187.00(13.68)	32.33(5.70)	37.33(6.14)	32.33(5.72)	102.00(10.12)
	T3	6.67(2.64)	5.67(2.47)	8.00(2.88)	20.33(4.56)	45.00(6.68)	46.33(6.83)	37.33(6.14)	128.67(11.35)	29.33(5.42)	28.33(5.35)	27.67(5.27)	85.33(9.22)
	T4	6.00(2.53)	4.33(2.16)	4.67(2.22)	15.00(3.93)	37.67(6.17)	41.67(6.48)	33.67(5.82)	113.00(10.65)	26.33(5.11)	33.00(5.77)	33.00(5.78)	92.33(9.63)
M2	T1	2.00(1.56)	6.00(2.51)	9.67(3.18)	17.67(4.25)	35.33(5.97)	36.33(6.07)	43.00(6.57)	114.67(10.73)	26.00(5.11)	28.33(5.36)	27.00(5.20)	81.33(9.00)
	T2	14.00(3.73)	10.67(3.32)	14.33(3.80)	39.00(6.27)	75.33(8.61)	59.33(7.72)	69.67(8.36)	204.33(14.27)	40.67(6.41)	42.33(6.54)	36.33(6.05)	119.33(10.94)
	T3	4.67(2.26)	6.33(2.61)	7.67(2.85)	18.67(4.37)	43.33(6.61)	34.67(5.92)	33.33(5.82)	111.33(10.57)	36.33(6.05)	31.00(5.60)	32.67(5.74)	100.00(9.99)
	T4	5.33(2.40)	7.00(2.71)	6.33(2.61)	18.67(4.36)	29.67(5.48)	37.33(6.13)	34.33(5.90)	101.33(10.09)	36.67(6.10)	30.00(5.52)	29.33(5.44)	96.00(9.82)
M3	T1	4.33(2.15)	10.33(3.22)	5.33(2.34)	20.00(4.51)	41.67(6.49)	30.67(5.55)	32.00(5.66)	104.33(10.24)	37.67(6.15)	33.00(5.76)	34.33(5.88)	105.00(10.27)
	T2	16.33(4.08)	19.67(4.46)	15.33(3.93)	51.33(7.18)	69.00(8.23)	71.00(8.38)	78.00(8.82)	218.00(14.72)	43.67(6.63)	38.33(6.19)	42.67(6.53)	124.67(11.18)
	T3	9.67(3.17)	3.67(2.00)	9.67(3.18)	23.00(4.84)	38.00(6.19)	36.67(6.09)	36.67(6.08)	111.33(10.56)	35.00(5.93)	40.33(6.38)	27.33(5.24)	102.67(10.16)
	T4	7.00(2.72)	7.00(2.72)	4.67(2.26)	18.67(4.35)	49.67(6.99)	38.67(6.23)	44.33(6.58)	132.67(11.48)	34.33(5.89)	40.33(6.37)	30.67(5.54)	105.33(10.29)
Mean of Factor-1													
1		7.33(2.69)	5.92(2.47)	7.08(2.67)	20.33(4.47)	44.50(6.63)	45.17(6.68)	43.08(6.51)	132.75(11.44)	27.33(5.22)	28.08(5.25)	28.08(5.29)	83.50(9.08)
2		6.50(2.49)	7.50(2.79)	9.50(3.11)	23.50(4.81)	45.92(6.67)	41.92(6.46)	45.08(6.66)	132.92(11.42)	34.92(5.91)	32.92(5.75)	31.33(5.61)	99.17(9.94)
3		9.33(3.03)	10.17(3.10)	8.75(2.92)	28.25(5.22)	49.58(6.98)	44.25(6.56)	47.75(6.78)	141.58(11.75)	37.67(6.15)	38.00(6.17)	33.75(5.80)	109.42(10.47)
CD(0.05)		NS	0.27	NS	0.14	NS	NS	NS	NS	0.27	0.4	0.19	0.23
Mean of Factor-2													
1		3.44(1.90)	7.00(2.66)	6.56(2.59)	17.00(4.15)	37.67(6.15)	32.78(5.73)	36.67(6.05)	107.11(10.36)	28.33(5.31)	25.00(4.95)	26.89(5.16)	80.22(8.88)
2		14.33(3.80)	13.11(3.60)	13.56(3.68)	41.00(6.38)	67.89(8.18)	63.89(7.97)	71.33(8.44)	203.11(14.22)	38.89(6.24)	39.33(6.29)	37.11(6.10)	115.33(10.75)
3		7.00(2.69)	5.22(2.36)	8.44(2.97)	20.67(4.59)	42.11(6.49)	39.22(6.28)	35.78(6.01)	117.11(10.83)	33.56(5.80)	33.22(5.78)	29.22(5.42)	96.00(9.79)
4		6.11(2.55)	6.11(2.53)	5.22(2.36)	17.44(4.21)	39.00(6.21)	39.22(6.28)	37.44(6.10)	115.67(10.74)	32.44(5.70)	34.44(5.88)	31.00(5.59)	97.89(9.91)
CD(0.05)		0.47	0.54	0.58	0.49	1.04	0.67	0.82	0.98	NS	0.57	0.63	0.64
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		2.74	2.79	2.9	4.83	6.76	6.57	6.65	11.54	5.76	5.72	5.57	9.83

(Values in parentheses are original)

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	PUDUCHERRY											
		Weed population at vegetative stage no/m^2				Weed population at panicle initiation stage no/m^2				Weed population at heading stage no/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	26.19(5.17)	16.49(4.12)	18.43(4.35)	61.11(7.85)	20.37(4.57)	11.64(3.48)	10.67(3.34)	42.68(6.57)	13.58(3.75)	8.73(3.04)	8.73(3.04)	31.04(5.62)
	T2	29.80(5.50)	18.87(4.40)	22.85(4.83)	71.52(8.49)	22.85(4.83)	13.91(3.80)	13.91(3.80)	50.66(7.15)	16.89(4.17)	10.93(3.38)	10.93(3.38)	38.74(6.26)
	T3	20.37(4.57)	10.67(3.34)	12.61(3.62)	43.65(6.64)	12.61(3.62)	8.73(3.04)	6.79(2.70)	28.13(5.35)	7.76(2.87)	4.85(2.31)	4.85(2.31)	17.46(4.24)
	T4	24.25(4.97)	13.58(3.75)	15.52(4.00)	53.35(7.34)	14.55(3.88)	9.70(3.19)	8.73(3.04)	32.98(5.79)	10.67(3.34)	7.76(2.87)	7.76(2.87)	26.19(5.17)
M2	T1	29.80(5.50)	17.88(4.29)	21.85(4.73)	69.53(8.37)	20.86(4.62)	13.91(3.80)	14.90(3.92)	49.67(7.08)	15.89(4.05)	10.93(3.38)	10.93(3.38)	37.75(6.18)
	T2	32.98(5.79)	22.31(4.78)	25.22(5.07)	80.51(9.00)	24.25(4.97)	15.52(4.00)	16.49(4.12)	56.26(7.53)	19.40(4.46)	12.61(3.62)	12.61(3.62)	44.62(6.72)
	T3	24.83(5.03)	12.91(3.66)	14.90(3.92)	52.65(7.29)	13.91(3.80)	9.93(3.23)	10.93(3.38)	34.77(5.94)	8.94(3.07)	6.95(2.73)	6.95(2.73)	22.85(4.83)
	T4	27.81(5.32)	14.90(3.92)	17.88(4.29)	60.59(7.82)	17.88(4.29)	11.92(3.52)	12.91(3.66)	42.71(6.57)	11.92(3.52)	8.94(3.07)	8.94(3.07)	29.80(5.50)
M3	T1	-	-	-	-	-	-	-	-	-	-	-	-
	T2	-	-	-	-	-	-	-	-	-	-	-	-
	T3	-	-	-	-	-	-	-	-	-	-	-	-
	T4	-	-	-	-	-	-	-	-	-	-	-	-
Mean of Factor-1													
1		25.15(5.05)	14.90(3.90)	17.35(4.20)	57.41(7.58)	17.59(4.22)	10.99(3.38)	10.02(3.22)	38.61(6.21)	12.22(3.53)	8.07(2.90)	8.07(2.90)	28.36(5.32)
2		28.86(5.41)	17.00(4.16)	19.96(4.50)	65.82(8.12)	19.22(4.42)	12.82(3.64)	13.81(3.77)	45.85(6.78)	14.04(3.78)	9.86(3.20)	9.86(3.20)	33.75(5.81)
3		-	-	-	-	-	-	-	-	-	-	-	-
CD(0.05)		0.14	0.1	0.11	0.2	0.11	0.09	0.09	0.17	0.08	0.07	0.07	0.14
Mean of Factor-2													
1		28.00(5.34)	17.18(4.20)	20.14(4.54)	65.32(8.11)	20.62(4.59)	12.77(3.64)	12.79(3.63)	46.17(6.83)	14.74(3.90)	9.83(3.21)	9.83(3.21)	34.39(5.90)
2		31.39(5.65)	20.59(4.59)	24.03(4.95)	76.01(8.74)	23.55(4.90)	14.71(3.90)	15.20(3.96)	53.46(7.34)	18.14(4.32)	11.77(3.50)	11.77(3.50)	41.68(6.49)
3		22.60(4.80)	11.79(3.50)	13.76(3.77)	48.15(6.97)	13.26(3.71)	9.33(3.13)	8.86(3.04)	31.45(5.64)	8.35(2.97)	5.90(2.52)	5.90(2.52)	20.15(4.53)
4		26.03(5.15)	14.24(3.84)	16.70(4.14)	56.97(7.58)	16.21(4.08)	10.81(3.36)	10.82(3.35)	37.85(6.18)	11.30(3.43)	8.35(2.97)	8.35(2.97)	28.00(5.34)
CD(0.05)		0.08	0.06	0.07	0.12	0.07	0.05	0.05	0.1	0.06	0.05	0.05	0.09
Interaction													
M and T		NS	0.09	NS	NS	0.09	NS	0.07	0.14	NS	0.06	0.06	NS
T and M		NS	0.11	NS	NS	0.12	NS	0.09	0.18	NS	0.08	0.08	NS
Experimental Mean		5.23	4.03	4.35	7.85	4.32	3.51	3.5	6.5	3.66	3.05	3.05	5.56

(Values in parentheses are original)

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	PANTNAGAR Total weeds: Weed population at mid-tillering stage stage no/m^2	PANTNAGAR Total weeds: Weed population at panicle initiation stage no/m^2	TITABAR Weed population at vegetative stage no/m^2: Grasses	Sedges	BLWs	Total
M1	T1	2.00(1.56)	7.33(2.80)	2.67(1.76)	1.33(1.29)	4.00(2.09)	8.00(2.91)
	T2	13.33(3.72)	27.67(5.30)	16.67(4.06)	3.00(1.86)	13.67(3.75)	33.33(5.76)
	T3	5.33(2.39)	6.67(2.68)	8.67(3.03)	1.00(1.17)	6.67(2.62)	16.33(4.08)
	T4	5.33(2.41)	3.33(1.95)	7.00(2.72)	1.33(1.18)	7.00(2.71)	15.33(3.96)
M2	T1	5.00(2.34)	5.33(2.41)	2.33(1.68)	1.00(1.17)	5.67(2.46)	9.00(3.06)
	T2	22.33(4.78)	34.00(5.87)	19.00(4.41)	7.33(2.79)	22.67(4.81)	49.00(7.03)
	T3	9.00(3.08)	5.00(2.34)	12.67(3.60)	3.00(1.86)	10.33(3.22)	26.00(5.15)
	T4	7.33(2.80)	2.33(1.68)	10.67(3.27)	2.00(1.52)	13.33(3.68)	26.00(5.10)
M3	T1	8.00(2.92)	6.33(2.61)	5.33(2.41)	1.33(1.29)	3.67(2.03)	10.33(3.28)
	T2	41.33(6.47)	48.33(6.98)	27.67(5.29)	8.67(3.01)	34.00(5.85)	70.33(8.41)
	T3	9.67(3.19)	6.33(2.61)	14.00(3.80)	6.00(2.49)	14.67(3.88)	34.67(5.90)
	T4	6.67(2.67)	3.67(2.04)	13.00(3.67)	4.67(2.26)	10.67(3.34)	28.33(5.37)
Mean of Factor-1							
1		6.50(2.52)	11.25(3.18)	8.75(2.89)	1.67(1.37)	7.83(2.79)	18.25(4.18)
2		10.92(3.25)	11.67(3.08)	11.17(3.24)	3.33(1.84)	13.00(3.54)	27.50(5.08)
3		16.42(3.81)	16.17(3.56)	15.00(3.79)	5.17(2.26)	15.75(3.77)	35.92(5.74)
CD(0.05)		0.2	0.1	0.29	NS	0.25	0.46
Mean of Factor-2							
1		5.00(2.27)	6.33(2.61)	3.44(1.95)	1.22(1.25)	4.44(2.19)	9.11(3.08)
2		25.67(4.99)	36.67(6.05)	21.11(4.59)	6.33(2.55)	23.44(4.80)	50.89(7.07)
3		8.00(2.88)	6.00(2.54)	11.78(3.48)	3.33(1.84)	10.56(3.24)	25.67(5.04)
4		6.44(2.63)	3.11(1.89)	10.22(3.22)	2.67(1.66)	10.33(3.24)	23.22(4.81)
CD(0.05)		0.21	0.2	0.48	0.37	0.49	0.51
Interaction							
M and T		0.37	0.34	NS	NS	NS	NS
T and M		0.34	0.3	NS	NS	NS	NS
Experimental Mean		3.19	3.27	3.31	1.82	3.37	5

(Values in parentheses are original)

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	VARANASI											
		Weed population at vegetative stage no/m^2				Weed population at panicle initiation stage no/m^2				Weed population at heading stage no/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	13.00(3.66)	8.33(2.96)	10.00(3.24)	31.33(5.63)	9.00(3.08)	9.67(3.19)	4.00(2.11)	22.67(4.81)	8.67(3.03)	8.67(3.03)	0.00(0.71)	17.33(4.22)
	T2	19.33(4.44)	67.67(8.25)	13.00(3.67)	100.00(10.02)	17.33(4.22)	50.00(7.10)	3.67(2.04)	71.00(8.45)	13.33(3.72)	30.00(5.52)	13.00(3.67)	56.33(7.54)
	T3	7.67(2.85)	12.00(3.52)	11.00(3.39)	30.67(5.58)	6.67(2.68)	10.67(3.34)	3.00(1.87)	20.33(4.56)	2.67(1.77)	2.67(1.77)	3.33(1.95)	8.67(3.03)
	T4	7.67(2.85)	3.00(1.86)	1.00(1.22)	11.67(3.49)	7.67(2.85)	7.00(2.73)	0.00(0.71)	14.67(3.89)	6.67(2.68)	6.67(2.68)	0.00(0.71)	13.33(3.72)
M2	T1	4.00(2.11)	13.33(3.71)	7.67(2.86)	25.00(5.04)	2.00(1.58)	14.00(3.81)	7.67(2.86)	23.67(4.91)	0.00(0.71)	0.00(0.71)	1.00(1.22)	1.00(1.22)
	T2	18.67(4.37)	69.67(8.37)	9.67(3.18)	98.00(9.92)	18.00(4.30)	53.00(7.31)	16.67(4.14)	87.67(9.39)	13.67(3.76)	41.00(6.44)	11.00(3.39)	65.67(8.13)
	T3	13.00(3.66)	29.67(5.48)	14.00(3.81)	56.67(7.55)	12.67(3.63)	11.00(3.39)	10.67(3.34)	34.33(5.90)	9.67(3.19)	9.67(3.18)	3.33(1.95)	22.67(4.81)
	T4	11.67(3.48)	3.67(2.04)	4.67(2.27)	20.00(4.52)	8.67(3.03)	3.00(1.86)	0.00(0.71)	11.67(3.49)	5.67(2.48)	5.67(2.48)	1.00(1.22)	12.33(3.58)
M3	T1	13.67(3.76)	20.00(4.53)	8.67(3.03)	42.33(6.54)	10.00(3.24)	17.00(4.18)	6.67(2.68)	33.67(5.85)	8.67(3.03)	8.67(3.03)	1.67(1.46)	19.00(4.41)
	T2	17.67(4.26)	67.33(8.23)	16.67(4.14)	101.67(10.10)	17.00(4.18)	43.33(6.62)	19.00(4.41)	79.33(8.93)	15.67(4.02)	42.33(6.54)	10.00(3.24)	68.00(8.28)
	T3	17.67(4.26)	58.00(7.65)	12.67(3.62)	88.33(9.42)	7.67(2.86)	18.00(4.30)	19.00(4.41)	44.67(6.72)	7.00(2.73)	7.00(2.73)	5.33(2.41)	19.33(4.45)
	T4	11.00(3.36)	23.67(4.92)	3.67(2.04)	38.33(6.23)	9.67(3.19)	10.00(3.24)	8.67(3.03)	28.33(5.37)	7.67(2.86)	7.67(2.86)	0.00(0.71)	15.33(3.98)
Mean of Factor-1													
1		11.92(3.45)	22.75(4.15)	8.75(2.88)	43.42(6.18)	10.17(3.21)	19.33(4.09)	2.67(1.68)	32.17(5.43)	7.83(2.80)	12.00(3.25)	4.08(1.76)	23.92(4.63)
2		11.83(3.41)	29.08(4.90)	9.00(3.03)	49.92(6.76)	10.33(3.13)	20.25(4.09)	8.75(2.76)	39.33(5.92)	7.25(2.53)	14.08(3.20)	4.08(1.95)	25.42(4.44)
3		15.00(3.91)	42.25(6.33)	10.42(3.21)	67.67(8.07)	11.08(3.37)	22.08(4.58)	13.33(3.63)	46.50(6.72)	9.75(3.16)	16.42(3.79)	4.25(1.96)	30.42(5.28)
CD(0.05)		NS	0.21	0.14	0.32	0.06	0.12	0.09	0.13	0.08	0.08	NS	0.09
Mean of Factor-2													
1		10.22(3.18)	13.89(3.73)	8.78(3.04)	32.89(5.74)	7.00(2.63)	13.56(3.73)	6.11(2.55)	26.67(5.19)	5.78(2.25)	5.78(2.25)	0.89(1.13)	12.44(3.29)
2		18.56(4.36)	68.22(8.28)	13.11(3.67)	99.89(10.01)	17.44(4.23)	48.78(7.01)	13.11(3.53)	79.33(8.92)	14.22(3.83)	37.78(6.17)	11.33(3.43)	63.33(7.98)
3		12.78(3.59)	33.22(5.55)	12.56(3.61)	58.56(7.52)	9.00(3.05)	13.22(3.68)	10.89(3.21)	33.11(5.73)	6.44(2.57)	6.44(2.56)	4.00(2.11)	16.89(4.10)
4		10.11(3.23)	10.11(2.94)	3.11(1.84)	23.33(4.74)	8.67(3.02)	6.67(2.61)	2.89(1.48)	18.22(4.25)	6.67(2.67)	6.67(2.67)	0.33(0.88)	13.67(3.76)
CD(0.05)		0.32	0.32	0.13	0.34	0.16	0.21	0.13	0.2	0.14	0.14	0.1	0.13
Interaction													
M and T		0.55	0.55	0.22	0.59	0.28	0.37	0.22	0.34	0.24	0.25	0.17	0.23
T and M		0.5	0.49	0.21	0.55	0.25	0.33	0.2	0.3	0.21	0.22	0.17	0.21
Experimental Mean		3.59	5.13	3.04	7	3.24	4.26	2.69	6.02	2.83	3.41	1.89	4.78

(Values in parentheses are transformed figures)

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	ADUTHURAI				CHIPLIMA		
		Weed dry biomass at vegetative stage g/m^2				Weed biomass g/m^2		
		Grasses	Sedges	BLWs	Total	Vegetative stage(Grasses+Sedges+BLWs)	Panicle initiation stage(Grasses+Sedges+BLWs)	Heading stage(Grasses+Sedges+BLWs)
M1	T1	1.30	1.55	1.16	4.01	0.00	0.00	0.00
	T2	2.61	1.92	1.62	6.15	14.44	32.34	82.41
	T3	1.53	1.25	1.15	3.93	7.16	15.50	36.50
	T4	1.36	1.23	1.07	3.67	4.35	10.38	20.88
M2	T1	1.37	1.88	1.40	4.65	0.00	0.00	
	T2	2.79	2.26	2.12	7.18	31.76	89.80	140.85
	T3	1.68	1.53	1.39	4.60	17.99	45.50	67.23
	T4	1.58	1.24	1.15	3.97	6.81	21.84	37.98
M3	T1	1.32	1.25	1.16	3.73	0.00	0.00	0.00
	T2	2.81	1.65	1.58	6.04	35.57	97.65	157.82
	T3	1.43	1.28	1.13	3.84	23.99	49.37	80.47
	T4	1.52	1.25	1.28	4.04	9.62	25.25	41.98
Mean of Factor-1								
1		1.70	1.49	1.25	4.44	6.49	14.55	34.95
2		1.86	1.73	1.52	5.10	14.14	39.28	82.02
3		1.77	1.36	1.29	4.41	17.30	43.07	70.07
CD(0.05)		NS	0.11	0.08	0.20	2.32	2.90	8.06
Mean of Factor-2		1.33	1.56	1.24	4.13			
1		2.74	1.94	1.78	6.46	0.00	0.00	0.00
2		1.55	1.35	1.22	4.13	27.25	73.26	127.02
3		1.49	1.24	1.17	3.89	16.38	36.79	61.40
4						6.93	19.16	33.61
CD(0.05)		0.12	0.08	0.13	0.20	3.17	4.01	8.85
Interaction								
M and T		NS	0.14	NS	0.35	5.49	6.94	15.33
T and M		NS	0.14	NS	0.32	4.94	6.24	14.11
Experimental Mean		1.78	1.52	1.35	4.65	12.64	32.30	55.51

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	GANGAVATHI								GHAGHRAGHAT		
		Weed biomass at vegetative stage g/m^2				Weed biomass at panicle initiation stage g/m^2				Weed biomass g/m^2		
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Active Vegetative stage	Panicle initiation stage	Heading stage
M1	T1	3.24	2.23	3.15	8.62	4.17	7.78	1.39	13.34	-	-	22.57
	T2	10.84	32.53	40.40	83.77	3.61	50.69	112.96	167.26	2.23	3.23	33.84
	T3	0.28	13.07	15.94	29.28	22.05	18.44	11.86	52.35	2.55	2.95	28.19
	T4	11.95	36.70	0.93	49.58	3.34	18.81	0.00	22.15	1.81	3	26.59
M2	T1	3.06	2.41	0.65	6.12	2.16	4.08	2.22	8.46	-	-	22.06
	T2	3.06	29.01	6.21	38.27	28.82	52.36	6.02	87.20	2.41	4.6	38.45
	T3	2.23	4.54	0.37	7.13	8.06	7.32	1.85	17.24	2.2	3.26	25.75
	T4	11.31	8.98	0.93	21.21	0.74	20.11	1.58	22.42	2.1	3.05	28.34
M3	T1	4.17	1.02	0.65	5.84	1.69	3.43	6.76	11.89	-	-	23.85
	T2	41.79	56.25	12.88	110.92	69.69	39.66	13.25	122.60	2.42	5.24	33.41
	T3	3.52	6.49	0.65	10.66	13.71	3.80	1.85	19.37	1.69	3.93	29.68
	T4	21.96	37.16	2.13	61.25	16.40	20.11	0.65	37.16	1.99	4.26	31.16
Mean of Factor-1												
1		6.58	21.13	15.10	42.81	8.29	23.93	31.55	63.78	2.2	3.06	27.8
2		4.91	11.23	2.04	18.18	9.94	20.97	2.92	33.83	2.24	3.64	28.65
3		17.86	25.23	4.08	47.17	25.37	16.75	5.63	47.75	2.04	4.47	29.52
CD(0.05)		3.48	2.22	2.52	2.62	2.87	NS	2.31	5.21	NS	0.27	NS
Mean of Factor-2												
1		3.49	1.88	1.48	6.86	2.67	5.10	3.46	11.23	-	-	22.83
2		18.56	39.26	19.83	77.65	34.04	47.57	44.08	125.69	2.36	4.36	35.23
3		2.01	8.03	5.65	15.69	14.61	9.85	5.19	29.65	2.15	3.38	27.87
4		15.07	27.61	1.33	44.01	6.83	19.68	0.74	27.24	1.97	3.44	28.69
CD(0.05)		5.43	6.38	3.58	8.96	3.99	5.04	5.04	8.06	0.2	0.33	3.51
Interaction												
M and T		9.40	11.05	6.20	15.51	6.90	NS	8.73	13.96	NS	NS	NS
T and M		8.37	9.64	5.56	13.50	6.20	NS	7.66	12.44	NS	NS	NS
Experimental Mean		9.78	19.20	7.07	36.05	14.54	20.55	13.37	48.45	2.16	3.72	28.66

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	JAGDALPUR											
		Weed biomass at vegetative stage g/m^2				Weed biomass at panicle initiation stage g/m^2				Weed biomass at Heading stage g/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	10.33	10.97	11.17	32.47	7.83	13.67	8.67	30.17	7.83	13.50	13.00	34.33
	T2	35.73	21.80	36.50	94.03	47.33	34.67	45.17	127.17	56.33	42.17	53.33	151.83
	T3	15.63	12.17	13.00	40.80	12.17	19.50	14.83	46.50	15.50	23.50	14.67	53.67
	T4	16.67	13.00	22.17	51.83	11.17	12.33	13.00	36.50	11.17	17.17	14.67	43.00
M2	T1	13.30	17.17	16.50	46.97	9.00	9.33	16.50	34.83	10.50	19.17	15.50	45.17
	T2	38.17	40.83	39.00	118.00	51.50	44.33	49.83	145.67	51.17	54.50	60.50	166.17
	T3	20.63	26.83	21.17	68.63	15.33	12.17	26.83	54.33	16.17	13.50	21.17	50.83
	T4	22.37	31.17	18.67	72.20	16.50	17.50	18.17	52.17	16.67	15.17	13.83	45.67
M3	T1	18.20	27.17	21.50	66.87	18.83	16.00	21.50	56.33	21.17	17.17	15.50	53.83
	T2	78.53	59.17	48.67	186.37	91.50	63.67	68.33	223.50	70.67	79.00	82.00	231.67
	T3	23.37	31.50	30.17	85.03	24.50	23.00	23.17	70.67	26.33	22.17	21.83	70.33
	T4	21.07	32.67	23.17	76.90	28.67	31.00	19.83	79.50	17.17	21.50	12.83	51.50
Mean of Factor-1													
1		19.59	14.48	20.71	54.78	19.62	20.04	20.42	60.08	22.71	24.08	23.92	70.71
2		23.62	29.00	23.83	76.45	23.08	20.83	27.83	71.75	23.63	25.58	27.75	76.96
3		35.29	37.63	30.88	103.79	40.88	33.42	33.21	107.50	33.83	34.96	33.04	101.83
CD(0.05)		6.27	2.83	NS	17.30	7.19	4.90	NS	17.13	NS	NS	NS	NS
Mean of Factor-2													
1		13.94	18.43	16.39	48.77	11.89	13.00	15.56	40.44	13.17	16.61	14.67	44.44
2		50.81	40.60	41.39	132.80	63.44	47.56	54.44	165.44	59.39	58.56	65.28	183.22
3		19.88	23.50	21.44	64.82	17.33	18.22	21.61	57.17	19.33	19.72	19.22	58.28
4		20.03	25.61	21.33	66.98	18.78	20.28	17.00	56.06	15.00	17.94	13.78	46.72
CD(0.05)		6.89	8.67	6.05	12.90	6.84	6.37	8.42	14.62				
Interaction										36.41	33.89	28.72	23.90
M and T		11.93	NS	NS	22.34	11.84	NS	NS	25.32	NS	NS	NS	NS
T and M		10.97	NS	NS	22.18	11.14	NS	NS	24.32	NS	NS	NS	NS
Experimental Mean		26.17	27.04	25.14	78.34	27.86	24.76	27.15	79.78	26.72	28.21	28.24	83.17

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	MALAN											
		Weed biomass at vegetative stage g/m^2				Weed biomass at panicle initiation stage g/m^2				Weed biomass at Heading stage g/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	T2	28.20	12.60	16.20	57.00	29.10	13.50	15.90	58.50	24.30	12.30	14.10	50.70
	T3	16.20	6.30	9.00	31.50	21.30	7.80	12.30	41.40	21.30	8.10	12.60	42.00
	T4	2.70	2.70	2.70	8.10	4.80	5.70	4.50	15.00	5.40	6.00	4.80	16.20
M2	T1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	T2	43.20	28.50	48.30	120.00	41.10	26.10	29.10	96.30	43.50	24.60	25.57	93.67
	T3	21.30	16.80	23.40	61.50	20.70	20.10	16.20	57.00	21.30	20.10	16.20	57.60
	T4	7.50	4.20	5.70	17.40	6.90	4.20	3.30	14.40	7.50	5.10	4.50	17.10
M3	T1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	T2	50.10	60.30	56.40	166.80	49.80	50.10	59.40	159.30	51.60	51.00	61.20	163.80
	T3	30.90	28.20	27.30	86.40	31.20	26.30	25.80	83.30	33.90	29.63	27.00	90.53
	T4	11.40	6.00	8.60	26.00	8.40	6.60	9.60	24.60	7.20	4.80	8.40	20.40
Mean of Factor-1													
1		11.77	5.40	6.97	24.15	13.80	6.75	8.18	28.72	12.75	6.60	7.88	27.22
2		18.00	12.38	19.35	49.72	17.18	12.60	12.15	41.92	18.08	12.45	11.57	42.09
3		23.10	23.62	23.08	69.80	22.35	20.75	23.70	66.80	23.18	21.36	24.15	68.68
CD(0.05)		1.72	1.24	1.21	2.42	1.72	1.66	1.55	3.72	1.05	0.70	1.40	1.68
Mean of Factor-2													
1		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2		40.50	33.80	40.30	114.60	40.00	29.90	34.80	104.70	39.80	29.30	33.62	102.72
3		22.80	17.10	19.90	59.80	24.40	18.07	18.10	60.57	25.50	19.28	18.60	63.38
4		7.20	4.30	5.67	17.17	6.70	5.50	5.80	18.00	6.70	5.30	5.90	17.90
CD(0.05)		2.39	1.79	2.30	3.60	1.99	2.05	2.36	4.39	1.95	1.47	2.58	3.88
Interaction													
M and T		4.14	3.10	3.99	6.24	3.44	3.55	4.08	7.60	3.38	2.54	4.46	6.71
T and M		3.72	2.77	3.52	5.58	3.15	3.22	3.64	6.93	2.98	2.24	3.94	5.89
Experimental Mean		17.63	13.80	16.47	47.89	17.78	13.37	14.68	45.82	18.00	13.47	14.53	46.00

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	MONCOMPU											
		Weed biomass at vegetative stage /m²				Weed biomass at panicle initiation stage g/m²				Weed biomass at Heading stage g/m²			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	2.00	0.40	1.73	4.13	4.80	1.73	3.60	10.13	70.40	0.00	0.00	70.40
	T2	11.73	97.47	25.87	135.07	7.47	75.07	11.07	93.60	242.00	0.00	1.33	243.33
	T3	7.60	19.20	19.47	46.27	8.67	25.60	16.00	50.27	43.07	0.00	3.20	46.27
	T4	22.67	37.47	8.67	68.80	16.67	23.60	1.33	41.60	136.13	0.00	1.47	137.60
M2	T1	0.67	2.67	4.00	7.33	1.33	1.60	2.13	5.07	0.67	1.60	1.87	4.13
	T2	7.60	126.67	40.53	174.80	34.27	104.13	24.27	162.67	37.33	84.40	28.13	149.87
	T3	1.87	43.33	7.33	52.53	58.67	95.33	8.40	162.40	85.33	94.67	4.00	184.00
	T4	3.87	16.67	0.80	21.33	16.00	16.67	2.40	35.07	2.53	37.87	1.20	41.60
M3	T1	0.13	16.13	2.13	18.40	0.67	3.47	1.33	5.47	0.00	1.07	0.80	1.87
	T2	1.07	40.80	17.20	59.07	10.00	77.33	6.67	94.00	32.80	74.00	4.93	111.73
	T3	1.60	24.53	23.73	49.87	12.00	43.20	9.60	64.80	2.67	22.13	1.33	26.13
	T4	1.07	4.00	2.80	7.87	6.67	5.33	1.33	13.33	2.13	2.40	1.20	5.73
Mean of Factor-1													
1		11.00	38.63	13.93	63.57	9.40	31.50	8.00	48.90	122.90	0.00	1.50	124.40
2		3.50	47.33	13.17	64.00	27.57	54.43	9.30	91.30	31.47	54.63	8.80	94.90
3		0.97	21.37	11.47	33.80	7.33	32.33	4.73	44.40	9.40	24.90	2.07	36.37
CD(0.05)		NS	NS	NS	NS	4.02	NS	NS	NS	22.85	NS	NS	NS
Mean of Factor-2													
1		0.93	6.40	2.62	9.96	2.27	2.27	2.36	6.89	23.69	0.89	0.89	25.47
2		6.80	88.31	27.87	122.98	17.24	85.51	14.00	116.76	104.04	52.80	11.47	168.31
3		3.69	29.02	16.84	49.56	26.44	54.71	11.33	92.49	43.69	38.93	2.84	85.47
4		9.20	19.38	4.09	32.67	13.11	15.20	1.69	30.00	46.93	13.42	1.29	61.64
CD(0.05)		5.98	26.91	11.97	33.17	11.60	32.73	10.22	40.58	44.93	30.03	7.25	52.39
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	77.81	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	68.54	NS	NS	NS
Experimental Mean		5.16	35.78	12.86	53.79	14.77	39.42	7.34	61.53	54.59	26.51	4.12	85.22

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	NAWAGAM											
		Weed biomass at vegetative stage g/m²				Weed biomass at panicle initiation stage g/m²				Weed biomass at Heading stage g/m²			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	1.64	1.79	2.73	6.16	15.30	11.87	20.73	47.89	9.07	5.20	11.42	25.68
	T2	5.11	3.46	6.5	15.07	25.22	23.40	38.96	87.57	13.74	14.20	19.09	47.02
	T3	2.72	2.17	4.68	9.57	19.13	17.72	22.07	58.92	12.47	10.77	16.46	39.69
	T4	2.4	1.63	2.72	6.75	16.01	15.93	20.00	51.93	11.19	12.62	19.54	43.35
M2	T1	0.86	2.4	5.91	9.17	17.17	15.04	26.04	58.25	12.64	11.73	16.54	40.91
	T2	6.05	4.25	8.81	19.1	36.61	24.56	42.23	103.41	19.76	17.53	21.98	59.27
	T3	2.01	2.53	4.63	9.17	21.06	14.35	20.28	55.69	17.66	12.83	20.00	50.49
	T4	2.3	2.78	3.85	8.93	14.42	15.46	20.93	50.80	17.82	12.42	17.96	48.20
M3	T1	2.06	4.26	3.4	9.72	21.00	13.25	20.49	54.74	18.98	14.26	22.33	55.57
	T2	7.77	8.23	10.04	26.04	34.78	30.67	50.60	116.05	22.01	16.56	27.82	66.39
	T3	4.6	1.51	6.2	12.31	19.15	15.84	23.61	58.60	17.64	17.42	17.48	52.54
	T4	3.33	2.9	3.05	9.28	25.03	16.70	29.10	70.84	17.30	17.42	19.99	54.72
Mean of Factor-1													
1		2.97	2.26	4.16	9.39	18.91	17.23	25.44	61.58	11.62	10.70	16.63	38.94
2		2.81	2.99	5.8	11.6	22.32	17.35	27.37	67.04	16.97	13.63	19.12	49.72
3		4.44	4.22	5.67	14.34	24.99	19.12	30.95	75.06	18.98	16.42	21.90	57.30
CD(0.05)		NS	0.44	NS	0.66	NS	NS	NS	3.95	1.55	1.92	1.59	1.27
Mean of Factor-2													
1		1.52	2.82	4.01	8.35	17.82	13.39	22.42	53.63	13.56	10.40	16.76	40.72
2		6.31	5.31	8.45	20.07	32.20	26.21	43.93	102.34	18.50	16.09	22.96	57.56
3		3.11	2.07	5.17	10.35	19.78	15.97	21.99	57.74	15.92	13.67	17.98	47.57
4		2.68	2.44	3.21	8.32	18.49	16.03	23.34	57.86	15.44	14.15	19.17	48.76
CD(0.05)		1.29	1.43	2.34	2.68	7.47	3.90	7.29	12.58	NS	2.76	4.40	6.04
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		3.41	3.16	5.21	11.77	22.07	17.90	27.92	67.89	15.86	13.58	19.22	48.65

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	PUDUCHERRY											
		Weed biomass at vegetative stage g/m^2				Weed biomass at panicle initiation stage g/m^2				Weed biomass at Heading stage g/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
M1	T1	14.11	8.89	9.77	32.77	10.98	6.27	5.72	22.97	7.32	4.7	4.65	16.68
	T2	16	10.13	12.4	38.54	12.27	7.47	7.63	27.37	9.07	5.87	5.96	20.9
	T3	10.62	5.56	6.68	22.87	6.58	4.55	3.64	14.77	4.05	2.53	2.58	9.16
	T4	12.78	7.16	8.23	28.17	7.67	5.11	4.68	17.46	5.62	4.09	4.14	13.85
M2	T1	16.18	9.71	11.86	37.74	11.32	7.55	8.18	27.05	8.63	5.93	5.96	20.52
	T2	17.58	11.89	13.37	42.84	12.92	8.27	8.84	30.03	10.34	6.72	6.72	23.78
	T3	13.33	6.93	8.09	28.36	7.47	5.33	6	18.8	4.8	3.73	3.8	12.33
	T4	14.77	7.91	9.71	32.39	9.5	6.33	7.09	22.92	6.33	4.75	4.88	15.96
M3	T1	-	-	-	-	-	-	-	-	-	-	-	-
	T2	-	-	-	-	-	-	-	-	-	-	-	-
	T3	-	-	-	-	-	-	-	-	-	-	-	-
	T4	-	-	-	-	-	-	-	-	-	-	-	-
Mean of Factor-1													
1		13.38	7.94	9.27	30.59	9.37	5.85	5.42	20.64	6.51	4.3	4.33	15.15
2		15.47	9.11	10.76	35.33	10.3	6.87	7.52	24.7	7.52	5.28	5.34	18.15
3		-	-	-	-	-	-	-	-	-	-	-	-
CD(0.05)		0.73	0.37	0.44	1.54	0.43	0.3	0.31	1.03	0.27	0.21	0.21	0.68
Mean of Factor-2													
1		15.14	9.3	10.82	35.26	11.15	6.91	6.95	25.01	7.97	5.32	5.31	18.6
2		16.79	11.01	12.88	40.69	12.6	7.87	8.23	28.7	9.7	6.29	6.34	22.34
3		11.98	6.25	7.39	25.61	7.02	4.94	4.82	16.78	4.42	3.13	3.19	10.74
4		13.78	7.54	8.97	30.28	8.58	5.72	5.88	20.19	5.98	4.42	4.51	14.91
CD(0.05)		0.45	0.28	0.33	1.06	0.32	0.21	0.21	0.74	0.24	0.16	0.16	0.56
Interaction													
M and T		NS	0.39	NS	NS	0.46	NS	0.3	NS	NS	0.23	0.23	NS
T and M		NS	0.45	NS	NS	0.52	NS	0.36	NS	NS	0.25	0.26	NS
Experimental Mean		14.42	8.52	10.01	32.96	9.84	6.36	6.47	22.67	7.02	4.79	4.84	16.65

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Table 4.3.2: Contd.

Main Plot	Sub Plots	PANTNAGAR		TITABAR	VARNASI		
		Weed biomass at mid-tillering stage stage g/m^2	Weed biomass at panicle initiation stage g/m^2	Weed dry weight vegetative stage g/m^2	Total Weed biomass g/m^2		
		Total weeds	Total weeds		Vegetative stage	Panicle initiation stage	Heading stage
M1	T1	0.83	1.80	2.76	14.42	5.35	5.24
	T2	4.50	13.13	23.06	62	85.47	5.68
	T3	2.67	4.67	9.27	33.51	36.07	4.19
	T4	1.58	2.33	8.37	32.45	15.33	4.36
M2	T1	2.08	2.73	2.03	6.57	23.86	15.58
	T2	16.75	23.80	22.01	102.61	100.06	63.12
	T3	1.42	3.50	6.36	13.98	45.88	32.23
	T4	1.50	1.63	5.29	28.45	7.54	5.43
M3	T1	1.50	2.77	2.11	38.32	46.2	22.62
	T2	31.00	33.83	16.79	238.33	280.25	150.07
	T3	3.58	4.43	4.95	73.57	111.21	9.68
	T4	3.42	3.57	4.95	37.73	30.5	8.06
Mean of Factor-1							
1		2.40	5.48	10.87	35.6	35.56	4.87
2		5.44	7.92	8.92	37.91	44.33	29.09
3		9.88	11.15	7.20	96.99	117.04	47.61
CD(0.05)		0.67	0.61	**1.13**	6.44	3.27	3.15
Mean of Factor-2							
1		1.47	2.43	2.30	19.77	25.14	14.48
2		17.42	23.59	20.62	134.32	155.26	72.96
3		2.56	4.20	6.86	40.36	64.39	15.37
4		2.17	2.51	6.21	32.88	17.79	5.95
CD(0.05)		0.86	1.35	**1.37**	5.99	7.48	3.58
Interaction							
M and T		1.49	2.33	NS	10.38	12.96	6.2
T and M		1.35	2.05	NS	9.8	11.36	5.68
Experimental Mean		5.90	8.18	**9.00**	56.83	65.64	27.19

M1- Mechanized transplanting
M2 - Puddled direct seeding
M3 - Un puddled dry direct seeding

T1 – Weed free
T2 – Weedy check
T3 – Mechanical weeding using weeder
T4 – Chemical weed control (pre & post emergence herbicide application)

Influence of Establishment Methods on Pest Incidence (IEMP)

In India, rice is grown traditionally by manual transplanting method which requires more water and labour leading to high crop production costs. To overcome these constraints, the, farmers are gradually shifting to alternative methods of rice cultivation like direct seeding, aerobic rice, mechanical transplanting etc. Hence, a collaborative trial with Agronomy section was initiated In order to assess the influence of crop establishment methods and weed management strategies on pest incidence.

The field trial was laid out in split plot design with three replications. Main plot treatments comprised of three different crop establishment methods (M1: Mechanised transplanting, M2: Puddled direct seeding and M3: Unpuddled dry direct seeding. The sub plot treatments comprised of four weed management treatments (S1 = Weed free; S2 = Weedy check; S3 = Mechanical weeding using weeder; S4 = Chemical weed control (pre and post emergence herbicide application)

During *Kharif* 2019, the trial was conducted at eight locations, *viz,* Aduthurai, Chiplima, Jagdalpur, Ludhiana, Malan, Mandya, Moncompu and Rajendranagar. Standard procedures were adopted to record insect pest incidence in different main and sub plot treatments. The results are summarized below.

At **Aduthurai**, the three main plots included mechanical transplanting, puddled direct seeding and unpuddled direct seeding methods of crop establishment, while the four sub plots consisted of weed free, weedy check, mechanical weeding and chemical weed control treatments. Incidence of stem borer, hispa, whorl maggot and BPH was observed. Dead heart incidence was low in different crop establishment methods and sub-plots with weed management treatments except in weedy check which recorded 10.70% DH exceeding ETL. However, white ear damage was high in all the main plots (15.74-27.54%) and sub plots (17.44 to 24.24%). Lowest white ear damage was recorded in Mechanised transplanting (15.74% WE) followed by puddled direct seeding (19.73% WE), while maximum white ear damage was observed in unpuddled direct seeding (27.54% WE). There were significant differences among the treatments. Among the sub-plots, weed free plot exhibited least white ear incidence (17.44%) significantly superior to mechanical weeding (20.30% WE), chemical weed treatment (22.02% WE), while weedy check treatment recorded highest incidence (24.24%). Interactive effects revealed that mechanised transplanting with weed free subplot showed the least white ear incidence (10.50%) followed by mechanical weeding subplot (15.50% WE) which was at par with puddled direct sowing with weed free sub plot (16.33% WE). These three treatments were significantly superior to rest of the treatments. Similarly, hispa damage was also significantly low in mechanised transplanting main plot (8.47% DL) and weed free sub plot (10.23% DL) while highest damage was recorded in unpuddled direct sowing (27.54% DL) and weedy check sub plot (24.24% DL). Whorl maggot (maximum of 8.23% DL and BPH (2.16 hoppers/hill) incidence was very low across main and sub plots.

Though there were significant differences, no trends were discernible on the effect of the treatments on these two pests.

Table Influence of Crop Establishment Methods on Pest Incidence at Aduthurai, *Kharif* 2019

Treatments		% DH	% WE	% HDL	% WMDL	BPH/hill
Mechanised transplanting	Weed free	6.73g	10.50i	3.67j	2.67h	0.60g
	Weedy check	9.43cd	19.43f	13.57f	6.17e	1.53de
	Mechanical weeding	7.07g	15.50h	17.03i	2.27g	0.97f
	Chemical weed control	7.93f	17.53g	9.60h	4.27f	1.10f
Puddled direct seeding	Weed free	7.23g	16.33h	11.97g	5.47e	1.30ef
	Weedy check	10.73b	23.67d	17.07c	8.43ab	2.17b
	Mechanical weeding	8.70e	18.20g	14.47e	7.17d	1.60de
	Chemical weed control	8.97de	20.70e	15.50d	7.57cd	1.83cd
Unpuddled direct seeding	Weed free	8.60e	25.50c	15.07de	7.37d	1.57de
	Weedy check	11.93a	29.63a	18.83a	8.83a	2.80a
	Mechanical weeding	9.33cd	27.20b	16.60c	8.13bc	2.00bc
	Chemical weed control	9.97c	27.83b	17.83b	8.60ab	2.27b
LSD (0.05)	**M in S**	**0.67**	**0.66**	**0.63**	**0.48**	**0.32**
	S in M	**0.62**	**0.84**	**0.71**	**0.84**	**0.34**
Main plots						
M1 = Mechanised transplanting		7.79c	15.74c	8.47c	4.09c	1.05c
M2 = Puddled direct seeding		8.91b	19.73b	14.75b	7.16b	1.73b
M3 = Unpuddled direct seeding		9.96a	27.54a	17.08a	8.23a	2.16a
LSD (0.05)		**0.23**	**0.63**	**0.47**	**0.74**	**0.20**
CV (%)		**2.27**	**2.64**	**3.06**	**10.08**	**10.87**
Sub plots						
S1 = Weed free		7.52d	17.44d	10.23d	5.17d	1.15d
S2 = Weedy check		10.70a	24.24a	16.49a	7.81a	2.17a
S3 = Mechanical weeding		8.37c	20.30c	12.70c	6.19c	1.52c
S4 = Chemical weed control		8.96b	22.02b	14.31b	6.81b	1.73b
LSD (0.05)		**0.39**	**0.38**	**0.37**	**0.28**	**0.19**
CV (%)		**4.39**	**1.83**	**2.74**	**4.35**	**11.45**

At **Chiplima**, five crop establishment methods, viz., normal transplanting, sowing behind the plough, mechanical line sowing, manual line sowing and broadcasting were evaluated with MTU 1156 variety. Low incidence of stem borer (2.07 to 6.62 DH% during 55 to 75 DAT & up to 6.91% WE), gall midge (3.09 to 7.33 SS% during 55 to 75 DAT) and BPH (29-33 to 38.00 hoppers/5 hills) was observed in all the establishment methods. Broadcasting method showed pest damage at par with normal transplanting method, however there were no discernible trends among the treatments.

Table Influence of Crop Establishment Methods on Pest Incidence at Chiplima, *Kharif* 2019

Treatments	% DH		% WE	% SS		BPH/ 5 hills
	55 DAT	75 DAT	Pre har	55 DAT	75 DAT	75 DAT
T1 = Normal transplanting	5.00 (2.11)a	4.47 (2.09)ab	2.97 (1.69)b	7.33 (2.71)a	5.95 (2.42)ab	31.00 (5.56)b
T2 = Sowing behind the plough	4.33 (2.07)a	4.71 (2.15)ab	5.88 (2.39)ab	7.39 (2.71)a	8.34 (2.89)a	34.67 (5.88)ab
T3 = Mechanical line sowing	2.23 (1.47)b	4.53 (2.12)ab	6.91 (2.61)a	3.09 (1.75)c	4.94 (2.21)b	29.33 (5.41)b
T4 = Manual line sowing	2.07 (1.42)b	3.71 (1.92)b	3.89 (1.97)ab	5.22 (2.28)b	6.04 (2.46)ab	30.67 (5.53)b
T5 = Broadcasting	5.47 (2.32)a	6.62 (2.55)a	5.91 (2.43)a	5.91 (2.43)ab	6.63 (2.55)ab	38.00 (6.16)a
LSD 0.05	***0.53***	***0.61***	***0.73***	***0.37***	***0.54***	***0.58***
CV (%)	***14.91***	***14.79***	***17.40***	***8.32***	***11.43***	***5.40***

At **Jagdalpur**, the trial was carried out with Durgeshwary variety and included three main plots with mechanical transplanting, puddled direct seeding and unpuddled dry direct seeding methods of crop establishment and four sub plots with weed free, weedy check, mechanical weeding and chemical weed control treatments. Observations were recorded on incidence of stem borer, leaf folder, whorl maggot and GLH. Low incidence of stem borer was recorded in all the treatments (0.7 to 9.7% DH) except in weedy check sub plot of unpuddled dry direct seeding which showed 17.9% dead heart damage at 70 DAT. Leaf folder (up to 8.7 % DL), whorl maggot (maximum of 10.7% DL) and GLH (highest of 12.7 hoppers/10 hills) incidence was also low and there were no significant trends in the impact of treatments on pest incidence.

At **Ludhiana**, three establishment methods, viz., ridge planting, flat planting and bed planting were practiced at three plant densities of 33 plants, 25 plants and 20 plants per square meter with PR 121 variety. Very low incidence of stem borer, leaf folder and planthoppers was observed in all the treatments.

Table Influence of Crop Establishment Methods on Pest Incidence at Jagdalpur, *Kharif* 2019

Treatments		% DH		%LFDL	% WMDL	GLH/10 hills
		50 DAT	70 DAT	70 DAT	70 DAT	70 DAT
Mechanised transplanting	Weed free	0.8(1.0)b	2.5(1.6)b	8.2(3.0)a	9.4(3.1)ab	9.3(3.1)a
	Weedy check	0.7(1.0)b	6.7(2.6)ab	6.1(2.5)a	13.7(3.8)a	7.0(2.7)a
	Mechanical weeding	0.8(1.0)b	2.7(1.7)b	8.1(2.7)a	9.8(3.2)ab	10.7(3.3)a
	Chemical weed control	5.5(2.3)a	3.8(1.6)b	5.0(2.3)a	10.0(3.2)ab	8.3(2.8)a
Puddled direct seeding	Weed free	0.0(0.7)b	1.7(1.4)b	7.3(2.8)a	8.3(2.9)ab	5.0(2.3)b
	Weedy check	1.0(1.1)b	4.5(2.0)ab	8.7(3.0)a	7.7(2.8)ab	8.7(3.0)a
	Mechanical weeding	1.8(1.3)ab	5.8(2.4)ab	6.0(2.5)a	5.5(2.4)b	8.0(2.8)a
	Chemical weed control	0.0(0.7)b	0.9(1.1)b	7.8(2.9)a	9.2(3.1)ab	2.3(1.7)b
Unpuddled dry direct seeding	Weed free	2.3(1.4)ab	3.5(2.0)ab	7.7(2.8)a	10.5(3.3)ab	3.7(1.9)b
	Weedy check	0.0(0.7)b	17.9(4.0)a	5.9(2.5)a	9.7(3.2)ab	6.7(2.6)a
	Mechanical weeding	0.0(0.7)b	5.0(2.0)ab	8.6(3.0)a	9.7(3.2)ab	12.7(3.5)a
	Chemical weed control	1.3(1.3)ab	0.9(1.1)b	6.0(2.5)a	10.5(3.2)ab	8.0(2.7)a
LSD (0.05)	**M in S**	**0.93**	**2.05**	**1.13**	**0.97**	**1.14**
	S in M	**1.1**	**2.04**	**1.14**	**1.23**	**1.55**
Main plots						
M1 = Mechanised transplanting		2.0(1.4)a	3.9(1.9)a	6.9(2.6)a	10.7(3.3)a	8.8(3.0)a
M2 = Puddled direct seeding		0.7(0.9)a	3.2(1.7)a	7.5(2.8)a	7.7(2.8)a	6.0(2.5)a
M3 = Unpuddled direct seeding		0.9(1.0)a	6.8(2.3)a	7.0(2.7)a	10.0(3.2)a	7.8(2.7)a
LSD (0.05)		**0.82**	**1.02**	**0.59**	**0.91**	**1.22**
CV (%)		**15.92**	**16.25**	**19.10**	**25.73**	**39.76**
Sub plots						
S1 = Weed free		1.0(1.0)a	2.6(1.7)b	7.7(2.9)a	9.4(3.1)a	6.0(2.4)b
S2 = Weedy check		0.6(0.9)a	9.7(2.8)a	6.9(2.7)a	10.3(3.3)a	7.4(2.8)ab
S3 = Mechanical weeding		0.8(1.0)a	4.5(2.0)ab	7.6(2.7)a	8.3(2.9)a	10.4(3.2)a
S4 = Chemical weed control		2.3(1.4)a	1.8(1.3)b	6.3(2.6)a	9.9(3.2)a	6.2(2.4)a
LSD (0.05)		**0.54**	**1.18**	**0.66**	**0.56**	**0.66**
CV (%)		**19.20**	**21.42**	**24.52**	**18.14**	**24.55**

At **Malan**, Direct seeding, normal transplanting and semi dry rice methods were evaluated in this trial. Incidence of leaf folder was observed ranging from 13.89 to 23.24% DL during 45 to 90 DAT in different crop establishment methods with maximum damage in normal transplanting method (17.68 – 23.24% LFDL) followed by semi dry rice and direct seeding.

Table Influence of Crop Establishment Methods on Pest Incidence at Ludhiana, *Kharif* 2019

Establishment methods	Plants/m^2 (Spacing)	% DH	% LFDL	PH/hill
		40 DAT	**40 DAT**	**40 DAT**
Ridge planting	33 plants (30 x 10 cm)	1.9 ± 0.2	2.3 ± 0.5	2.4 ± 0.5
	25 plants (30 x 13 cm)	1.6 ± 0.3	2.0 ± 0.5	2.0 ± 0.4
	20 plants (30 x 16 cm)	1.5 ± 0.3	1.6 ± 0.4	1.9 ± 0.5
Flat planting	33 plants (15 x 20 cm)	2.1 ± 0.4	2.4 ± 0.6	1.3 ± 0.3
	25 plants (20 x 20 cm)	2.1 ± 0.3	1.7 ± 0.3	1.3 ± 0.3
	20 plants (25 x 20 cm)	1.3 ± 0.4	1.5 ± 0.3	1.2 ± 0.3
Bed planting	33 plants (33.75 x 9 cm)	3.2 ± 0.5	4.1 ± 0.8	1.1 ± 0.3
	25 plants (33.75 x 12 cm)	3.2 ± 0.5	3.1 ± 0.6	1.0 ± 0.2
	20 plants (33.75 x 15 cm)	2.3 ± 0.3	2.3 ± 0.5	0.9 ± 0.2

Table Influence of Crop Establishment Methods on Pest Incidence at Malan, Kharif 2019

Establishment methods	% Leaf folder damaged leaves			
	45 DAT	**60 DAT**	**75 DAT**	**90 DAT**
Direct seeding	13.89 (3.71)a	14.44 (3.78)b	14.72 (3.82)a	17.85 (4.21)ab
Normal transplanting	17.68 (4.20)a	19.55 (4.42)a	17.00 (4.11)a	23.24 (4.81)a
Semi dry rice	15.65 (3.94)a	15.74 (3.94)ab	15.19 (3.89)a	16.32 (4.01)b
LSD 0.05	*0.56*	*0.62*	*0.59*	*0.61*
CV (%)	*9.68*	*10.47*	*10.27*	*9.69*

At **Mandya**, three crop establishment methods, *viz.*, mechanical transplanting, direct seeding and normal transplanting were assessed. Low incidence of stem borer (3.31-5.75% DH & 5.29 to 9.54% WE), leaf folder and case worm(<5.00% DL) as well as BPH (up to 9.00 hoppers/5 hills) was observed in all the methods in KMP 175 variety.

At **Moncompu**, drum seeding and normal transplanting methods were practiced with cono weeding and chemical weed control by spraying pre and post emergence herbicides. Uma variety was grown in this trial. Low incidence of stem borer (<9.0% DH &<5% WE), leaf folder (<1% LFDL), BPH (<8/hill), WBPH (<4/hill) and GLH (<2/hill) was observed in both the crop establishment methods and weed management sub plots. Incidence of gall midge was also observed but only in chemical weed control sub plot of normal transplanting method (<2% SS).

Table ......Influence of Crop Establishment Methods on Pest Incidence at Mandya, *Kharif* 2019

Establishment methods	% Dead hearts					% WE
	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	Pre har
Mechanical transplanting	3.31 ±1.97	6.15 ±1.64	3.33 ± 0.76	2.50 ± 0.91	1.24 ± 0.32	5.29 ±1.44
Direct seeding	3.58 ±1.44	4.22 ±1.02	4.92 ±1.15	3.50 ± 1.03	1.83 ± 0.27	9.29 ± 2.31
Normal transplanting	5.74 ± 2.26	5.24 ±1.00	5.75 ± 0.78	4.44 ± 1.22	3.65 ± 0.80	9.54 ±1.97
Establishment methods	**% Leaffolder damaged leaves**					
	15 DAT	**30 DAT**	**45 DAT**	**60 DAT**	**75 DAT**	**90 DAT**
Mechanical transplanting	0.54 ± 0.22	1.55 ± 0.49	4.19 ± 0.57	2.02 ± 0.69	1.02 ± 0.32	
Direct seeding		1.76 ± 0.35	3.40 ± 0.72	2.91 ± 0.69	1.92 ± 0.56	0.67 ± 0.30
Normal transplanting	0.61 ± 0.28	2.35 ± 0.76	4.61 ± 0.73	3.36 ± 0.57	2.15 ± 0.69	0.52 ± 0.13
Establishment methods	**% Case worm damaged leaves**					
	15 DAT	**30 DAT**	**45 DAT**	**60 DAT**	**75 DAT**	**90 DAT**
Mechanical transplanting	0.36 ± 0.22	0.62 ± 0.20	0.92 ± 0.19	1.58 ± 0.38	1.26 ± 0.36	0.40 ± 0.16
Direct seeding		0.37 ± 0.15	1.08 ± 0.40	1.44 ± 0.29	0.58 ± 0.18	
Normal transplanting	0.32 ± 0.20	0.82 ± 0.14	1.32 ± 0.32	1.97 ± .41	1.52 ± 0.33	1.15 ± 0.24
Establishment methods	**BPH numbers per 5 hills**					
	45 DAT	**60 DAT**	**75 DAT**	**90 DAT**	**105 DAT**	
Mechanical transplanting	0.40 ± 0.24	2.80 ± 0.86	5.60 ±1.29	4.60 ±0.93	2.40 ± 0.51	
Direct seeding	0.80 ± 0.37	2.20 ± 0.80	5.00 ±1.30	5.60 ±1.50	1.80 ± 0.58	
Normal transplanting	2.60 ± 1.21	4.00 ± 1.30	9.00 ±1.73	8.20 ±1.66	3.20 ± 0.86	

Table Influence of Crop Establishment Methods on Pest Incidence at Moncompu, *Kharif* 2019

Main plots	Sub plots	% DH		% WE	% SS	% LFDL	BPH/hill
		30 DAT	90 DAT	Pre har	60 DAT	60 DAT	90 DAT
Drum seeding	Cono weeding		1.42 ± 0.6	4.33 ± 0.5		0.25 ± 0.1	6.80 ± 3.0
	Chemical weed control		1.58 ± 0.8	3.08 ± 0.9		0.14 ± 0.1	5.80 ± 2.5
Normal Transplanting	Cono weeding	1.55 ± 1.0	8.06 ± 3.5	2.82 ± 1.2		0.30 ± 0.2	7.00 ± 1.2
	Chemical weed control	1.47 ± 0.9	3.58 ± 1.0	4.36 ± 0.8	1.79 ± 0.9	0.16 ± 0.2	6.00 ± 2.9

At **Rajendranagar**, the three establishment methods included normal transplanting, wet seeding (line sowing under puddle condition) and dry sowing converted to wet method. RNR 15048 (Telangana sona) variety was grown in this trial in all the methods. Very low incidence of stem borer was observed in all the three methods.

Table Influence of Crop Establishment Methods on Pest Incidence at Rajendranagar, *Kharif* 2019

Establishment methods	% DH	% WE
	55 DAT	97 DAT
Normal transplanting	3.75 ± 0.11	5.49 ± 1.86
Wet seeding (Line sowing under puddle condition)	3.27 ± 0.13	1.99 ± 1.08
Dry sowing converted to wet	1.11 ± 0.05	1.12 ± 0.22

Among the crop establishment methods, across the locations, the pest incidence was found relatively high in dry direct seeding followed by normal transplanting method. White ears caused by stem borer were found high in dry direct seeding followed by puddled direct seeding which might be due to very high incidence at Aduthurai, resulting in skewness. BPH population was observed high in normal transplanting method compared to other methods.

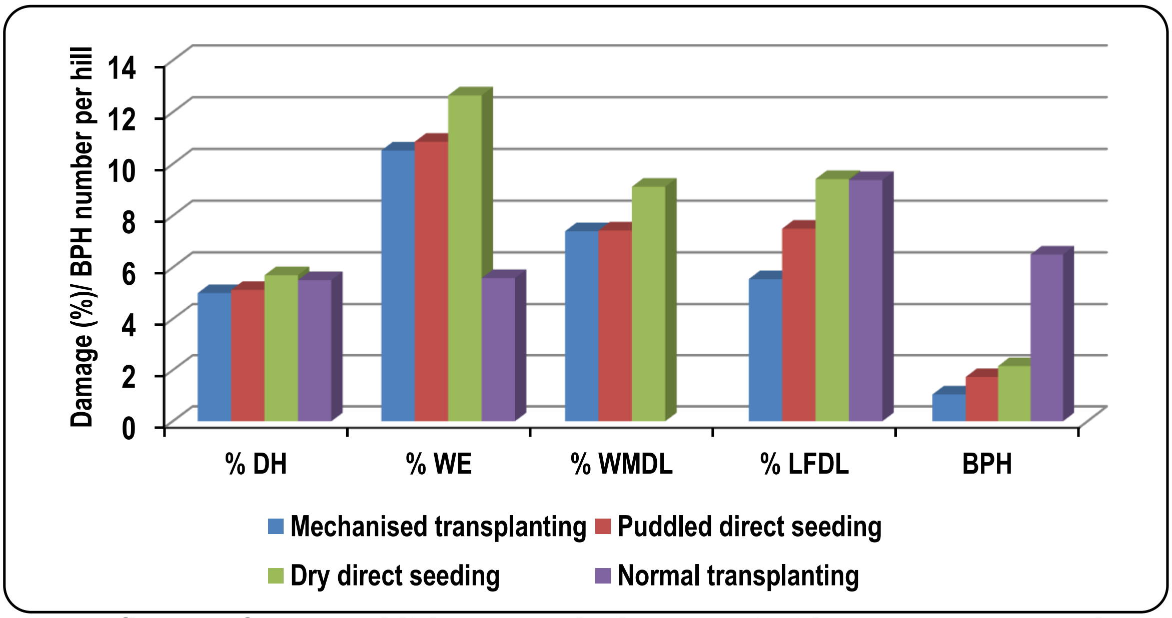


Fig .....Influence of crop establishment methods on pest incidence (IEMP) across locations, *Kharif* 2019

Influence of crop establishment methods on pest incidence (IEMP) trial, initiated this year in collaboration with Agronomy, revealed that dry direct seeding recorded relatively high stem borer (12.65% WE), leaf folder (9.42% LFDL) and whorl maggot (9.12% WMDL) damage followed by normal transplanting method (10.86% WE; 9.38% LFDL). BPH numbers were found high in normal transplanting (6.5/hill) method as compared to dry direct seeding, puddle direct seeding and mechanised transplanting methods. Since this was the first year of this trial the findings need further years of observation, testing and validation.

4.3.3: Evaluation of cultivars for weed competitiveness under direct seeded rice system

With the objective of evaluating the performance of recently released high yielding varieties for weed competitive ability and yield performance, multilocational trial was conducted at five locations viz., **Chinsurah, Ghaghraghat, Malan, Nellore** and **Tuljapur** during kharif 2019. At **Monompu, Pantnagar, Pattambi** and **Parbhani**, the trail was conduted with different technical programme cannot fit in this trial report. The treatments consisted of four weed control treatments (T1-Weed free, T2-Weedy check, T3-Mechanical weeding using weeder and T4-Chemical weed control (pre & post emergence herbicide application)) as main plots and three varieties (V1 - DRRDhan 50, V2 - DRRDhan 52 and V3 - Latest released state variety) as sub plot treatments in replicated split plot design. The results of the data recorded on crop growth, yield attributes, yield and weed parameters are presented in table 4.3.3.

The results of yield attributes and yield showed that the mean grain yield ranged from 1.75 t/ha at **Ghaghraghat** to 4.42 t/ha at **Nellore**. At **Nellore**, the results showed no significant differences among weed control treatments including weedy check, indicating that there is no considerable weed problem. But, among the test varieties, both DRRDhan 50 and DRRDhan 52 were significantly superior over the NLR 3449 irrespective of the uniformity in adoption cultivation technology in the trial. **(Table 4.3.3)**

In clay loam soils of **Chinsurah**, results showed that the weed free treatment, mechanical weeding using weeder, chemical weed control were statistically on par and significantly superior over weedy check. The treatment of mechanical weeding using weeder showed comparable performance with chemical weed control and weed free condition. Mechanical weeding was highly economical method compared to other methods and this non-chemical and economic method need to be further fine tuned and popularized among the farmers. Among the test varieties, DRRDhan 50 has recorded superior grain yield over DRRDhan 52 and local high yielding variety (Manisha). **(Table 4.3.3)**

In sandy loam soils of **Ghaghraghat**, the treatments of weed free and mechanical weeding using weeder were significantly superior in-terms of grain yield over chemical weed control and weedy check indicating the scope of using mechanical power in weed control which is highly economic and environmental friendly. Among the test varieties, NDR 2064 (local high yielding variety) and DRRDhan 52 recorded similar and higher grain yields. **(Table 4.3.3)**

At **Malan**, Weed free treatment and chemical weed control were significantly superior. The mechanical weeding method has not contributed significantly and not suitable for this region of study. The local high yielding variety HPR 2880 was found superior over DRRDhan 52.

At **Tuljapur**, under un-puddled dry direct seeding system, except weedy check all weed control treatments were comparable indicating that, mechanical weeding and chemical control were equally effective as that of weed free treatment. Among the test varieties TJP-48 has recorded significantly high yield and superior over DRRDhan 52 and DRRDhan 50. The results of data on straw yield recorded by **Malan**, **Nellore** and **Tuljapur** reflected same trend as that of grain yield. **(Table 4.3.3)**

The results of data on growth parameters i.e., no. of tillers per m^2 at maximum tillering stage and panicle initiation stage were reported by **Chinsurah, Malan, Nellore** and **Tuljapur**. Among weed control treaments, weed free condition and chemical weed control were superior at **Chinsurah** and **Tuljapur**. At **Malan**, weed free treatment was significantly superior over others. The second recorder was chemical weed control treatment. At **Nellore**, no significant difference among weed control treatments was reported. Similar trend was observed at panicle initiation stage also. Among the test varieties, no significant difference was reported by **Malan,** DRRDhan 50 and DRRDhan 52 at **Chinsurah**, DRRDhan 50 and NLR 3449 at **Nellore** and TJP 48 at **Tuljapur** showed superiority over others. At panicle initiation stage, significant differences were reported among test varieties. **(Table 4.3.3)**

The data on one of the yield attributes i.e., no. of panicle per m^2 reported by **Chinsurah, Gahghraghat, Malan, Nellore** and **Tuljapur** showed that, no significant difference among weed control methods at **Nellore**; superiority of weed free treatment at **Chinsurah, Ghaghraghat** and **Malan**; superiority of weed free treatment and chemical weed control at **Tuljapur**. Among the test varieties, local high yielding variety at **Malan**, DRRDhan 52 and local high yielding variety at **Ghaghraghat** and **Tuljapur**, DRRDhan 50 and local high yielding variety at Nellore exhibited superiority. **(Table 4.3.3)**

The data on panicle weight was reported by **Chinsurah, Ghaghraghat, Malan** and **Tuljapur,** indicated similar trend as that of panicle no. per m^2. The data on test weight was reported by **Malan, Nellore** and **Tuljapur**. Except at **Malan** DRRDhan 52 and local high yielding variety recorded higher and comparable panicle weight at other locations. The test weight was not influenced by weed control treatments at **Nellore** and **Tuljapur**. At **Malan**, test weight was significantly high and comparable under weed free treatment and chemical weed control. **(Table 4.3.3)**

The data on weed population at vegetative stage, panicle initiation stage and heading stage was reported by four locations viz., **Chinsurah, Ghaghraghat, Malan** and **Nellore**. At vegetative stage, the relative dominance of weed groups was in the order of grasses, sedges and broad leaf weeds (BLW) at all the three stages of observation at **Chinsurah**. At **Malan**, BLW followed by grasses were dominant, at **Nellore** grasses flowed by sedges, at **Chinsurah** sedges followed by BLW. The weed population density increased from vegetative stage to heading stage at **Ghaghraghat** whereas, at **Chinsurah**, increased from vegetative stage to panicle initiation stage and no considerable change was noticed at heading stage. At **Malan** and **Nellore,** the population increased from vegetative stage to panicle initiation stage and decreased at heading stage. At vegetative stage, among the weed control treatments at

Chinsurah, chemical weed control recorded lower weed population closely followed by mechanical weeding but at panicle initiation and heading stages, mechanical weeding treatment alone has recorded lower weed population. Initially local high yielding variety recorded lower total weed population but at panicle initiation and heading stages, DRRDhan 50 recorded lowest weed population of all weed groups individually as well as combined. Contrarily, at **Ghaghraghat**, the lowest total weed population was observed under mechanical weeding using weeder closely followed by chemical weed control and test varieties showed no significant difference. Similarly, at **Malan**, the test varieties did not differ significantly. But, weed control treatment showed significant difference with lowest under chemical weed control. At **Nellore**, the weed control treatments had significant influence on grasses, sedges and total weed population at vegetative and panicle initiation stages. The chemical weed control treatment was on par with weed free treatment at vegetative stage and closely followed by at panicle initiation and heading stages. Among the varieties tested, no significant difference was observed among all groups individually and combined at vegetative stage, BLW and total weeds at panicle initiation and heading stages. Grass weeds were significantly low under DRRDhan 50 and sedges were significantly high. **(Table 4.3.3)**

The data on weed biomass at vegetative stage, panicle initiation stage and heading stage was reported by four locations viz., **Chinsurah, Ghaghraghat, Malan** and **Nellore**. The interaction effect of weed control treatments and varieties was significant. At **Chinsurah**, sedges recorded highest weed biomass followed by BLW's and the weed biomass increased from vegetative stage to heading stage. Similarly, the total weed biomass increased at **Ghaghraghat** also. At **Malan**, the weed biomass was highest with BLW followed by grasses and progressive increase was recorded from vegetative stage to heading stage. At **Nellore**, grasses recorded highest weed biomass followed by sedges. The weed biomass increased from vegetative stage to panicle initiation stage and decreased at heading stage. At vegetative stage, among the test varieties at **Chinsurah**, DRRDhan 52 & local high yielding variety recorded lowest weed biomass, where as DRRDhan 50 at panicle initiation and heading stages. At **Ghaghraghat** and **Malan**, no significant difference among test varieties was noticed. At **Nellore**, DRRDhan 52 and NLR 34449 recorded lowest weed biomass.**(Table 4.3.3)**

Under Direct Seeded Rice systems, the multi-locational results of kharif 2019 revealed that, at the test locations, the trend in usual relative dominance of weed groups varied from the earlier order of grasses-BLW-sedges to sedges-BLW-grasses and/or BLW-grasses-sedges. At majority of the locations, in clay loam and clay soils, chemical weed control using pre and post emergence herbicides was found superior and in sandy loam soils, mechanical weeding using weeder showed superior performance. Varietal performance varied among the test locations. DRRDhan 50 at two locations, DRRDhan 52 at two locations, local high yielding varieties at two locations showed superior performance with lower weed population, weed biomass, higher crop growth parameters, yield attributes and grain yield.

Table 4.3.3: Summary of data on grain yield, yield attributes and weed parameters in the trial on "Evaluation of cultivars for weed competitiveness under direct seeded rice systems", Kharif - 2019.

Main Plot	Sub Plots	Grain yield (t/ha)				
		CHN	GGT	MLN	NLR	TJP
T1	V1	5.26	1.93	-	4.58	1.31
	V2	4.17	2.20	2.52	4.51	1.83
	V3	4.10	2.42	2.86	4.19	1.97
T2	V1	3.56	0.87	-	4.52	0.62
	V2	2.98	1.11	1.43	4.43	0.65
	V3	2.94	1.29	1.42	4.11	0.87
T3	V1	5.28	1.85	-	4.42	0.99
	V2	4.05	1.95	1.80	4.87	1.57
	V3	3.78	2.18	1.96	3.94	1.82
T4	V1	5.04	1.58	-	4.52	0.98
	V2	4.48	1.80	2.44	4.65	1.66
	V3	3.62	1.87	2.76	4.26	2.03
Mean of Factor-1						
1		4.51	2.18	2.69	4.43	1.70
2		3.16	1.09	1.43	4.36	0.71
3		4.37	1.99	1.88	4.41	1.46
4		4.38	1.75	2.60	4.48	1.56
CD(0.05)		0.40	0.26	0.12	NS	0.27
Mean of Factor-2						
1		4.78	1.56	-	4.51	0.97
2		3.92	1.77	2.05	4.62	1.43
3		3.61	1.94	2.25	4.13	1.67
CD(0.05)		0.23	0.20	0.07	0.19	0.15
Interaction						
M and T		NS	NS	0.13	NS	NS
T and M		NS	NS	0.13	NS	NS
Experimental Mean		**4.10**	**1.75**	**2.15**	**4.42**	**1.36**
Name of latest released variety		Manisha	NDR-2064	HPR 2880	NLR 34449	TJP-48
Soil type		Clay loam	Sandy loam	-	Sandy clay loam	-
pH		7.87	8.06	5.6	7.48	7.6
EC		0.49	-	-	-	-
Applied NPK kg/ha		80:40:40	120:60:40	60-30-30	-	-
Available NPK kg/ha		560:54.9:307.5		317:47.1;232	213:34:530	-

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	Straw yield (t/ha)			No of tillers /m^2 at max tillering stage				No of tillers /m^2 at panicle inititiation stage		
		MLN	NLR	TJP	CHN	MLN	NLR	TJP	CHN	MLN	NLR
T1	V1	-	7.17	2.66	388	268	370	455	325	267	359
	V2	2.80	7.10	2.74	358	267	324	578	303	266	315
	V3	3.17	7.27	3.14	394	273	363	538	335	271	343
T2	V1	-	6.73	1.68	288	233	419	272	264	233	403
	V2	1.58	6.40	1.97	282	237	268	371	249	237	248
	V3	1.58	7.83	1.96	280	238	286	354	225	243	274
T3	V1	-	7.83	1.82	417	238	361	273	354	238	342
	V2	2.01	7.93	2.46	370	241	282	389	313	241	265
	V3	2.17	7.87	2.67	322	241	392	403	271	245	378
T4	V1	-	7.67	1.80	409	254	368	339	347	254	358
	V2	2.71	7.93	2.64	402	255	264	551	341	256	244
	V3	3.07	7.37	2.94	380	256	396	559	322	257	386
Mean of Factor-1											
1		2.99	7.18	2.84	380	269	352	524	321	268	339
2		1.58	6.99	1.87	283	236	324	332	246	238	309
3		2.09	7.88	2.32	370	240	345	355	313	241	328
4		2.89	7.66	2.46	397	255	343	483	336	256	329
CD(0.05)		0.15	0.59	0.38	18	3	NS	48	13	4	NS
Mean of Factor-2											
1		-	7.35	1.99	376	248	380	335	323	248	365
2		2.28	7.34	2.45	353	250	285	472	302	250	268
3		2.50	7.58	2.68	344	252	359	464	288	254	346
CD(0.05)		0.07	NS	0.19	22	NS	30	25	13	3	29
Interaction											
M and T		0.15	NS	NS	NS	NS	59.15	50.01	25.6	NS	58.01
T and M		0.15	NS	NS	NS	NS	58.94	54.21	23.13	NS	58.6
Experimental Mean		**2.39**	**7.43**	**2.37**	**358**	**250**	**341**	**423**	**304**	**251**	**326**

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	Panicle No/m^2					Panicle weight (g)				Test weight (g)		
		CHN	GGT	MLN	NLR	TJP	CHN	GGT	MLN	TJP	MLN	NLR	TJP
T1	V1	334	164	-	351	223	3.79	2.94	-	2.07	-	22.13	23.03
	V2	300	168	263	301	307	3.30	3.01	2.46	2.20	26.38	26.73	24.07
	V3	265	195	272	332	315	3.46	3.37	2.67	2.52	27.04	19.53	25.80
T2	V1	228	65	-	388	160	2.92	1.98	-	1.37	-	23.33	23.40
	V2	206	80	170	227	190	2.83	2.43	1.43	1.58	22.26	31.83	23.93
	V3	207	67	183	262	218	2.88	2.69	1.82	1.64	22.63	18.97	24.93
T3	V1	226	140	-	322	221	3.78	2.54	-	2.03	-	22.10	23.90
	V2	225	147	236	242	250	3.42	2.79	2.15	1.94	24.06	29.17	23.60
	V3	254	158	246	366	264	3.43	2.91	2.17	2.06	25.24	21.21	24.93
T4	V1	230	117	-	346	267	3.80	2.40	-	2.16	-	23.70	23.40
	V2	232	130	258	231	329	3.56	2.68	2.32	2.59	26.17	25.43	24.27
	V3	273	139	265	369	323	3.39	2.52	2.27	2.64	26.25	20.67	25.73
Mean of Factor-1													
1		300	176	267	328	282	3.52	3.11	2.56	2.26	26.71	22.80	24.30
2		214	71	176	292	189	2.88	2.37	1.63	1.53	22.44	24.71	24.09
3		235	149	241	310	245	3.54	2.74	2.16	2.01	24.65	24.16	24.14
4		245	129	261	315	306	3.59	2.54	2.30	2.46	26.21	23.27	24.47
CD(0.05)		17	18	5	NS	31	0.31	0.19	0.15	0.31	0.46	NS	NS
Mean of Factor-2													
1		255	122	-	352	218	3.57	2.47	-	1.91	-	22.82	23.43
2		241	131	231.5	250	269	3.28	2.73	2.09	2.08	24.71	28.29	23.97
3		250	140	241.5	332	280	3.29	2.87	2.23	2.21	25.29	20.09	25.35
CD(0.05)		NS	11	4	31	22	0.19	0.19	0.10	0.20	0.48	1.38	0.62
Interaction													
M and T		26.21	NS	NS	61.4	NS	NS	NS	NS	NS	NS	2.76	NS
T and M		24.89	NS	NS	60.72	NS	NS	NS	NS	NS	NS	2.66	NS
Experimental Mean		**248**	**131**	**237**	**311**	**256**	**3.38**	**2.69**	**2.16**	**2.07**	**25.00**	**23.73**	**24.25**

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	CHINSURAH											
		Weed population at vegetative stage no/m^2				Weed population at panicle initiation stage no/m^2				Weed population at heading stage no/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
T1	V1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	1.67(1.39)	0.67(1.05)	0.67(1.05)	3.00(1.81)	1.33(1.27)	0.33(0.88)	0.67(1.00)	2.33(1.60)
	V2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	1.67(1.46)	0.67(1.05)	1.00(1.17)	3.33(1.95)	0.33(0.88)	0.33(0.88)	1.33(1.29)	2.00(1.56)
	V3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	1.67(1.46)	1.00(1.17)	0.67(1.05)	3.33(1.95)	1.00(1.17)	1.00(1.17)	0.67(1.05)	2.67(1.74)
T2	V1	8.00(2.90)	19.33(4.45)	6.67(2.68)	34.00(5.86)	19.33(4.44)	13.67(3.72)	9.00(3.07)	42.00(6.51)	26.00(5.14)	16.67(4.11)	14.33(3.85)	57.00(7.57)
	V2	14.33(3.85)	5.33(2.41)	8.33(2.95)	28.00(5.33)	34.33(5.89)	22.00(4.61)	11.67(3.47)	68.00(8.28)	34.33(5.89)	19.00(4.41)	18.33(4.32)	71.67(8.48)
	V3	12.00(3.53)	11.67(3.48)	8.00(2.90)	31.67(5.66)	41.33(6.42)	24.67(4.93)	14.67(3.89)	80.67(9.00)	41.33(6.42)	24.33(4.96)	23.00(4.83)	88.67(9.43)
T3	V1	5.33(2.41)	6.33(2.46)	5.33(2.25)	17.00(4.18)	2.67(1.77)	8.67(3.03)	4.33(2.18)	15.67(4.02)	3.67(2.02)	10.00(3.22)	4.33(2.18)	18.00(4.30)
	V2	5.33(2.40)	3.33(1.85)	6.33(2.60)	15.00(3.92)	9.67(3.19)	9.33(3.13)	3.67(2.04)	22.67(4.81)	7.33(2.73)	10.00(3.24)	3.67(2.04)	21.00(4.62)
	V3	2.00(1.56)	1.67(1.46)	3.00(1.81)	6.67(2.67)	6.33(2.58)	8.67(3.02)	7.00(2.71)	22.00(4.72)	8.33(2.96)	9.67(3.17)	8.33(2.91)	26.33(5.13)
T4	V1	4.33(2.16)	4.33(2.18)	3.00(1.87)	11.67(3.48)	4.33(2.12)	2.00(1.56)	2.00(1.52)	8.33(2.94)	4.00(2.06)	2.00(1.56)	2.00(1.52)	8.00(2.89)
	V2	3.67(2.04)	5.00(2.32)	3.00(1.84)	11.67(3.47)	8.33(2.97)	5.67(2.46)	5.00(2.32)	19.00(4.40)	8.33(2.97)	5.67(2.46)	5.00(2.32)	19.00(4.40)
	V3	3.67(2.04)	5.00(2.32)	3.00(1.84)	11.67(3.47)	5.33(2.39)	6.33(2.60)	4.00(2.10)	15.67(4.02)	5.33(2.39)	6.33(2.60)	4.00(2.10)	15.67(4.02)
Mean of Factor-1													
1		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	1.67(1.44)	0.78(1.09)	0.78(1.09)	3.22(1.91)	0.89(1.11)	0.56(0.98)	0.89(1.11)	2.33(1.63)
2		11.44(3.43)	12.11(3.45)	7.67(2.84)	31.22(5.62)	31.67(5.58)	20.11(4.42)	11.78(3.48)	63.56(7.93)	33.89(5.82)	20.00(4.49)	18.56(4.33)	72.44(8.49)
3		4.22(2.12)	3.78(1.92)	4.89(2.22)	12.89(3.59)	6.22(2.52)	8.89(3.06)	5.00(2.31)	20.11(4.52)	6.44(2.57)	9.89(3.21)	5.44(2.38)	21.78(4.68)
4		3.89(2.08)	4.78(2.27)	3.00(1.85)	11.67(3.47)	6.00(2.49)	4.67(2.21)	3.67(1.98)	14.33(3.79)	5.89(2.47)	4.67(2.21)	3.67(1.98)	14.22(3.77)
CD(0.05)		0.34	0.62	0.47	0.51	0.49	0.67	0.49	0.44	0.69	0.41	0.52	0.71
Mean of Factor-2													
1		4.42(2.05)	7.50(2.45)	3.75(1.87)	15.67(3.56)	7.00(2.43)	6.25(2.34)	4.00(1.96)	17.25(3.82)	8.75(2.62)	7.25(2.44)	5.33(2.14)	21.33(4.09)
2		5.83(2.25)	3.42(1.82)	4.42(2.02)	13.67(3.36)	13.50(3.38)	9.42(2.81)	5.33(2.25)	28.25(4.86)	12.58(3.12)	8.75(2.75)	7.08(2.49)	28.42(4.77)
3		4.42(1.96)	4.58(1.99)	3.50(1.82)	12.50(3.12)	13.67(3.21)	10.17(2.93)	6.58(2.44)	30.42(4.93)	14.00(3.23)	10.33(2.97)	9.00(2.72)	33.33(5.08)
CD(0.05)		0.2	0.35	NS	0.24	0.41	0.5	0.27	0.3	0.44	0.38	0.39	0.41
Interaction													
M and T		0.41	0.71	NS	0.47	NS	NS	NS	0.6	NS	NS	NS	NS
T and M		0.42	0.74	NS	0.54	NS	NS	NS	0.6	NS	NS	NS	NS
Experimental Mean		2.08	2.09	1.9	3.35	3.01	2.7	2.21	4.54	2.99	2.72	2.45	4.65

(Values in parentheses are transformed figures)

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	MALAN											
		Weed population at vegetative stage no/m^2				Weed population at panicle initiation stage no/m^2				Weed population at heading stage no/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
T1	V1	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	V2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	V3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
T2	V1	40.00(6.36)	0.67(1.05)	77.00(8.79)	117.67(10.86)	28.67(5.39)	0.67(1.05)	56.00(7.51)	85.33(9.26)	23.33(4.80)	0.67(1.05)	36.67(6.08)	60.67(7.82)
	V2	38.33(6.23)	2.67(1.77)	66.33(8.16)	107.33(10.38)	30.33(5.53)	1.00(1.17)	56.00(7.48)	87.33(9.37)	21.67(4.69)	1.00(1.17)	46.67(6.87)	69.33(8.35)
	V3	55.67(7.46)	1.67(1.35)	70.67(8.39)	128.00(11.29)	34.67(5.87)	2.33(1.68)	60.67(7.82)	97.67(9.89)	20.67(4.52)	1.00(1.17)	41.33(6.40)	63.00(7.95)
T3	V1	12.00(3.50)	2.33(1.60)	13.67(3.75)	28.00(5.33)	14.00(3.78)	0.67(1.05)	16.33(4.08)	31.00(5.57)	10.67(3.30)	0.33(0.88)	13.33(3.67)	24.33(4.92)
	V2	13.67(3.76)	1.33(1.29)	20.33(4.54)	35.33(5.96)	16.00(4.04)	1.00(1.17)	18.33(4.33)	35.33(5.97)	8.67(3.00)	0.33(0.88)	15.33(3.96)	24.33(4.98)
	V3	15.33(3.96)	2.00(1.56)	19.67(4.48)	37.00(6.12)	7.67(2.82)	1.33(1.34)	8.33(2.96)	17.33(4.19)	9.67(3.19)	1.33(1.34)	17.33(4.21)	28.33(5.36)
T4	V1	5.33(2.38)	3.00(1.86)	4.67(2.24)	13.00(3.66)	5.33(2.36)	0.67(1.05)	3.00(1.86)	9.00(3.03)	3.00(1.84)	0.67(1.00)	2.67(1.72)	6.33(2.56)
	V2	7.33(2.79)	2.00(1.56)	2.33(1.64)	11.67(3.47)	3.00(1.79)	1.00(1.17)	6.00(2.54)	10.00(3.23)	2.00(1.52)	0.67(1.05)	2.67(1.76)	5.33(2.36)
	V3	4.00(2.11)	3.00(1.86)	6.00(2.50)	13.00(3.64)	3.67(2.02)	1.00(1.17)	5.67(2.45)	10.33(3.28)	4.00(2.08)	0.67(1.05)	4.33(2.18)	9.00(3.08)
Mean of Factor-1													
1		0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
2		44.67(6.68)	1.67(1.39)	71.33(8.45)	117.67(10.84)	31.22(5.60)	1.33(1.30)	57.56(7.60)	90.11(9.51)	21.89(4.67)	0.89(1.13)	41.56(6.45)	64.33(8.04)
3		13.67(3.74)	1.89(1.48)	17.89(4.26)	33.44(5.81)	12.56(3.55)	1.00(1.19)	14.33(3.79)	27.89(5.24)	9.67(3.16)	0.67(1.03)	15.33(3.95)	25.67(5.09)
4		5.56(2.43)	2.67(1.76)	4.33(2.13)	12.56(3.59)	4.00(2.05)	0.89(1.13)	4.89(2.28)	9.78(3.18)	3.00(1.81)	0.67(1.03)	3.22(1.89)	6.89(2.67)
CD(0.05)		0.4	0.34	0.85	0.77	0.76	0.36	0.53	0.67	0.8	NS	0.66	0.63
Mean of Factor-2													
1		14.33(3.24)	1.50(1.30)	23.83(3.87)	39.67(5.14)	12.00(3.06)	0.50(0.97)	18.83(3.54)	31.33(4.64)	9.25(2.66)	0.42(0.91)	13.17(3.04)	22.83(4.00)
2		14.83(3.37)	1.50(1.33)	22.25(3.76)	38.58(5.13)	12.33(3.02)	0.75(1.06)	20.08(3.77)	33.17(4.82)	8.08(2.48)	0.50(0.95)	16.17(3.32)	24.75(4.10)
3		18.75(3.56)	1.67(1.37)	24.08(4.02)	44.50(5.44)	11.50(2.85)	1.17(1.22)	18.67(3.48)	31.33(4.52)	8.58(2.63)	0.75(1.07)	15.75(3.38)	25.08(4.27)
CD(0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction													
M and T		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Expert. Mean		3.39	1.34	3.89	5.24	2.98	1.08	3.6	4.66	2.59	0.98	3.25	4.13

(Values in parentheses are transformed figures)

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	NELLORE											
		Weed population at vegetative stage no/m²				Weed population at panicle initiation stage no/m²				Weed population at heading stage no/m²			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
T1	V1	2.67(1.61)	1.00(1.17)	0.00(0.71)	3.67(1.83)	3.67(1.91)	7.00(2.73)	1.33(1.34)	12.00(3.51)	0.67(1.05)	0.33(0.88)	0.00(0.71)	1.00(1.17)
	V2	4.67(2.21)	3.00(1.84)	0.00(0.71)	7.67(2.81)	3.67(2.02)	8.67(3.02)	2.33(1.64)	14.67(3.88)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	V3	4.00(2.08)	1.67(1.44)	0.00(0.71)	5.67(2.45)	3.67(1.97)	1.67(1.46)	1.33(1.27)	6.67(2.68)	0.00(0.71)	0.33(0.88)	0.33(0.88)	0.67(1.05)
T2	V1	80.00(8.84)	20.00(4.29)	0.00(0.71)	100.00(10.00)	45.67(6.72)	92.00(9.33)	0.00(0.71)	137.67(11.67)	40.00(6.34)	93.33(9.40)	0.00(0.71)	133.33(11.45)
	V2	89.00(9.41)	10.67(3.03)	0.00(0.71)	99.67(9.92)	88.00(9.32)	24.67(4.90)	0.33(0.88)	113.00(10.62)	81.33(9.00)	24.33(4.93)	4.67(2.11)	110.33(10.51)
	V3	131.33(11.35)	3.33(1.85)	0.33(0.88)	135.00(11.52)	81.33(9.04)	23.33(4.86)	2.67(1.44)	107.33(10.37)	80.00(8.96)	28.33(5.36)	5.67(2.39)	114.00(10.70)
T3	V1	29.00(5.37)	8.67(2.74)	0.00(0.71)	37.67(6.05)	10.00(3.21)	14.33(3.84)	3.33(1.67)	27.67(5.30)	14.33(3.83)	16.00(4.04)	5.67(2.29)	36.00(5.98)
	V2	34.00(5.72)	14.67(3.80)	0.00(0.71)	48.67(6.98)	9.67(3.13)	14.67(3.89)	2.00(1.56)	26.33(5.17)	12.33(3.56)	14.67(3.87)	3.67(2.02)	30.67(5.57)
	V3	13.00(3.64)	5.00(2.26)	0.00(0.71)	18.00(4.23)	13.33(3.72)	8.67(2.88)	2.00(1.32)	24.00(4.89)	11.67(3.48)	6.67(2.58)	2.67(1.76)	21.00(4.62)
T4	V1	3.00(1.68)	2.00(1.32)	0.00(0.71)	5.00(1.99)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)
	V2	4.33(2.12)	0.00(0.71)	0.00(0.71)	4.33(2.12)	1.33(1.18)	0.00(0.71)	0.00(0.71)	1.33(1.18)	0.67(1.00)	0.00(0.71)	0.00(0.71)	0.67(1.00)
	V3	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	1.33(1.29)	4.00(1.65)	0.67(1.00)	6.00(2.12)	0.67(1.05)	3.33(1.55)	0.67(1.00)	4.67(1.87)
Mean of Factor-1													
1		3.78(1.97)	1.89(1.48)	0.00(0.71)	5.67(2.37)	3.67(1.96)	5.78(2.41)	1.67(1.42)	11.11(3.35)	0.22(0.82)	0.22(0.82)	0.11(0.76)	0.56(0.98)
2		100.11(9.87)	11.33(3.06)	0.11(0.76)	111.56(10.48)	71.67(8.36)	46.67(6.36)	1.00(1.01)	119.33(10.89)	67.11(8.10)	48.67(6.56)	3.44(1.74)	119.22(10.89)
3		25.33(4.91)	9.44(2.93)	0.00(0.71)	34.78(5.76)	11.00(3.35)	12.56(3.54)	2.44(1.52)	26.00(5.12)	12.78(3.62)	12.44(3.50)	4.00(2.02)	29.22(5.39)
4		2.44(1.50)	0.67(0.91)	0.00(0.71)	3.11(1.61)	0.89(1.06)	1.33(1.02)	0.22(0.80)	2.44(1.33)	0.44(0.92)	1.11(0.99)	0.22(0.80)	1.78(1.19)
CD(0.05)		2.06	0.75	NS	1.8	0.59	1.08	NS	1.09	0.48	1.09	0.77	1
Mean of Factor-2													
1		28.67(4.38)	7.92(2.38)	0.00(0.71)	36.58(4.97)	14.83(3.14)	28.33(4.15)	1.17(1.11)	44.33(5.30)	13.75(2.98)	27.42(3.76)	1.42(1.10)	42.58(4.83)
2		33.00(4.86)	7.08(2.34)	0.00(0.71)	40.08(5.46)	25.67(3.91)	12.00(3.13)	1.17(1.20)	38.83(5.21)	23.58(3.57)	9.75(2.55)	2.08(1.39)	35.42(4.45)
3		37.08(4.45)	2.50(1.56)	0.08(0.75)	39.67(4.73)	24.92(4.00)	9.42(2.71)	1.67(1.26)	36.00(5.01)	23.08(3.55)	9.67(2.59)	2.33(1.51)	35.08(4.56)
CD(0.05)		NS	NS	NS	NS	0.72	1.02	NS	NS	0.48	0.95	NS	NS
Interaction													
M and T		1.47	NS	NS	NS	NS	NS	NS	NS	0.96	1.9	NS	NS
T and M		1.93	NS	NS	NS	NS	NS	NS	NS	0.87	1.76	NS	NS
Experimental Mean		4.56	2.1	0.72	5.05	3.68	3.33	1.19	5.17	3.37	2.97	1.33	4.61

(Values in parentheses are transformed figures)

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	GHAGHRAGHAT Weed population no/m^2 Active vegetative stage	Panicle initiation stage	Heading stage
T1	V1	-	-	53.67(7.35)
	V2	-	-	54.33(7.40)
	V3	-	-	50.00(7.09)
T2	V1	54.67(7.41)	75.33(8.70)	89.67(9.48)
	V2	58.33(7.66)	69.00(8.33)	95.67(9.80)
	V3	57.67(7.62)	68.67(8.31)	91.00(9.56)
T3	V1	42.67(6.56)	54.00(7.37)	62.33(7.92)
	V2	37.67(6.16)	46.67(6.84)	57.33(7.59)
	V3	39.67(6.33)	56.33(7.53)	65.00(8.08)
T4	V1	37.00(6.09)	46.00(6.80)	62.67(7.93)
	V2	51.33(7.17)	56.00(7.49)	75.67(8.72)
	V3	45.00(6.71)	54.00(7.37)	67.33(8.22)
Mean of Factor-1				
1		-	-	52.67(7.28)
2		56.89(7.57)	71.00(8.45)	92.11(9.61)
3		40.00(6.35)	52.33(7.25)	61.56(7.86)
4		44.44(6.66)	52.00(7.22)	68.56(8.29)
CD(0.05)		0.48	0.43	0.46
Mean of Factor-2				
1		44.78(6.69)	58.44(7.63)	67.08(8.17)
2		49.11(6.99)	57.22(7.55)	70.75(8.38)
3		47.44(6.88)	59.67(7.74)	68.33(8.24)
CD(0.05)		NS	NS	NS
Interaction				
M and T		NS	NS	NS
T and M		NS	NS	NS
Experimental Mean		6.86	7.64	8.26

(Values in parentheses are transformed figures)

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	CHINSURAH											
		Weed biomass at vegetative stage g/m^2				Weed biomass at panicle initiation stage g/m^2				Weed biomass at heading stage/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
T1	V1	0.00	0.00	0.00	0.00	0.13	0.25	0.10	0.48	0.12	0.14	0.15	0.42
	V2	0.00	0.00	0.00	0.00	0.13	0.25	0.15	0.53	0.03	0.14	0.30	0.47
	V3	0.00	0.00	0.00	0.00	0.13	0.38	0.10	0.61	0.09	0.43	0.15	0.67
T2	V1	0.40	7.39	1.06	8.85	1.45	5.23	1.35	8.03	2.44	7.21	3.20	12.85
	V2	0.72	2.04	1.33	4.08	2.58	8.41	1.75	12.74	3.23	8.21	4.09	15.53
	V3	0.60	4.46	1.27	6.33	3.10	9.43	2.20	14.73	3.88	10.52	5.13	19.53
T3	V1	0.27	2.42	0.85	3.54	0.20	3.31	0.65	4.17	0.35	4.32	0.97	5.64
	V2	0.27	1.27	1.01	2.55	0.73	3.57	0.55	4.84	0.69	4.32	0.82	5.83
	V3	0.10	0.63	0.48	1.21	0.48	3.31	1.05	4.84	0.78	4.18	1.86	6.82
T4	V1	0.22	1.66	0.48	2.35	0.33	0.76	0.30	1.39	0.38	0.86	0.44	1.68
	V2	0.18	1.91	0.48	2.58	0.63	2.17	0.75	3.54	0.78	2.45	1.12	4.35
	V3	0.18	1.91	0.48	2.58	0.40	2.42	0.60	3.42	0.50	2.74	0.89	4.13
Mean of Factor-1													
1		0.00	0.00	0.00	0.00	0.13	0.30	0.12	0.54	0.08	0.24	0.20	0.52
2		0.57	4.63	1.22	6.42	2.38	7.69	1.77	11.83	3.18	8.65	4.14	15.97
3		0.21	1.44	0.78	2.43	0.47	3.40	0.75	4.62	0.61	4.28	1.21	6.10
4		0.19	1.83	0.48	2.50	0.45	1.78	0.55	2.78	0.55	2.02	0.82	3.39
CD(0.05)		0.09	1.07	0.36	0.98	0.33	2.29	0.40	1.96	0.39	0.80	0.52	1.34
Mean of Factor-2													
1		0.22	2.87	0.60	3.69	0.53	2.39	0.60	3.52	0.82	3.13	1.19	5.15
2		0.29	1.31	0.70	2.30	1.01	3.60	0.80	5.41	1.18	3.78	1.58	6.55
3		0.22	1.75	0.56	2.53	1.03	3.89	0.99	5.90	1.32	4.47	2.01	7.79
CD(0.05)		0.05	0.63	NS	0.58	0.27	NS	0.16	1.31	0.37	NS	0.50	1.31
Interaction													
M and T		0.10	1.25	NS	1.16	0.54	NS	0.32	NS	NS	NS	NS	NS
T and M		0.11	1.30	NS	1.20	0.51	NS	0.39	NS	NS	NS	NS	NS
Experimental Mean		**0.24**	**1.98**	**0.62**	**2.84**	**0.86**	**3.29**	**0.80**	**4.94**	**1.11**	**3.79**	**1.59**	**6.49**

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	GHAGHRAGHAT			MALAN											
		Weed dry biomass g/m^2			Weed biomass at vegetative stage no/m^2				Weed biomass at panicle initiation stage g/m^2				Weed biomass at heading stage g/m^2			
		Active vegetative stage	Panicle initiation stage	Heading stage	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
T1	V1	-	-	33.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	V2	-	-	31.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	V3	-	-	27.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2	V1	3.2	4.52	46.45	36.00	0.57	68.33	104.90	25.47	0.53	50.17	76.17	21.00	0.57	32.97	54.53
	V2	3.22	4.51	46.74	34.50	2.37	58.50	95.37	27.20	0.90	49.97	78.07	19.50	1.47	42.00	62.97
	V3	3.13	4.33	40.37	49.80	1.50	62.57	113.87	30.73	2.03	54.60	87.37	18.57	0.57	37.13	56.27
T3	V1	2.55	3.95	44.96	10.80	2.10	12.13	25.03	12.57	0.83	14.70	28.10	9.50	0.30	12.00	21.80
	V2	2.39	3.26	33.56	12.30	1.20	18.27	31.77	14.27	0.83	16.50	31.60	7.73	0.00	13.80	21.53
	V3	2.46	3.39	35.65	13.80	1.77	17.60	33.17	6.83	1.23	7.50	15.57	8.70	1.20	15.50	25.40
T4	V1	2.26	2.8	29.49	4.80	3.00	4.40	12.20	4.73	0.53	2.70	7.97	2.67	0.57	2.40	5.63
	V2	2.66	3.14	31.91	6.60	1.77	2.03	10.40	2.63	0.90	5.40	8.93	1.77	0.83	2.40	5.00
	V3	2.54	3.35	29.55	3.60	2.67	5.33	11.60	3.27	0.87	5.10	9.23	3.57	0.57	3.87	8.00
Mean of Factor-1																
1				30.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2		3.18	4.45	44.52	40.10	1.48	63.13	104.71	27.80	1.16	51.58	80.53	19.69	0.87	37.37	57.92
3		2.47	3.53	38.06	12.30	1.69	16.00	29.99	11.22	0.97	12.90	25.09	8.64	0.50	13.77	22.91
4		2.49	3.1	30.32	5.00	2.48	3.92	11.40	3.54	0.77	4.40	8.71	2.67	0.66	2.89	6.21
CD(0.05)		0.1	0.09	7.04	5.20	1.07	10.70	14.83	6.10	0.68	5.47	7.62	6.97	NS	6.03	5.44
Mean of Factor-2																
1		2.67	3.76	38.56	12.90	1.42	21.22	35.53	10.69	0.48	16.89	28.06	8.29	0.36	11.84	20.49
2		2.75	3.64	36.04	13.35	1.33	19.70	34.38	11.02	0.66	17.97	29.65	7.25	0.57	14.55	22.37
3		2.71	3.69	33.3	16.80	1.48	21.37	39.66	10.21	1.03	16.80	28.04	7.71	0.58	14.12	22.42
CD(0.05)		NS	NS	NS	3.39	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction																
M and T		NS	0.31	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T and M		NS	0.26	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Experimental Mean		**2.71**	**3.69**	**35.97**	**14.35**	**1.41**	**20.76**	**36.53**	**10.64**	**0.72**	**17.22**	**28.58**	**7.75**	**0.51**	**13.51**	**21.76**

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

Table 4.3.3: Contd.

Main Plot	Sub Plots	NELLORE											
		Weed biomass at vegetative stage g/m^2				Weed biomass at panicle initiation stage g/m^2				Weed biomass at Heading stage g/m^2			
		Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total	Grasses	Sedges	BLWs	Total
T1	V1	2.00	1.00	0.00	3.00	1.67	3.00	1.00	5.67	0.67	0.33	0.00	1.00
	V2	3.00	1.00	0.00	4.00	1.67	3.33	1.33	6.33	0.00	0.00	0.00	0.00
	V3	1.67	1.67	0.00	3.33	1.33	1.00	1.00	3.33	0.00	0.33	0.33	0.67
T2	V1	24.00	11.67	0.00	35.67	32.67	46.33	0.00	79.00	19.00	45.00	0.00	64.00
	V2	37.67	10.00	0.00	47.67	47.33	13.67	0.33	61.33	38.33	14.33	2.67	55.33
	V3	85.33	1.67	0.33	87.33	36.33	11.67	1.33	49.33	39.67	14.00	2.33	56.00
T3	V1	16.00	4.33	0.00	20.33	4.33	6.00	1.67	12.00	5.33	8.33	2.67	16.33
	V2	17.33	6.67	0.00	24.00	5.00	7.33	1.33	13.67	5.67	8.00	1.67	15.33
	V3	3.67	1.33	0.00	5.00	6.33	4.33	1.00	11.67	6.00	3.33	1.33	10.67
T4	V1	1.00	0.67	0.00	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	V2	1.67	0.00	0.00	1.67	0.33	0.00	0.00	0.33	0.33	0.00	0.00	0.33
	V3	0.00	0.00	0.00	0.00	0.67	1.33	0.33	2.33	0.67	1.33	0.33	2.33
Mean of Factor-1													
1		2.22	1.22	0.00	3.44	1.56	2.44	1.11	5.11	0.22	0.22	0.11	0.56
2		49.00	7.78	0.11	56.89	38.78	23.89	0.56	63.22	32.33	24.44	1.67	58.44
3		12.33	4.11	0.00	16.44	5.22	5.89	1.33	12.44	5.67	6.56	1.89	14.11
4		0.89	0.22	0.00	1.11	0.33	0.44	0.11	0.89	0.33	0.44	0.11	0.89
CD(0.05)		20.18	NS	NS	19.99	10.87	7.79	NS	11.86	2.95	9.47	1.46	9.45
Mean of Factor-2													
1		10.75	4.42	0.00	15.17	9.67	13.83	0.67	24.17	6.25	13.42	0.67	20.33
2		14.92	4.42	0.00	19.33	13.58	6.08	0.75	20.42	11.08	5.58	1.08	17.75
3		22.67	1.17	0.08	23.92	11.17	4.58	0.92	16.67	11.58	4.75	1.08	17.42
CD(0.05)		7.03	2.56	NS	NS	NS	NS	NS	6.09	2.82	NS	NS	NS
Interaction													
M and T		14.06	NS	NS	14.98	NS	NS	NS	NS	5.64	NS	NS	NS
T and M		18.69	NS	NS	19.09	NS	NS	NS	NS	5.12	NS	NS	NS
Experimental Mean		**16.11**	**3.33**	**0.03**	**19.47**	**11.47**	**8.17**	**0.78**	**20.42**	**9.64**	**7.92**	**0.94**	**18.50**

T1-Weed free
T2-Weedy check
T3-Mechanical weeding using weeder
T4-Chemical weed control (pre & post emergence herbicide application)

V1 - DRRDhan 50
V2 - DRRDhan 52
V3 - Latest released state variety

4.3.4 Integrated Pest Management

In recent years, intensive cultivation of rice has resulted in the frequent occurrence of biotic stresses that formed major constraint in rice production. Although, IPM has been accepted as the most effective option for protection of crops from the ravages of pests, however, its implementation at the farmer's level has been limited. As IPM involves a number of components, farmers must have capability of taking decisions and selecting IPM options accordingly for economical and long term management. Most of these options also need to be refined at individual farm level keeping in view the availability of resources and feasibility to farmers. Therefore, IPM involves working with the farmers in their fields and devising technologies suitable to their conditions. Keeping this in view, IPM special trial was conducted with an aim to manage pests (including insects, diseases and weeds) in a holistic way in farmers' fields involving them in a participatory way and allowing them to select IPM practices from a basket of options available. The IPM practices recommended for weed management is given in the below table.

Treatment	IPM block	FP block
Nursery	❖ Apply **butachlor** or **pretilachlor + safener @ 5 ml/lt** water at 8-10 days after sowing. ❖ If weed intensity is more apply **bispyribacsodium @ 8 ml/lt** water at 2-3 leaf stage of weeds	❖ As per the local farmers practice. ❖ Please record the practices followed by farmers whenever you go for observation / visit
Main field	❖ Transplant seedlings at a spacing of 20 x 15 cm. ❖ Leave alleyways of 30 cm after every 2 m or 10 rows. ❖ Fertilizers should be applied as per local recommended fertilizer dose. ❖ Apply herbicide within one week after transplanting the crop.	❖ As per the local farmers practice ❖ Please record the practices followed by farmers whenever you go for observation / visit
30 – 59DAT	❖ Depending on weed intensity spray post emergence herbicide as given N top dressing to be taken up as given in protocol using Leaf Color Chart ❖ Mid season drainage	❖ As per the local farmers practice (mention the quantities) ❖ Please record the practices followed by farmers whenever you go for observation / visit
> 90 DAT up to harvest	❖ Mark 5 x 5 m^2 area and take yield, at 5 places (5 repl.) in this block	❖ Mark 5 x 5 m^2 and take yield, at 5 places (5 repl.) in this block
	❖ Also record the cost involved for each practice/ operation taken in IPM starting from nursery to harvest to estimate cost of cultivation as given in data sheet	❖ Also record the cost involved for each practice/ operation taken up by farmers starting from nursery to harvest to estimate cost of cultivation as given in data sheet

During kharif 2019, the trial was conducted at 11 locations viz., **Chatha, Chinsurah, Gangavathi, Malan, Mandya, Navsari, Nellore, Puducherry, Raipur, Titabar** and **Vadgaon**. The data on weed parameters during critical period of crop weed competition and grain yield were reported and the results are summarized and presented in **Table 4.3.4.**

At **Chatha**, the data on weed population and biomass were recorded at 30 & 60 DAT; with relatively lower weed intensity in IPM adopted fields((14.87 & 33.07% lower weed population; 15.37 and 32.26% lower biomass than that of farmers practice.

At **Chinsurah**, The trial was conducted in the village Bele, Pandua, Block of Hoogly District. The data on weed population and biomass showed significant decrease in IPM by 42.58 and 32.57%; 52.85 and 33.33% respectively than in farmers practice. The significant decrease in weed population and biomass had resulted in higher crop growth, yield attributes and grain yield increase (12%) by variety Swarna.

At **Gangavathi**, BPT 5204 has recorded a mean grain yield increase of 12.8% in IPM adopted fields with significantly low weed intensity 63.48 &50% in weed population and 40.51% in weed biomass. **Table 4.3.4.**

At **Malan**, the variety HPR 2880 resulted in higher grain yield by 51.86% than Raftar in farmers fields. The weed population was 63-65% lower in IPM implemented fields.

At **Mandya**, variety MTU 1001 was tested under IPM program. The variety showed 12.77% yield advantage under IPM adoption compared to farmers practice. The weed population data recorded at 30 & 60 DAT showed drastic reduction in IPM fields with 71 and 79% respectively. The weed biomass was 69.82 and 81.40% higher in farmers practice adopted fields.

At **Navsari**, the IPM and farmers practice have recorded similar weed intensity showing the farmers are practicing good weed management measures and recorded only 10 and 4% higher than IPM implemented fields with weed biomass of 5% higher than IPM fields. The yield gap of farmers practice and IPM fields also was only 1.7% indicating the implementation of latest technologies by farmers commonly.

At **Nellore**, variety BPT 5204 has recorded 72 & 58% lower weed population, 60 & 70% lower weed biomass at 30 and 60 DAT in IPM adopted fields resulting in yield advantage of 13% over farmers practice. The yield gap was low indicating the adoption of IPM practices timely especially weed control practices.

At **Puducherry**, ADT 53 has recorded highest grain yield in IPM implemented fields and resulted in 7.6% yield advantage. IPM fields recorded 31.5 and 29% lower weed population at 30 & 60 DAT respectively. Similarly the weed biomass was lower by 35.5 and 26,3% at 30 and 60 DAT respectively compared to farmers practice.

At **Raipur**, under wet direct sown system, Swarna has 8.49% higher grain yields in IPM implemented fields compared to farmers practice adopted fields. The weed population was 14 and 16.6% higher at 30 and 60 DAS respectively in farmers practice adopted fields. The weed biomass was also 18% and 10% higher in farmers practice fields than IPM implemented fields.

At **Titabar**, Rajit Sub-1 variety was tested under IPM and farmers practice implemented fields. IPM implementation resulted in 25% higher grain yields compared to farmers practice adopted fields. IPM implemented fields recorded 63% lower weed population and 47% lower weed biomass compared to farmers practice adopted fields.

At **Vadgaon**, Phule Samrudhi was cultivated in both IPM and farmers practice implemented fields. Same variety showed highest yield advantage of 44.7% in IPM implemented fields. The weed intensity was high and IPM implemented fields showed 67 and 50% lower weed population at 30 & 60 DAT in IPM implemented fields was lower by 58 and 65% compared to farmers practice adopted fields indicating the necessity of timely weed control in farmers fields. **Table 4.3.4.**

Integrated Pest Management (IPMs) trial was conducted at 11 locations during *Kharif*2019 with an objective of managing all pests i.e., weeds, insects, diseases in a holistic way in farmers' fields involving them in a participatory mode. Across the locations, weeds, insect pests, and disease incidence was low in IPM plots. The mean weed population was considerably reduced by 9 to 71% at 30 DAT, 4 to 79% at 60 DAT; resulting in reduction of the mean weed biomass by 5 to 70% at 30 DAT, 5 to 81% at 60 DAT respectively. The mean grain yield advantage in IPM implemented plots compared to farmers practice is 2 to 52% among the test locations.

(For more details regarding pest and diseases please see Volume.2 Progress Report 2019 (**Entomology–IPMspecial trial).**

Table 4.3.4: Summary of data on weed parameters, yield parameters and grain yield of IPM trial as influenced by IPM vs Farmers Practice in Kharif - 2019.

Location	Mean/ standard error	Treatments	Panicle No/m^2	Panicle wt (g)	Grain Yield (t/ha)	Yield Advantage	Straw Yield (t/ha)	Weed Population No/m^2				Weed Dry Biomass g/m^2			
								30 DAT	% Reduction	60 DAT	% Reduction	30 DAT	% Reduction	60 DAT	% Reduction
CHATHA	Mean	IPM	312	1.82	3.79	11.60	5.22	21.00	14.87	29.67	33.07	11.28	15.37	31.14	32.26
		Farmers Practice	235	1.69	3.35		4.53	24.67		44.33		13.33		45.97	
	Standard errors		2.52	0.06	0.03		0.10	1.00		1.53		1.17		1.59	
			3.79	0.05	0.09		0.13	0.58		2.08		1.57		0.60	
CHINSURAH	Mean	IPM	348	3.20	4.53	12.14		36.40	42.58	65.40	32.57	3.41	52.85	6.23	33.33
		Farmers Practice	293	3.13	3.98			63.40		97.00		6.66		9.34	
	Standard errors		17	0.08	0.25			9.02		10.14		0.97		1.76	
			16	0.05	0.22			11.87		20.21		1.16		2.41	
GANGAVATHI	Mean	IPM	496	2.56	5.86	12.79	6.73	3.40	63.48	2.20	50.00	5.82	40.00	5.32	51.10
		Farmers Practice	429	1.74	5.11		5.94	8.60		4.40		9.70		10.88	
	Standard errors		60	0.23	0.41		0.49	2.51		0.84		2.41		3.08	
			14	0.42	0.31		0.27	2.70		2.70		4.97		8.45	
LUDHIANA	Mean	IPM	367	3.26	7.47	3.34	10.63	2.05	75.15	2.63	74.43	-	-	-	-
		Farmers Practice	346	3.24	7.23		10.20	8.25		10.25		-		-	
	Standard errors		23	0.09	0.21		0.33	1.28		1.56		-		-	
			24	0.14	0.24		0.25	2.56		3.61		-		-	
MALAN	Mean	IPM	225	2.06	3.49	51.86	4.01	12.00	64.91	16.40	63.06	10.40	64.86	14.80	63.00
		Farmers Practice	187	1.74	1.68		1.96	34.20		44.40		29.60		40.00	
	Standard errors		5.87	0.11	0.28		0.31	2.92		3.36		2.51		3.49	
			3.96	0.11	0.11		0.12	4.66		5.77		4.04		4.69	
MANDYA	Mean	IPM	367	3.43	7.75	12.77	8.67	2.30	71.25	2.20	79.24	0.51	69.82	1.03	81.40
		Farmers Practice	356	3.01	6.76		7.65	8.00		10.60		1.69		5.54	
	Standard errors		33	0.34	0.65		0.54	1.48		1.48		0.32		0.59	
			10	0.36	0.39		0.32	3.00		2.30		1.22		1.39	

Table 4.3.4: Contd.

Location	Mean/ standard error	Treatments	Panicle No/m²	Panicle wt (g)	Grain Yield (t/ha)	Yield Advantage	Straw Yield (t/ha)	Weed Population No/m²				Weed Dry Biomass g/m²			
								30 DAT	% Reduction	60 DAT	% Reduction	30 DAT	% Reduction	60 DAT	% Reduction
NAVASARI	Mean	IPM	215	3.82	5.15	1.74	7.75	19.92		34.28	4.40	34.08	5.28	50.90	4.64
		Farmers Practice	202	3.63	5.06		7.66	21.98	9.37	35.86		35.98		53.38	
	Standard errors		4	0.20	0.16		0.15	0.97		1.49		0.65		1.28	
			9	0.11	0.16		0.17	0.77		1.06		0.33		1.68	
NELLORE	Mean	IPM	447	2.46	6.53	12.90	8.40	2.60	71.73	3.00	58.33	3.00	60.52	10.40	69.76
		Farmers Practice	380	2.42	6.28		7.92	9.20		7.20		7.60		34.40	
	Standard errors		31	0.456	0.31		0.29	1.14		0.71		1.87		3.13	
			26	0.319	0.27		0.56	2.28		1.79		2.07		9.56	
PUDUCHERRY	Mean	IPM	357	4.00	6.31	7.60	8.21	28.20	31.55	33.60	29.11	15.60	35.53	17.40	26.27
		Farmers Practice	332	3.75	5.83		7.58	41.20		47.40		24.20		23.60	
	Standard errors		15	0.21	0.18		0.24	2.59		3.36		2.41		2.07	
			8	0.17	0.10		0.13	5.81		4.83		5.72		2.70	
RAIPUR	Mean	IPM	371	2.61	5.06	8.49	5.80	16.64	14.22	28.18	16.57	8.63	18.12	40.23	10.34
		Farmers Practice	362	2.50	4.63		5.41	19.40		33.78		10.54		44.87	
	Standard errors		28	0.183	0.22		0.17	4.18		5.45		1.33		3.42	
			22	0.075	0.26		0.33	4.73		5.22		1.52		2.74	
TITABAR	Mean	IPM	195	5.10	5.22	25.28	-	-	-	15.60	62.67	-	-	16.45	46.91
		Farmers Practice	129	4.32	3.90		-	-		41.80		-		30.99	
	Standard errors		19	0.486	0.41		-	-		2.79		-		15.73	
			7	0.093	0.32		-	-		8.23		-		31.40	
VADAGOAN	Mean	IPM	241	5.25	5.79	44.73	6.10	4.83	66.62	10.71	50.09	7.46	58.39	8.07	65.45
		Farmers Practice	172	2.97	3.20		4.01	14.47		21.46		17.93		23.36	
	Standard errors		12	0.336	0.27		0.25	2.05		0.88		1.65		1.58	
			8	0.139	0.28		0.34	2.60		4.40		2.69		3.50	

(RESOURCE CONSERVATION TECHNOLOGIES)

in

RICE BASED CROPPING SYSTEMS

4.4. RESOURCE CONSERVATION TECHNOLOGIES in RBCS

Indian Agriculture faces the dual challenge of feeding more than a billion people in changing climatic and economic scenario. Agriculture is the main source of livelihood for almost 60% of the country's total population. The impact of climate change on agriculture was severely felt in India. It has been projected that under the scenario of a 2.5^0C to 4.9^0C temperature rise, rice yields will drop by 32-40% and wheat yields by 41 to 52%. As Indian agriculture is highly dependent on specific climatic conditions, the research on the impact of climate change on agriculture in general and rice production in specific is a high priority in India. There is an urgent need to focus on climate resilient input management practices for improving use efficiency and sustaining the rice and rice based cropping systems across the country. A total of four trials i.e., Conservation Agriculture, cultivars for late planting, exploration of rice fallow with millers (Sorghum) and pulses were conducted during Rabi 2018-19 and Kharif 2019

4.4.1. Conversation Agriculture/system base management practices in rice and rice based cropping systems (crop diversification) to utilise the resources and enhancing the profitability and productivity

Conservation agriculture systems utilize soils for the production of crops with the aim of reducing excessive mixing of the soil and maintaining crop residues on the soil surface in order to minimize damage to the environment. **The three principles** of CA are: minimum tillage and soil disturbance, permanent soil cover with crop residues live mulches and crop rotation and intercropping.

Among the various cropping systems being practiced in India, Rice based cropping systems is considered to be the most important because of its large area coverage and contribution to total food grain production. Transplanting is the most dominant and traditional method of establishment in irrigated lowland rice. However, due to non-availability of irrigation water, shortage of labour during peak period of transplanting and escalating labour costs make the transplanting technique more expensive which invariably leads to delay in transplanting and resulting in reduction of yield. Crop residue especially Rice-Straw containing about 1-2% of 'K' a good source of nutrient especially for intensively cropped soils. Residue incorporation is known to help *Rabi* crops in rice-based cropping systems. To address this problem, alternate methods of crop establishment need to be evolved to substitute manual transplanting method under various agro-ecologies. Hence, this trial was initiated with a view to evaluate systems of rice crop establishment under different residue management during 2017 and continued in *kharif* 2019 to realize the production potential of alternate systems of crop establishment under different residue retention.

The trial was laid out in split plot design with four replications during *Kharif* 2017 at three locations continued at **Vadagaon**, **Ghaghraghat**, **Krajat, Rajendranagar** and **Titabar** during 2019 to assess the effect of different crop establishment methods under various residue/straw management practices. Main plot treatments comprised of three different crop establishment methods (M_1: Transplanting, M_2: Wet seeding (line sowing under puddled conditions) and M3: Aerobic rice – Dry rice cultivation). The sub plot treatments comprised of three different residue/straw management (S_1: No residue, S_2: 15cm height of rice straw from ground, S_3: 30cm height of rice straw from ground) to be superimposed for *Rabi* crops. The results are summarized and presented in Table 4.4.1 and the salient findings are summarized below.

Crop establishment methods influenced the grain yield significantly at all locations. At **Vadagaon**, results revealed that $M_{3:}$ Aerobic of rice recorded significantly higher yield attributes and grain yield (5.49 t/ha) as compared to other crop establishment methods. Similarly at **Rajendranagar**, the grain yields were higher (7.12 t/ha), **Titabar** (4.49 t/ha), **Gharghraghat** (3.33 t/ha) and **Karjat** (3.94 t/ha) also during kharif 2019. However, at **Vadagaon**, aerobic rice method gave significantly higher grain yield (5.65 t/ha) over other methods of crop establishment during kharif 2018. Suitability of wet seeding and Aerobic rice at **Vadagaon** location under clay loam soil. Transplanting method showed its significant superiority in minimizing the weed population and weed dry biomass at 45 and 60 DAS over wet seeding at most of the locations. Among the residue management practices, rice straw incorporation during *Rabi* season gave better yields over no residue at **Vadagoan, Rajendranagar** and **Karjat** with reduced weed population and weed dry matter.

The system productivity analysis (kharif and rabi) clearly indicated superiority of transplanting at **Rajendranagar** (8.62 t/ha) and **Karjat** (8.68 t/ha) based on the REY while three systems were comparable at **Vadagaon**. Rice residue incorporation was found to be superior at all three locations with higher REY values (9.26 t/ha, 7.54 t/ha and 8.71 t/ha at **Vadagaon**, **Rajendranagar** and **Karjat** respectively).

Among crop establishment methods transplanting exhibit significant differences with respect to growth and yield attributes at **Titabar, Rajendranagar, Ghaghraghat** and **Karjat**. However, aerobic rice method found promising over transplanting and wet seeding in puddle rice at **Vadagoan**. The REY of the system productivity indicated superiority over the residue application at all three locations (**Vadagaon**, **Rajendranagar** and **Karjat**).

Table 4.4.1: Summary of data on grain yield and ancillary characters of conservation Agriculture/system based management practices in rice and rice based cropping systems to utilise the resources and enhancing the profitability and productivity, Kharif - 2019.

		VADAGAON					RAJENDRANAGAR					KARJAT					TITABAR		GGT
		Kh-18	Rb18-19			Kh-19	Kh-18	Rb 18-19			Kh-19	Kh-18	Rb 18-19			Kh-19	Kh-18	Kh-19	Kh-19
Main plot	**Sub plots**	**Grain Yield (t/ha) Rice**	**Grain Yield (t/ha) Gram**	**REY**	**K +R (REY)**	**Grain Yield (t/ha)**	**Grain Yield (t/ha) Rice**	**Grain Yield (t/ha) Maize**	**REY**	**K +R (REY)**	**Grain Yield (t/ha)**	**Grain Yield (t/ha) Rice**	**Grain Yield (t/ha) Gram**	**REY**	**K +R (REY)**	**Grain Yield (t/ha)**	**Grain Yield (t/ha)**	**Grain Yield (t/ha)**	**Grain Yield (t/ha)**
M1- Transplanting	**S1**	4.89	0.90	2.92	7.81	4.96	5.67	4.02	3.91	9.58	7.12	4.89	0.99	3.21	8.10	3.94	4.96	4.96	3.33
	S2	5.61	1.03	3.34	8.95	5.68		2.48	2.41	8.08			1.14	3.70	8.59		4.59	4.93	
	S3	5.72	1.06	3.44	9.16	5.83		2.84	2.76	8.43			1.37	4.44	9.33		3.91	4.64	
M2- Wet seeding	**S1**	4.7	0.85	2.76	7.46	4.69	5.00	4.41	4.28	9.28	6.75	4.51	1.00	3.24	7.75	3.83	3.69	3.01	3.17
	S2	5.78	0.99	3.21	8.99	5.47		3.84	3.73	8.73			1.13	3.66	8.17		3.5	3.17	
	S3	5.89	1.04	3.37	9.26	5.73		2.34	2.27	7.27			1.29	4.18	8.69		2.95	3.12	
M3- Aerobic rice	**S1**	4.91	0.82	2.66	7.57	4.52	3.73	2.33	2.26	5.99	3.44	4.09	0.93	3.02	7.11	3.66	2.19	2.09	2.92
	S2	5.97	0.97	3.15	9.12	5.31		1.83	1.78	5.51			1.12	3.63	7.72		2.16	2.21	
	S3	6.07	1.01	3.28	9.35	5.55		1.69	1.64	5.37			1.23	3.99	8.08		2.01	2.13	
Mean of main plots										0.00									
M1		5.41	1.00	3.24	8.65	5.49	5.67	3.11	3.02	8.69	7.12	4.89	1.17	3.79	8.68	3.94	4.49	4.84	3.33
M2		5.45	0.96	3.11	8.56	5.30	5.00	3.53	3.43	8.43	6.75	4.51	1.14	3.70	8.21	3.83	3.38	3.10	3.17
M3		5.65	0.93	3.02	8.67	5.13	3.73	1.95	1.89	5.62	3.44	4.09	1.09	3.53	7.62	3.66	2.12	2.14	2.92
C.D.(0.05)		0.16	0.00			0.00	0.57	0.45			0.84	0.06	NS			0.10	0.14	0.27	0.54
C.V.(%)		2.85	0.10			0.10	8.16	18.64			10.06	0.97	4.65			1.88	4.96	9.71	11.85
Mean of Sub plots																			
S1		4.83	0.86	2.79	7.62	4.72	3.79	3.59	3.49	7.28		4.50	0.97	3.15	7.64		3.61	3.35	
S2		5.78	1.00	3.24	9.02	5.49	4.52	2.72	2.64	7.16			1.13	3.66	8.16		3.42	3.43	
S3		5.89	1.04	3.37	9.26	5.70	5.32	2.29	2.22	7.54			1.30	4.22	8.71		2.95	3.30	
C.D.(0.05)		0.19	0.03			0.14		0.92					0.12				0.23	NS	
C.V. (%)		3.93	2.57			2.57		31.27					10.36				6.74	3.48	
Interaction																			
N at same V		NS	NS			NS		NS					NS				NS	NS	
V at same N		NS	NS			NS		NS					NS				NS	NS	
Expt. Mean		**5.50**	0.96	3.11	8.61	5.31	4.54	2.86	2.78	7.32		4.50	1.13	3.66	8.16		**3.33**	3.36	
Variety			Gram			Phule samruddhi		-					-				Shraboni	Numoli	
Soil type			Clay loam			-		-					-				-	Clay loam	
pH			7.2			7.8		-					-				-	5.2	
RDF N:P:K (kg/ha)			152:15:210			100;50;50		-					-				-	60:20:40	
Aval. N:P:K of soil (kg/ha)			Rice-Gram			172:16:219		Rice-Maize					Rice-Gram				-	440:21:335	

S1 - No residue

S2 - 15cm height of rice straw from ground

S3 - 30cm height of rice straw from ground

Table 4.4.1: Cntd…

Main plot	Sub plots	VADGAON									
		Grain Yield (t/ha)	Panicle/m2 (No.)	Panicle weight (g)	Test weight (g)	Days 50% flowering	Germination %	Weed population at 30 DAS (No/m2)	Weed Dry wt at 30 DAS (g/m2)	Weed population at 60 DAS (No/m2)	Weed Dry wt at 60 DAS (g/m2)
M1- Transplanting	S1	4.96	238	2.91	21.57	97	99.3	9.33(3.13)	16.58	11.19(3.40)	19.98
	S2	5.68	273	3.34	22.17	98	98.3	5.33(2.41)	9.41	6.33(2.61)	11.22
	S3	5.83	280	3.43	22.76	99	99.0	3.67(2.04)	6.41	4.33(2.20)	7.62
M2- Wet seeding	S1	4.69	220	2.53	20.63	97	98.0	11.33(3.44)	16.97	13.57(3.74)	20.12
	S2	5.47	257	2.96	21.87	98	98.0	5.00(2.34)	7.47	6.01(2.54)	8.88
	S3	5.73	269	3.10	22.92	99	97.7	3.67(2.04)	10.95	4.39(2.20)	12.63
M3- Aerobic rice	S1	4.52	208	2.27	20.36	100	97.7	13.00(3.67)	18.85	15.52(4.00)	22.48
	S2	5.31	244	2.67	21.26	100	98.0	5.33(2.41)	7.73	6.33(2.61)	9.17
	S3	5.55	255	2.79	22.19	100	98.0	3.67(2.04)	6.23	4.37(2.20)	7.38
Mean of main plots											
M1		5.49	264	3.23	22.16	98	98.9	6.11(2.53)	10.80	7.28(2.74)	12.94
M2		5.30	249	2.86	21.81	98	97.9	6.67(2.60)	11.80	7.99(2.83)	13.88
M3		5.13	236	2.58	21.27	100	97.9	7.33(2.71)	10.94	8.74(2.94)	13.01
C.D.(0.05)		0.00	0.33	0.01	0.23	NS	NS	NS	NS	NS	NS
C.V.(%)		0.10	0.16	0.38	1.26	1.74	0.72	5.37	36.39	5.59	35.84
Mean of Sub plots											
S1		4.72	222	2.57	20.85	98	98.3	11.22(3.41)	17.47	13.43(3.71)	20.86
S2		5.49	258	2.99	21.76	99	98.1	5.22(2.39)	8.20	6.23(2.59)	9.76
S3		5.70	268	3.11	22.62	99	98.2	3.67(2.04)	7.86	4.36(2.20)	9.21
C.D.(0.05)		0.14	6.60	0.07	0.59	NS	NS	0.17	3.66	0.21	4.45
C.V. (%)		2.57	2.58	2.52	2.65	1.74	0.93	6.40	31.89	7.14	32.60
Interaction											
N at same V		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
V at same N		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Expt. Mean		5.31	249	2.89	21.74	99	98.2	2.61	11.18	2.83	13.28
Variety		Phulesamruddhi									
Soil type		-									
pH		7.8									
RDF N:P:K (kg/ha)		100;50;50									
Aval. N:P:K of soil (kg/ha)		172:16:219									

S1 - No residue
S2 - 15cm height of rice straw from ground
S3 - 30cm height of rice straw from ground

Table 4.4.1: Cntd…

Main plot	Sub plots	TITABAR					Over all mean	Rank
		Grain Yield (t/ha)	Panicle/m2 (No.)	Panicle weight (g)	Days 50% flowering	Weed Dry wt at 60 DAS (g/m2)		
M1- Transplanting	S1	4.96	225	5.41	105	40.50(6.40)	4.96	3
	S2	4.93	233	5.26	105	34.97(5.95)	5.31	1
	S3	4.64	220	5.21	107	30.03(5.52)	5.24	2
M2- Wet seeding	S1	3.01	271	4.85	94	67.63(8.22)	3.85	6
	S2	3.17	288	4.84	94	60.80(7.83)	4.32	5
	S3	3.12	255	4.85	95	55.80(7.50)	4.43	4
M3- Aerobic rice	S1	2.09	252	3.87	105	119.57(10.95)	3.31	9
	S2	2.21	233	3.29	106	113.73(10.68)	3.76	8
	S3	2.13	212	3.29	107	114.83(10.72)	3.84	7
Mean of main plots								
M1		4.84	226	5.29	106	35.17(5.96)	5.17	1
M2		3.10	271	4.85	94	61.41(7.85)	4.20	2
M3		2.14	232	3.48	106	116.04(10.78)	3.64	3
C.D.(0.05)		0.27	13.47	0.45	0.95	0.37		
C.V.(%)		9.71	6.62	11.89	1.11	5.36		
Mean of Sub plots								
S1		3.35	249	4.71	101	75.90(8.52)	4.04	3
S2		3.43	251	4.46	101	69.83(8.15)	4.46	2
S3		3.30	229	4.45	103	66.89(7.91)	4.50	1
C.D.(0.05)		NS	19.09	NS	1.27	0.36		
C.V. (%)		3.48	7.64	7.30	1.21	4.28		
Interaction								
N at same V		NS	NS	NS	NS	NS		
V at same N		NS	NS	NS	NS	NS		
Expt. Mean		3.36	243	4.54	102	8.20	4.34	
Variety		Numoli						
Soil type		Clay loam						
pH		5.2						
RDF N:P:K (kg/ha)		60:20:40						
Aval. N:P:K of soil (kg/ha)		440:21:335						

S1 - No residue
S2 - 15cm height of rice straw from ground
S3 - 30cm height of rice straw from ground

Table 4.4.1: Cntd…

Main Methods	GHAGHRAGHAT			KARJAT									
	Grain Yield (t/ha)	Panicle/m2 (No.)	Panicle weight (g)	Grain Yield (t/ha)	Panicle/m2 (No.)	Panicle weight (g)	Test weight (g)	Days 50% flowering	Germination %	Weed population at 30 DAS (No/m2)	Weed Dry wt at 30 DAS (g/m2)	Weed population at 60 DAS (No/m2)	Weed Dry wt at 60 DAS (g/m2)
M1- Transplanting	3.33	116	2.9	3.94	226.37	2.63	23.4	87	98.67	7.33(2.80)	1.17	5.53(2.46)	1.00
M2- Wet seeding	3.17	108	2.72	3.83	220.10	2.56	23.4	87	94.67	8.43(2.99)	1.27	6.43(2.63)	1.10
M3- Aerobic rice	2.92	104	2.38	3.66	210.07	2.44	23.4	87	94.33	9.50(3.16)	1.33	7.50(2.83)	1.20
Exp. mean	3.14	109	2.67	3.81	218.84	2.54	23.4	87	95.89	2.98	1.26	2.64	1.10
CD(0.05)	0.54	13.06	0.11	0.10	5.58	0.07	0.05	0.84	0.48	0.17	0.15	0.10	0.09
CV	11.85	8.24	2.81	1.88	1.76	1.78	0.15	0.66	0.35	3.88	8.25	2.58	5.47
res(t)	NS	NS	**	*	*	*	NS	NS	**	*	NS	**	*
Variety	**NDR 359**			**-**									
Soil type	**Sandy loam**			**-**									
pH	**8.06**			**-**									
RDF N:P:K (kg/ha)	**100:50:30**			**-**									
Aval. N:P:K of soil (kg/ha)	**-**			**-**									

Table 4.4.1: Cntd…

Main Methods	RAJENDRANAGAR-ARI								
	Grain Yield (t/ha)	Panicle/m2 (No.)	Panicle weight (g)	Test weight (g)	Germination %	Weed population at 30 DAS (No/m2)	Weed Dry wt at 30 DAS (g/m2)	Weed population at 60 DAS (No/m2)	Weed Dry wt at 60 DAS (g/m2)
M1- Transplanting	7.12	425	4.36	12.43	97.33	18.00(4.30)	5.53	5.44(2.44)	2.85
M2- Wet seeding	6.75	405	4.21	11.87	83.00	40.00(6.35)	5.69	9.44(3.15)	11.36
M3- Aerobic rice	3.44	399	3.86	11.40	70.00	49.00(7.03)	11.12	10.33(3.26)	16.00
Exp. mean	5.77	410	4.14	11.90	83.44	5.89	7.45	2.95	10.07
CD(0.05)	0.84	49.19	0.62	0.75	12.17	0.32	2.75	0.35	4.37
CV	10.06	8.28	10.31	4.34	10.06	3.69	25.47	8.25	29.95
res(t)	**	NS	NS	NS	*	**	*	*	*
Variety	-								
Soil type	Clay loam								
pH	7.9								
RDF N:P:K (kg/ha)	120:60:40								
Aval. N:P:K of soil (kg/ha)	213:88:750								

Table 4.4.1: (Rabi) Summary of data on grain yield and ancillary characters of conservation Agriculture/system based management practices in rice and rice based cropping systems to utilise the resources and enhancing the profitability and productivity, Rabi 2018-19.

Main plot	Sub plots	KARJAT										
		Grain Yield (t/ha)	Straw yield (t/ha)	Kharif Grain Yield (t/ha) Rice	Germination %	Weed population at 30 DAS (No/m2)	Weed Dry wt at 30 DAS (g/m2)	Weed population at 60 DAS (No/m2)	Weed Dry wt at 60 DAS (g/m2)	Cost of cultivation (Rs/ha)	REY	K +R (REY)
M1- Transplanting	S1	0.99	3.85	4.89	92.67	6.00(2.55)	1.17	7.13(2.76)	1.47	109937	3.21	8.10
	S2	1.14	4.56	4.89	93.00	5.70(2.49)	1.07	7.03(2.74)	1.40	109937	3.70	8.59
	S3	1.37	5.63	4.89	93.00	5.87(2.48)	1.03	6.97(2.73)	1.33	109937	4.44	9.33
M2- Wet seeding	S1	1.00	3.90	4.51	93.00	7.63(2.84)	1.47	8.17(2.94)	1.63	96797	3.24	7.75
	S2	1.13	4.52	4.51	93.33	7.13(2.75)	1.33	7.77(2.87)	1.53	96797	3.66	8.17
	S3	1.29	5.31	4.51	93.33	5.53(2.45)	0.97	7.07(2.75)	3.13	96797	4.18	8.69
M3- Aerobic rice	S1	0.93	3.63	4.09	93.00	8.80(3.05)	1.70	8.63(3.02)	1.70	96437	3.02	7.11
	S2	1.12	4.47	4.09	89.67	6.00(2.55)	1.13	8.27(2.96)	1.63	96437	3.63	7.72
	S3	1.23	5.03	4.09	93.00	6.00(2.53)	1.07	7.50(2.83)	1.40	96437	3.99	8.08
Mean of main plots												
M1		1.17	4.68	4.89	92.89	5.86(2.51)	1.09	7.04(2.75)	1.40	109937	3.79	8.68
M2		1.14	4.57	4.51	93.22	6.77(2.68)	1.26	7.67(2.86)	2.10	96797	3.70	8.21
M3		1.09	4.38	4.09	91.89	6.93(2.71)	1.30	8.13(2.94)	1.58	96437	3.53	7.62
C.D.(0.05)		NS	NS		NS	NS	NS	0.04	0.19	0		
C.V.(%)		4.65	4.67		1.90	12.57	29.60	1.68	13.55	0		
Mean of Sub plots												
S1		0.97	3.79	4.50	92.89	7.48(2.81)	1.44	7.98(2.91)	1.60	101057	3.15	7.64
S2		1.13	4.52	4.50	92.00	6.28(2.59)	1.18	7.69(2.86)	1.52	101057	3.66	8.16
S3		1.30	5.32	4.50	93.11	5.80(2.49)	1.02	7.18(2.77)	1.96	101057	4.22	8.71
C.D.(0.05)		0.12	0.48		NS	NS	0.32	0.11	0.27	0		
C.V. (%)		10.36	10.37		2.07	10.75	25.32	3.60	15.55	0		
Interaction												
N at same V		NS	NS		NS	NS	NS	NS	0.47	0		
V at same N		NS	NS		NS	NS	NS	NS	0.40	0		
Expt. Mean		1.13	4.54	4.50	92.67	2.63	1.21	2.85	1.69	0	3.66	8.16
Variety		-										
Soil type		-										
RDF N:P:K (kg/ha)		-										
Aval. N:P:K of soil (kg/ha)		-										
System		Rice-Gram										

S1 - No residue *Gram MSP = Rs 56750/t *Rice MSP for Kharif 2018 = Rs. 17500/t

S2 - 15cm height of rice straw from ground

S3 - 30cm height of rice straw from ground

Table 4.4.1(R): Cntd….

Main plot	Sub plots	RAJENDRANAGAR-ARI										VADAGAON					Over all mean	Rank
		Grain Yield (t/ha)	Straw yield (t/ha)	Kharif Grain Yield (t/ha	Germination %	Weed population at 30 DAS (No/m2)	Weed Dry wt at 30 DAS (g/m2)	Weed population at 60 DAS (No/m2)	Weed Dry wt at 60 DAS (g/m2)	REY	K +R (REY)	Grain Yield (t/ha)	Kharif Grain Yield (t/ha	Germination %	REY	K +R (REY)		
M1- Transplanting	S1	4.02	6.90	5.67	92.00	49.33(6.92)	49.04	80.67(8.96)	53.11	3.91	9.58	0.90	4.89	97.00	2.92	7.81	1.97	1
	S2	2.48	7.29	5.67	89.33	50.00(6.68)	73.48	95.67(9.65)	94.56	2.41	8.08	1.03	5.61	98.00	3.34	8.95	1.09	5
	S3	2.84	7.29	5.67	87.33	41.67(6.27)	39.57	29.67(4.71)	25.82	2.76	8.43	1.06	5.72	97.33	3.44	9.16	1.22	2
M2- Wet seeding	S1	4.41	9.00	5.00	85.33	41.33(6.43)	26.78	73.33(8.00)	28.06	4.28	9.28	0.85	4.7	96.33	2.76	7.46	0.93	8
	S2	3.84	10.71	5.00	89.00	58.67(7.67)	64.46	68.33(7.75)	66.58	3.73	8.73	0.99	5.78	97.33	3.21	8.99	1.06	6
	S3	2.34	12.14	5.00	89.33	34.67(5.93)	47.14	55.67(6.31)	38.98	2.27	7.27	1.04	5.89	98.00	3.37	9.26	1.17	3
M3- Aerobic rice	S1	2.33	13.81	3.73	85.67	32.67(5.73)	385.76	59.33(7.00)	33.17	2.26	5.99	0.82	4.91	96.33	2.66	7.57	0.88	9
	S2	1.83	11.62	3.73	88.67	46.67(6.77)	31.92	24.67(4.26)	17.85	1.78	5.51	0.97	5.97	97.33	3.15	9.12	1.05	7
	S3	1.69	13.14	3.73	85.33	42.33(6.49)	32.96	66.67(6.33)	29.29	1.64	5.37	1.01	6.07	97.00	3.28	9.35	1.12	4
Mean of main plots											0.00							
M1		3.11	7.16	5.67	89.56	47.00(6.62)	54.03	68.67(7.77)	57.83	3.02	8.69	1.00	5.41	97.44	3.24	8.65	1.09	1
M2		3.53	10.62	5.00	87.89	44.89(6.67)	46.13	65.78(7.35)	44.54	3.43	8.43	0.96	5.45	97.22	3.11	8.56	1.05	2
M3		1.95	12.86	3.73	86.56	40.56(6.33)	150.21	50.22(5.87)	26.77	1.89	5.62	0.93	5.65	96.89	3.02	8.67	1.01	3
C.D.(0.05)		0.45	1.46		NS	NS	NS	NS	NS			0.00	0.16	NS				
C.V.(%)		18.64	17.03		6.18	34.98	239.09	33.63	79.87			0.10	2.85	0.63				
Mean of Sub plots																		
S1		3.59	9.90	3.79	87.67	41.11(6.36)	153.86	71.11(7.99)	38.11	3.49	7.28	0.86	4.83	96.56	2.79	7.62	0.92	3
S2		2.72	9.87	4.52	89.00	51.78(7.04)	56.62	62.89(7.22)	59.66	2.64	7.16	1.00	5.78	97.56	3.24	9.02	1.07	2
S3		2.29	10.86	5.32	87.33	39.56(6.23)	39.89	50.67(5.78)	31.36	2.22	7.54	1.04	5.89	97.44	3.37	9.26	1.17	1
C.D.(0.05)		0.92	NS		NS	NS	NS	NS	NS			0.03	0.19	NS				
C.V. (%)		31.27	22.24		3.41	17.62	240.14	61.45	82.62			2.57	3.93	1.41				
Interaction																		
N at same V		NS	NS		NS	NS	NS	NS	NS			NS	NS	NS				
V at same N		NS	NS		NS	NS	NS	NS	NS			NS	NS	NS				
Expt. Mean		2.86	10.21	4.54	88.00	6.54	83.46	7.00	43.05	2.78	7.32	0.96	**5.50**	97.19	3.11	8.61	1.05	
Variety		-										-						
Soil type		-										Clay loam						
pH		-										7.2						
RDF N:P:K (kg/ha)		-										-						
AvalN:P:K of soil (kg/ha)		-										152:15:210						
System		Rice-Maize										Rice-Gram						

S1 - No residue *Maize MSP = Rs 17000/t *Gram MSP = Rs 56750/t

S2 - 15cm height of rice straw from ground

S3 - 30cm height of rice straw from ground

Cropping Systems Influence on Pest Incidence (CSIP)

Rice based cropping system is the major crop production system being practiced by Indian farmers involving rotation with crops like other cereals, pulses, cotton and vegetables. Generally, normal transplanting method is followed in raising the rice crop. However, due to the constraints in water and labour availability, farmers have been forced to look into the alternative methods like direct seeding in wet and dry conditions, aerobic rice etc. Similarly, incorporation of crop residues is known to help *Rabi* crops in rice based cropping systems. As rice straw contains about 1-2% of Potassium, incorporation of rice straw acts as a good source of nutrients for crops grown after rice. Keeping these in view, a trial on cropping systems influence on pest incidence (CSIP) was initiated in collaboration with Agronomy section to evaluate the influence of different rice crop establishment methods under different residue management strategies with the main aim of realising the potential of the sequence crop to improve the overall productivity of the rice based cropping system.

During Kharif 2019, the trial was conducted at, Karjat and Jagdalpur. At both these locations, incidence of stem borer, leaf folder, whorl maggot and GLH was too low to draw valid conclusions.

The field trial was laid out in split plot design with three replications. Main plot treatments comprised of three different crop establishment methods (M1: Transplanting, M2: Wet seeding (line sowing under puddled conditions) and M3: Aerobic rice – Dry rice cultivation). The sub plot treatments comprised of three different Residue/straw management techniques (S1: No residue, S2: Incorporation of 15 cm height of rice straw from ground, S3: Incorporation of 30 cm height of rice straw from ground) to be superimposed for *Rabi* crops. During *Kharif* 2019, the trial was conducted at two locations, *viz*, Karjat, and Jagdalpur. Standard procedures were followed to record observations on insect pest incidence in all treatments The results are summarized below.

At **Karjat**, only stem borer was observed and incidence was low in all the three methods of crop establishment and residue management strategies. However, the incidence crossed ETL in M3 - aerobic rice (10.2% DH) and S1- No residue sub-plot (10.9% DH), at 60 DAT. The white ear incidence ranged from 8.1 to 10.8 across main plot and sub plot treatments. There were no significant differences among the treatments in pest incidence at both vegetative and reproductive stages.

At **Jagdalpur**, incidence of stem borer, leaf folder, whorl maggot and GLH was observed. Stem borer incidence at vegetative stage did not exceed 7.0% DH across the treatments, while leaf folder damage was also low ranging between 4.5 and 7.3% DL. Whorl maggot incidence was observed up to a maximum of 11.1% and GLH populations were recorded up to 12.7 hoppers/5 hills. Due to low pest incidence all the treatments were on par and no trends were discernible.

Table…. Influence of cropping systems on pest incidence at Karjat, *Kharif* 2019

Treatments		% DH				% WE
		15 DAT	30 DAT	45 DAT	60 DAT	90 DAT
M1= Transplanting	S1	8.0(2.8)a	8.3(2.8)a	10.3(3.2)a	14.2(3.8)a	14.1(3.7)a
	S2	6.2(2.5)a	6.4(2.5)a	7.7(2.7)a	7.8(2.8)a	8.0(2.8)b
	S3	4.5(2.1)a	5.3(2.2)a	6.8(2.6)a	7.3(2.7)a	7.0(2.7)b
M2 = Wet seeding	S1	5.9(2.4)a	6.1(2.4)a	6.8(2.6)a	8.6(2.9)a	8.7(2.9)ab
	S2	5.6(2.3)a	5.9(2.3)a	6.5(2.5)a	8.7(2.9)a	8.6(2.9)ab
	S3	2.4(1.5)a	4.5(2.1)a	5.2(2.3)a	7.6(2.8)a	7.3(2.7)b
M3 = Aerobic rice	S1	5.4(2.3)a	4.4(2.1)a	5.8(2.4)a	9.9(3.1)a	9.6(3.1)ab
	S2	5.8(2.4)a	5.6(2.3)a	6.1(2.5)a	10.1(3.2)a	10.5(3.2)ab
	S3	5.4(2.3)a	4.2(2.0)a	6.7(2.6)a	10.5(3.2)a	10.1(3.2)ab
LSD (0.05)	**M in S**	**1.23**	**1.58**	**1.00**	**1.00**	**0.87**
	S in M	**1.27**	**1.84**	**1.42**	**1.13**	**0.97**
Main plots						
M1= Transplanting		6.2(2.5)a	6.6(2.5)a	8.3(2.8)a	9.8(3.1)a	9.7(3.1)a
M2 = Wet seeding		4.6(2.1)a	5.5(2.3)a	6.2(2.5)a	8.3(2.9)a	8.2(2.8)a
M3 = Aerobic rice		5.5(2.3)a	4.7(2.1)a	6.2(2.5)a	10.2(3.2)a	10.1(3.2)a
LSD (0.05)		**0.54**	**0.90**	**0.79**	**0.54**	**0.46**
CV (%)		**13.97**	**23.14**	**18.15**	**10.56**	**8.96**
Sub plots						
S1 = No residue		6.4(2.5)a	6.2(2.4)a	7.6(2.7)a	10.9(3.3)a	10.8(3.2)a
S2 = 15 cm ht. of rice straw		5.9(2.4)a	5.9(2.4)a	6.8(2.6)a	8.9(2.9)a	9.0(3.0)a
S3 = 30 cm ht of rice straw		4.1(2.0)a	4.6(2.1)a	6.2(2.5)a	8.5(2.9)a	8.1(2.8)a
LSD (0.05)		**0.51**	**0.66**	**0.42**	**0.41**	**0.36**
CV (%)		**17.67**	**22.53**	**12.72**	**10.81**	**9.44**

Table…. Influence of cropping systems on pest incidence at Jagdalpur, *Kharif* 2019

Treatments		% DH	% LFDL		% WMDL		GLH (N0./10 hills)
		70 DAT	50 DAT	70 DAT	50 DAT	70 DAT	70 DAT
M1= Transplanting	S1	4.5(2.2)a	7.1(2.7)a	5.9(2.5)a	6.7(2.7)b	4.5(2.2)a	7.0(2.3)ab
	S2	4.5(2.1)a	7.0(2.7)a	2.6(1.7)b	6.6(2.6)b	4.6(2.2)a	10.3(3.0)a
	S3	1.5(1.1)a	7.2(2.8)a	5.1(2.4)a	7.3(2.7)b	6.0(2.5)a	12.7(3.7)a
M2 = Puddled direct seeding	S1	3.6(1.8)a	5.6(2.4)a	4.6(2.2)ab	9.8(3.2)a	6.5(2.5)a	7.7(2.7)ab
	S2	7.6(2.5)a	5.3(2.4)a	7.2(2.8)a	8.3(3.0)a	8.6(3.0)a	7.3(2.7)ab
	S3	2.0(1.3)a	9.0(3.1)a	6.3(2.6)a	10.4(3.3)a	5.8(2.5)a	5.7(2.3)ab
M3 = Unpuddled dry direct seeding	S1	5.1(1.8)a	4.1(2.1)a	5.0(2.3)ab	11.2(3.4)a	5.1(2.4)a	1.7(1.3)b
	S2	8.9(2.9)a	7.5(2.8)a	5.6(2.5)a	9.9(3.2)a	8.5(2.9)a	9.3(3.0)ab
	S3	2.7(1.8)a	5.6(2.4)a	5.6(2.5)a	12.2(3.6)a	8.4(2.9)a	7.3(2.7)ab
LSD (0.05)	**M in S**	**1.95**	**1.01**	**0.64**	**0.34**	**1.25**	**1.76**
	S in M	**1.93**	**1.02**	**0.65**	**0.59**	**1.13**	**1.64**
Main plots							
M1= Transplanting		3.5(1.9)a	7.1(2.7)a	4.5(2.2)a	6.9(2.7)b	5.1(2.3)a	10.0(3.0)a
M2 = Puddled direct seeding		4.4(1.9)a	6.6(2.6)a	6.0(2.5)a	9.5(3.2)ab	6.9(2.6)a	6.9(2.6)a
M3 = Unpuddled dry direct seeding		5.6(2.2)a	5.8(2.4)a	5.4(2.4)a	11.1(3.4)a	7.3(2.7)a	6.1(2.3)a
LSD (0.05)		**1.12**	**0.61**	**0.38**	**0.52**	**0.50**	**0.80**
CV (%)		**23.25**	**18.00**	**12.25**	**12.93**	**14.73**	**23.14**
Sub plots							
S1 = No residue		4.4(1.9)a	5.6(2.4)a	5.2(2.3)a	9.3(3.1)ab	5.4(2.4)a	5.4(2.1)a
S2 = 15 cm ht. of rice straw		7.0(2.5)a	6.6(2.6)a	5.2(2.3)a	8.3(2.9)b	7.2(2.7)a	9.0(2.9)a
S3 = 30 cm ht of rice straw		2.1(1.4)a	7.3(2.8)a	5.7(2.5)a	10.0(3.2)a	6.7(2.6)a	8.6(2.9)a
LSD (0.05)		**1.12**	**0.58**	**0.37**	**0.19**	**0.72**	**1.02**
CV (%)		**25.40**	**21.87**	**15.25**	**6.13**	**27.32**	**37.67**

4.4.2 (Rabi CA/SM 2) Enhancing productivity of rice-pulse system under different crop establishment methods

Among the various cropping systems being practiced in India, Rice based cropping systems is considered to be the most important because of its large area coverage and contribution to total food grain production.

On an average, 30% of area under rice production during *kharif s*eason in India remains fallow in the subsequent *rabi* due to number of biotic, abiotic and socio-economic constraints. A large area (11.6 m ha) of rice fallow under rain-fed condition can be brought under pulse provided availability of land water resources.

Pulses are the ideal crops that can be grown in the areas vacated after rice, because of their property to establish with the surface seeding and suitability for relay/para cropping and resistance against soil moisture and temperature stress. The suitable pulse crops are lentil, lathyrus, urd bean, mung bean and chick pea.

Transplanting is the most dominant and traditional method of establishment in irrigated lowland rice. However, due to non-availability of irrigation water, shortage of labour during peak period of transplanting and escalating labour costs make the transplanting technique more expensive which invariably leads to delay in transplanting and resulting in reduction of yield. To mitigate this problem, alternate methods need to be evolved to substitute manual transplanting method under various agro-ecologies. Hence, this trial was initiated with a view to evaluate systems of rice crop establishment under different cropping systems (especially rice-pulse) to realize the production potential of alternate systems (inclusion of pulses) of crop establishment under different sequences.

This trial was initiated with a view to evaluate system productivity of rice crop establishment under rice-pulse systems to realize the production potential of alternate systems of crop establishment at one location viz. **Mandya**. The results revealed that higher average higher system productivity (11.06 t/ha) was recorded under rice-cowpea system at **Mandya**. Wet seeding was comparable at this location. Rice-pulse system increases grain yield significantly over rice-rice system at both the method of cultivation.

Among the cropping sequences, rice-cowpea exhibited significant differences with respect to grain yield (REY) at **Mandya** (10.65 t/ha) during 2018-19. *Post-kharif* pulse increased grain yield significantly over rice-rice system. Among method of establishment, wet seeding method found promising at and comparable with transplanting at Mandya and rice-cowpea systems (10.65 t/ha) increased grain yield significantly over rice-rice system alone (7.65 t/ha).

Table-4.4.2: (Rabi) Summary of data on grain yield characters of rice from enhancing productivity of rice-pulse system under different establishment methods in during Rabi 2018-19

Treatment	Croping Sequence	MANDYA					
		Grain yield (t/ha) Kharif 2018	Grain yield (t/ha) Rabi 2018-19	Germination % (R)	Plant population No.m2	REY	Total REY (K+ R)
M1- Transplanting	S1 - Rice-Cowpea	5.60	1.08	93	20.7	4.64	10.24
	S2 - Rice-Greengram	6.15	0.89	97	31.7	3.55	9.70
	S3 - Rice-Black gram	6.33	0.83	100	32.0	2.66	8.99
	S4 - Rice-Soybean	6.40	0.84	90	32.0	1.63	8.03
	S5 - Rice-Avare	5.52	0.73	94	14.3	1.93	7.45
M2- Wet Seeding (line sowing under puddled condition	S1 - Rice-Cowpea	6.38	1.09	90	20.0	4.68	11.06
	S2 - Rice-Greengram	5.99	0.88	93	31.3	3.51	9.50
	S3 - Rice-Black gram	5.56	0.87	90	29.7	2.78	8.34
	S4 - Rice-Soybean	6.04	0.97	90	29.0	1.88	7.92
	S5 - Rice-Avare	5.80	0.78	100	14.7	2.06	7.86
Interaction							
M and S		NS	NS	NS	NS	-	
S and M		NS	NS	NS	NS	-	
Mean of Factor-1							
M1		6.00	0.87	95	26.1	2.88	8.88
M2		5.95	0.92	93	24.9	2.98	8.94
C.D. (0.05)		NS	NS	NS	NS	-	
C.V. (%)		36.72	29.51	14.05	6.55	-	
Mean of Factor-2							
S1		5.99	1.09	92	20.3	4.66	10.65
S2		6.07	0.89	95	31.5	3.53	9.60
S3		5.94	0.85	95	30.8	2.72	8.67
S4		6.22	0.90	90	30.5	1.76	7.98
S5		5.66	0.76	97	14.5	1.99	7.65
CD (0.05)		NS	NS	NS	2.57	-	-
C.V. (%)		7.38	26.78	6.47	8.22	-	-
Experimental Mean		5.98	0.90	94	25.5	**2.93**	**8.91**
Soil type		Red sandy loam					
Applied fertiliser dose (N-P-K-Zn kg/ha)		100:50:50:20	25:50:25				
pH		6.95					
Available soil nutrient status		107:30:216					
Variety		MTU 1001					

S1	Rice: IR-64 (MSP = Rs. 1750/Q)	Cowpea:PGCP 6 (MSP Rs.7511/Q)
S2		Green gram: KKM-3 (MSP Rs.6975/Q)
S3		Black gram: KU-14-8 (MSP Rs.5600/Q)
S4		Soybean: J-5-335 (MSP Rs.3399/Q)
S5		Avare: HA-4 (MSP Rs.4620)

4.4.3. Evaluation of promising cultivars for late plantingand management for higher productivity and mitigate the effect climate change

Late planting of rice is becoming very common due to number of reasons such as weather, late on set of monsoon, machinery breakdown, water availability. There is a yield reduction due to delay in planting. Late planting also delay harvest, reduces the turn around time for second crop. There is a need to find out superior cultivars adopted to late planting and to minimize the loss in productivity of rice with suitable management practices.

The trial to evaluate promising cultivars for late planting at **Aduthurai**, **Mandya** and two fertilizer doses application in late planting situation at **Gangavathi** was conducted during this season (Date of sowing is 04.09.2019)**..**

The trial on late planting at **Aduthurai** was conducted during kharif 2019 with Five cultivars viz., AD 16019, AD 17036, AD 17037, AD 17130 and ADT 53 were evaluated at 100% and 125% RDF at Normal and late sown (i.e., 30 days after normal sowing),Fifteen cultivars (IR-64, MTU 1010, Rasi, CTH-1, CTH-3, KMP-175, RNR-15048, Co-51, CR Dhan 201, Samalashwari, NLR-40024, NLR-34449, US 314 (HC), Indira Barani Dhan-1 and DRR Dhan-42) at three dates of sowing (M1-Normal 01.09.209, M2- 15 days late 15.09.2019 and M3- 30 days late 31.09.2019) were tested at **Mandya**. Two fertilizer combinations i.e., 100% NPK (150:75:75) and 125% NPK (187.5:93.75:93.75) were tested with eleven cultivars (MTU-1010, IR-64, CRDHAN-201, Indiraero-1, Co-51, PR-124, RNR-15048, Anjali, NLR-40024, GVT-05-01 and GNV-10-89) at **Gangavathi**.

The results of the trial indicate that planting on 11.08.2019 gave significantly higher grain yield (4.78 t/ha) over normal planting (4.28 t/ha) at **Aduthurai**. Application of 125% RDF gave significantly higher grain yield (4.76 t/ha) over 100% RDF. Among the cultures tested AD 17037 (5.48 t/ha) followed by ADT 53 (5.44 t/ha) found promising over other cultivars. Hence, AD 17037 and ADT 53 can be recommended under late planting situation. and transplanting can be delayed up to 11.08.2019 at this location.

At **Mandya**, three dates of sowing 1, 15 and 30th September was tested with 15 cultivars viz., IR-64, MTU 1010, Rasi, CTH-1, CTH-3, KMP-175, RNR-15048, Co-51, CR Dhan 201, Samalashwari, NLR-40024, NLR-34449, US 314 (HC), Indira Barani Dhan-1 and DRR Dhan-42. The results indicate that, the delay in transplanting from normal (01.09.2019) decreased grain yield significantly by 16% and 53% due to 15 days (15.09.2019) and 30 days (31.09.2019) respectively from normal date of sowing. Mean over the dates of sowing, cultivar KMP 175 (4.12 t/ha) followed by Samleshwari (3.69 t/ha), CR Dhan 201 and CO-51 (3.59 t/ha) and CTH-3 (3.48 t/ha) were promising and can be recommended for late planting.

At **Gangavathi**, under late planting situation (4th September 2019), application of higher dose of NPK (125% of NPK) did not influence the grain yield of cultivars. The top most cultivars were Indiraero-1 (8.29 t/ha) > MTU 1010 (7.69 t/ha) > CO-51 (7.61 t/ha) > IR 64 (7.44 t/ha) and GNV-1089 (7.36 t/ha) which can be recommended for late planting due to better grain yield.

The results indicated that, AD 17037, ADT 53 at **Aduthurai**, Indiraero-1, MTU 1010, Co-51, IR 64, GNV-1089 at **Gangavathi** and KMP 175, Samleshwari, CR Dhan 201, Co-51 and CTH-3 at **Mandya** were found promising with better yields.

Table 4.4.3. (RCT-3) - Evaluation of promising cultivars for late planting and managementfor higher productivity & mitigate the effect of climate change, Kharif-2019.

ADUTHURAI

Main plot: Crop Establishing methods	Sub plot: Fertilizer treatments	Cultures	Grain yield (t/ha)	No tillers/m2	No of panciles/m2	Test wt (g)	Grains/panicles
M1: Normal Sowing	S1 - 20 x 15 100 % RDF	V1- AD 16019	2.87	275	257	18.67	152
	S1 - 20 x 15 100 % RDF	V2- AD 17036	3.47	304	291	17.37	127
	S1 - 20 x 15 100 % RDF	V3- AD 17037	5.14	326	310	16.77	153
	S1 - 20 x 15 100 % RDF	V4- AD 17130	3.75	314	304	16.67	149
	S1 - 20 x 15 100 % RDF	V5- ADT 53	4.89	344	330	17.50	180
	S3 - 20 x 15 125 % RDF	V1- AD 16019	3.42	291	278	18.93	164
	S3 - 20 x 15 125 % RDF	V2- AD 17036	4.09	319	303	17.77	141
	S3 - 20 x 15 125 % RDF	V3- AD 17037	5.39	343	329	17.33	172
	S3 - 20 x 15 125 % RDF	V4- AD 17130	4.21	333	316	17.10	164
	S3 - 20 x 15 125 % RDF	V5- ADT 53	5.56	363	343	17.77	191
M2: Late Sowing (30 days after normal)	S1 - 20 x 15 100 % RDF	V1- AD 16019	3.30	284	269	18.50	166
	S1 - 20 x 15 100 % RDF	V2- AD 17036	4.17	334	316	17.50	132
	S1 - 20 x 15 100 % RDF	V3- AD 17037	5.53	341	327	16.97	175
	S1 - 20 x 15 100 % RDF	V4- AD 17130	4.35	334	321	16.67	158
	S1 - 20 x 15 100 % RDF	V5- ADT 53	5.48	359	347	17.67	181
	S3 - 20 x 15 125 % RDF	V1- AD 16019	3.83	312	303	19.33	159
	S3 - 20 x 15 125 % RDF	V2- AD 17036	4.77	349	339	17.97	151
	S3 - 20 x 15 125 % RDF	V3- AD 17037	5.85	354	340	17.37	124
	S3 - 20 x 15 125 % RDF	V4- AD 17130	4.66	353	341	17.27	169
	S3 - 20 x 15 125 % RDF	V5- ADT 53	5.83	374	359	17.93	190
Mean of main plot							
M1			4.28	321	306	17.59	159
M2			4.78	339	326	17.72	160
C.D.			0.284	18.192	15.337	N/A	N/A
SE(m)			0.046	2.949	2.486	0.045	3.761
Mean of sub plot							
S1			4.30	321	307	17.43	157
S3			4.76	339	325	17.88	163
C.D.			0.131	4.003	4.419	0.158	N/A
SE(m)			0.033	1.025	1.132	0.041	3.982
Mean of sub-sub plot							
V1- AD 16019			3.36	291	277	18.86	160
V2- AD 17036			4.13	327	312	17.65	138
V3- AD 17037			5.48	341	326	17.11	156
V4- AD 17130			4.24	333	320	16.93	160
V5- ADT 53			5.44	360	345	17.72	185
C.D.			0.208	5.556	5.496	0.144	17.225
SE(m)			0.072	1.928	1.907	0.05	5.978
Interactiona							
C.D.			N/A	N/A	N/A	N/A	N/A
SE(m)			0.144	3.856	3.815	0.1	11.956
Experimental mean			4.53	330	316	17.65	160

S1: Optimum feriliser dose with Normal spacing (20x15cm)

S2: Optimum feriliser dose with Closed spacing (15x10cm)

S3: Higher feriliser dose (125% of Recommended) with Normal spacing (20x15cm)

S4: Higher feriliser dose (125% of Recommended) with Closed spacing (15x10cm)

Table 4.4.3. Contd….

Gangavathi (Normal sowing time)

Main plot: Fertilizer treatments	Sub plot: Cultivars	Grain yield (t/ha)	No of panciles/m2	Panicle wt (g)	Grains/panicle	Test wt (g)	Days for 50% flowering
M1:100%NPK(150:75:75)	V1:MTU-1010	7.84	484	2.11	75	25.52	87
	V2:IR-64	7.47	481	2.22	72	28.28	88
	V3:CRDHAN-201	6.57	419	2.50	93	23.46	89
	V4:Indiraero-1	8.80	301	3.87	169	20.72	88
	V5:Co-51	7.39	468	2.76	135	18.62	87
	V6:PR-124	6.14	469	3.06	99	27.57	90
	V7:RNR-15048	6.25	400	2.72	188	13.19	87
	V8:Anjali	5.72	350	2.53	89	26.32	79
	V9:NLR-40024	6.11	654	1.74	81	18.69	91
	V10:GVT-05-01	5.74	411	2.41	129	15.27	97
	V11:GNV-10-89	7.81	423	3.49	174	17.49	88
M2: 125%NPK (187.5:93.75:93.75)	V1:MTU-1010	7.55	464	2.49	90	25.21	87
	V2:IR-64	7.41	473	2.20	75	27.00	88
	V3:CRDHAN-201	6.29	430	2.18	82	23.38	88
	V4:Indiraero-1	7.79	324	3.55	158	20.42	88
	V5:Co-51	7.82	463	2.54	129	18.06	87
	V6:PR-124	6.91	521	2.66	85	27.88	91
	V7:RNR-15048	7.33	370	2.87	206	12.50	87
	V8:Anjali	5.69	349	2.54	90	27.65	79
	V9:NLR-40024	6.07	628	1.84	86	18.95	91
	V10:GVT-05-01	7.21	369	2.93	159	15.40	97
	V11:GNV-10-89	6.90	456	2.87	143	17.14	88
Mean of Factor-1							
M1		6.89	442	2.67	118	21.38	88
M2		7.00	441	2.61	119	21.23	88
CD(0.05)		NS	NS	NS	NS	NS	NS
CV(%)		8.30	4.60	15.07	18.59	1.77	1.12
Mean of Factor-2							
V1:MTU-1010		7.69	474	2.30	82	25.37	87
V2:IR-64		7.44	477	2.21	73	27.64	88
V3:CRDHAN-201		6.43	425	2.34	88	23.42	89
V4:Indiraero-1		8.29	313	3.71	164	20.57	88
V5:Co-51		7.61	466	2.65	132	18.34	87
V6:PR-124		6.53	495	2.86	92	27.73	90
V7:RNR-15048		6.79	385	2.79	197	12.84	87
V8:Anjali		5.70	350	2.54	90	26.98	79
V9:NLR-40024		6.09	641	1.79	84	18.82	91
V10:GVT-05-01		6.48	390	2.67	144	15.33	97
V11:GNV-10-89		7.36	439	3.18	159	17.31	88
CD(0.05)		0.37	26.39	0.29	10.19	0.68	0.96
CV(%)		4.56	5.13	9.37	7.37	2.74	0.93
Interaction							
M and T		0.52	NS	0.41	14.42	NS	NS
T and M		0.69	NS	0.51	22.71	NS	NS
Experimental Mean		**6.95**	**441**	**2.64**	**119**	**21.31**	**88**

Table 4.4.3. Contd….

MANDYA

Main plot: Fertilizer treatments	Sub plot: Cultivars	Grain yield (t/ha)	No of panciles/ m2	Panicle wt (g)	Test wt (g)	spikelet sterility %	Grains/panicle	Days for 50% flowering
M1: Normal Sowing	IR-64	3.62	322	2.78	27.57	9.89	96	91
	MTU 1010	3.78	332	3.39	24.28	11.91	131	90
	Rasi	4.40	354	3.53	24.27	7.20	137	91
	CTH-1	3.42	221	5.09	29.67	14.74	187	93
	CTH-3	4.33	380	2.77	20.64	18.53	125	94
	KMP-175	5.08	303	5.07	22.41	12.61	215	93
	RNR-15048	3.82	382	3.45	13.52	10.50	243	91
	Co-51	4.87	401	3.33	20.02	10.43	153	90
	CR Dhan 201	4.42	364	3.15	25.19	13.58	118	91
	Samalashwari	4.34	272	4.76	21.79	7.59	204	94
	NLR-40024	3.29	310	4.69	25.08	11.30	177	93
	NLR-34449	4.79	388	3.29	16.20	10.00	190	100
	US 314 (HC)	4.14	343	4.99	22.99	10.13	207	84
	Indira Barani Dhan-1	3.56	330	3.43	22.97	14.70	141	80
	DRR Dhan-42	4.06	322	4.12	26.23	20.21	143	96
M2: Late Sowing (15 days after normal)	IR-64	2.97	261	2.72	27.03	14.35	94	90
	MTU 1010	3.58	273	3.19	24.03	15.73	124	91
	Rasi	3.64	256	2.59	28.27	15.88	83	91
	CTH-1	3.93	228	3.59	27.36	19.20	126	93
	CTH-3	3.93	279	2.55	21.52	27.01	110	93
	KMP-175	4.47	231	4.76	23.09	13.83	194	92
	RNR-15048	2.77	256	2.99	15.26	13.67	182	91
	Co-51	3.80	233	2.81	18.72	12.24	138	90
	CR Dhan 201	4.15	259	3.09	27.57	23.54	105	90
	Samalashwari	4.73	249	4.32	24.31	16.32	166	92
	NLR-40024	2.54	232	4.32	26.96	25.15	149	93
	NLR-34449	3.00	303	2.64	16.79	20.50	146	100
	US 314 (HC)	3.34	243	3.89	24.78	18.63	149	84
	Indira Barani Dhan-1	2.29	248	3.19	23.75	22.08	128	81
	DRR Dhan-42	2.83	243	3.97	29.02	27.52	127	96
M3: Late sowing of 30 days after normal	IR-64	1.88	210	2.24	25.94	20.72	79	98
	MTU 1010	1.54	206	2.16	25.36	22.55	76	96
	Rasi	2.22	231	2.73	24.84	17.17	100	93
	CTH-1	2.07	199	3.78	26.34	18.09	126	95
	CTH-3	2.19	221	1.95	19.21	29.88	92	91
	KMP-175	2.79	214	4.02	22.35	18.55	165	91
	RNR-15048	2.06	211	2.43	14.11	26.57	154	91
	Co-51	2.10	233	2.71	18.80	26.42	120	91
	CR Dhan 201	2.21	220	2.30	24.86	29.12	81	92
	Samalashwari	2.00	200	3.25	23.95	23.67	123	95
	NLR-40024	1.59	200	3.59	26.84	23.97	120	92
	NLR-34449	1.98	236	2.42	17.21	28.60	124	102
	US 314 (HC)	1.48	202	2.89	23.23	29.27	115	92
	Indira Barani Dhan-1	1.68	195	2.53	25.24	46.50	87	92
	DRR Dhan-42	1.49	184	2.72	27.81	33.45	89	102

Table 4.4.3. Contd….

Main plot: Fertilizer treatments	Sub plot: Cultivars	Grain yield (t/ha)	No of panciles/m2	Panicle wt (g)	Test wt (g)	spikelet sterility %	Grains/panicle	Days for 50% flowering
Mean of Factor-1								
M1		4.13	335.04	3.86	22.85	12.22	164	91.24
M2		3.47	252.98	3.37	23.90	19.04	135	91.18
M3		1.95	210.82	2.78	23.07	26.30	110	94.02
CD(0.05)		0.35	19.39	0.19	NS	2.56	8.81	0.24
CV(%)		29.12	19.45	15.39	7.34	35.68	17.25	0.70
Mean of Factor-2								
V1	IR-64	2.82	264	2.58	26.85	14.99	90	93
V2	MTU 1010	2.97	271	2.91	24.55	16.73	110	92
V3	Rasi	3.42	280	2.95	25.79	13.42	107	92
V4	CTH-1	3.14	216	4.15	27.79	17.35	146	93
V5	CTH-3	3.48	293	2.42	20.45	25.14	109	93
V6	KMP-175	4.12	249	4.62	22.62	15.00	191	92
V7	RNR-15048	2.88	283	2.96	14.29	16.92	193	91
V8	Co-51	3.59	289	2.95	19.18	16.36	137	90
V9	CR Dhan 201	3.59	281	2.85	25.87	22.08	101	91
V10	Samalashwari	3.69	241	4.11	23.35	15.86	164	94
V11	NLR-40024	2.47	248	4.20	26.29	20.14	149	92
V12	NLR-34449	3.25	309	2.78	16.73	19.70	154	101
V13	US 314 (HC)	2.99	263	3.92	23.67	19.34	157	87
V14	Indira Barani Dhan-1	2.51	258	3.05	23.99	27.76	119	84
V15	DRR Dhan-42	2.79	250	3.60	27.69	27.06	120	98
CD(0.05)		0.56	32.55	0.47	1.49	3.09	17.23	0.67
CV(%)		18.91	13.10	15.03	6.88	17.26	13.53	0.78
Interaction								
M and T		NS	NS	NS	NS	5.36	NS	1.16
T and M		NS	NS	NS	NS	5.42	NS	1.13
Experimental Mean		3.18	266	3.34	23.27	19.19	136	92

4.4.4 . Assessing the performance and yielding ability of *kharif* sorghum hybrids in Rice-Sorghum sequence cropping system

In rice-fallows, sorghum cultivation was found to be high yield potential with labour and inputs intensive crop system. It is found that use of high inputs viz., pesticides, weedicides, fertilizers, labourers, and skillful management of all the innovative practices including irrigations, were resulted into the high yield. It is implied that the farmers were highly profit oriented and obtained high returns from the sorghum cultivation. Their profit margin could be further increased by mechanization and introducing standard package of practices. Keeping the yield benefits in view, the farmers innovative knowledge should be validated on their fields to develop standardize location-specific production technologies so that the productivity and soil health will sustain in long run. These innovative farmers would be able to educate and transfer the viable technologies more effectively among the other sorghum growers in rice-fallows as change agent. Further very efficient genotypes had been developed which are very much suitable for rice fallows. There is need to test in them in rice fallows of different locations to gain the benefit of the Rice sorghum cropping system.

A trial was laid out with four replications during *Kharif* 2019 at three locations continued at **Chinsurah, Mandya and Ragolu** to assess the effect of different crop establishment methods (M_1: Transplanting, M_2: Wet seeding (line sowing under puddled conditions) and M3: Dry DSR – Dry rice cultivation method). The sub plot treatments comprised of different promising cultures viz., IIMRH 2, IIMRH 3, IIMRH 4, IIMRH 5, IIMRH 6, CSH16 (C), CSH 25 (C), CSH 30 (C) and CSH 41 (C) will be tested under split plot design during *rabi* season. The results are summarized and presented in Table 4.4.3.

Crop establishment methods did not influence the grain yield significantly at all locations. The grain yield ranged from 2.56 t/ha to 6.80 t/ha at **Chinsurah** and **Mandya** during *kharif* 2019.

Among crop establishment methods, transplanting gave comparable yields with wet DSR method at **Chinsurah**, **Mandya** and **Ragolu**. However, the effect of promising cultivars of sorghum in the rice fallows need to be assessed during rabi (2019-20) season. Grain yield data of sorghum did not receive to assess the effect cultures in rice fallows.

Table- 4.4.4: Assessing the performance and yielding ability of kharif sorghum hybrids in Rice-Sorghum sequence cropping system, Kharif-2019

Treatments	CHINSURAH			MANDYA							RAGOLU						Over all mean	Rank
	Grain Yield (t/ha)	Panicle No./m²	Panicle wt (g)	Grain Yield (t/ha)	Panicle No./m²	Panicle wt (g)	Panicle length (cm)	filled grains/ panicle	Test wt (g)	Days for 50% flowering	Grain Yield (t/ha)	Panicle No./m²	Panicle wt (g)	Panicle length (cm)	filled grains/ panicle	Test wt (g)		
T1	2.53	204	2.48	6.74	348	3.68	23.79	161	26.22	96	5.11	298.6	3.26	22.57	111.6	23.82	4.79	1
T2	2.59	227	2.54	6.86	354	3.29	23.54	162	26.72	93	4.24	272.8	2.63	21.22	85	22.9	4.56	2
T3																		
Expt. Mean	2.56	215	2.51	6.80	351	3.49	23.66	162	26.47	94	4.68	285.7	2.95	21.89	98.3	23.36	4.68	
CD(0.05)	0.21	28.39	0.11	1.03	16.93	0.23	0.23	0.85	0.63	0.44	0.66	14.15	0.43	0.4	19.52	0.27		
CV(%)	7.16	11.74	3.96	13.53	4.29	5.91	0.88	0.47	2.12	0.41	12.54	4.41	12.92	1.61	17.68	1.01		
res(t)	NS	NS	NS	NS	NS	*	NS	NS	NS	**	NS	*	NS	**	NS	**		
Variety	Gobindabhog			MTU 1001							-							
Soil type	-			Red sandy loam							Red sandy loam							
pH	7.77			6.99							7.82							
Available NPK kg/ha	515:87:342			385:115:274							240:26:308							
Fertilizer applied kglha	50:25:25			100:50:50							120:60:50							

T1: Transplanting

T2: Wet DSR

T3: Dry DSR

Annexure - I

Major weeds observed during Kharif 2019

Grasses	Sedges	BLW
Brachiariaeruciformis	*Cyperusdiffformis*	*Alternantheraphiloxeroides*
Chloris barbata	*Cyperusesculentus*	*Aeschynomeneindica*
Cynodondactylon	*Cyperusiria*	*Ammaniabaccifera*
Dactyloctameumspp	*Cyperusrotundus*	*Celosia argentea*
Digitariasanguinalis	*Fimbristylislitoralis*	*Caesuliaaxilaris*
Echinochloacolona	*Fimbristylismiliacea*	*Commelinabenghalensis*
Echinochloacrusgalli		*Eclipta alba*
Eleusineindica		*Ludwigiaparviflora*
Ischaemumrugosum		*Marseliaquadrifolia*
Paspalumdilatatum		*Phyllanthusniruri*
Panicumdichotomiflorum		*Rotaladensiflor*
Panicumrepens		*Spilanthesacmela*
Setariaglauca		*Trianthemaportulacastrum*

Annexure - II

WEATHER DATA – KHARIF 2019

Please refer volume-I Plant Breading Progress Report for Weather data of Kharif-2019

Annexure - III

a. Details of herbicide manufacturers *Kharif* - 2019

S.No.	Name of the herbicides	Agro-Input-Agency
1	Bispyribac sodium 10% SC	PI Industries Ltd, Bayer Crop Science
2	Pretilachlor 50 %EC	Dhanuka, Nagarjunaagrichem Ltd, Crop chemicals India ltd, SWAL corporation India, Agro care , Paramount Pesticides Ltd.
3	Metsulfuronmethyl+chlorimuronehtyl-20%WP	DuPont India Ltd
4	Pyrazosulfuronethyl 10 WP	UPL

b. Details of product/material provided byprivate company/organization in *Rabi*- 2017-18 and *Kharif* - 2018

S.No.	Name of the product	Agro-Input-Agency
1	Iron coated seed	JFE Steel India Pvt. Ltd., 806, 8thFloor,Tower-B, Unitech Signature Towers,South City-I, NH-8, Gurgaon – 122001,Haryana, India
2	Thiobencarb 5 l/ha	India Pesticides Limited
3	Nutrient Expert®	Internationl Plant Nutrition Institute, Gurgaon, India

Annexure - IV

ABBREVIATIONS

ADT	Aduthurai	**MNC**	Moncompu
ALM	Almora (VPKAS)	**MND**	Mandya
ARD	Arundhutinagar	**MTU**	Maruteru
BNK	Bankura	**NGN**	Nagina
CBT	Coimbatore	**NLR**	Nellore
CHN	Chinsura	**NVS**	Navsari
CHP	Chiplima	**NWG**	Nawagam
CHT	Chatha	**PDG**	Phondaghat
CKD	Chakdha	**PNT**	Pantnagar
CNG	Canning (CSSRI)	**PNV**	Panvel
CTK	Cuttak (NRRI)	**POB**	Port Blair (CIARI)
FZB	Faizabad(Masodha)	**PSA**	Pusa
GER	Gerua (NRRI)	**PTB**	Pattambi
GGT	Ghaghraghat	**PTN**	Patna (Dhangain)
GNV	Gangavati	**PDC**	Puducherry
GRD	Giridih	**RCI**	Ranchi
HZB	Hazaribagh (NRRI)	**REW**	Rewa
JDP	Jagadalpur	**RGL**	Ragolu
KHD	Khudwani	**RNR**	Rajendranagar
KJT	Karjat	**RPR**	Raipur
KNP	Kanpur	**SBR**	Sabour
KRK	Karaikal	**TLJ**	Tuljapur
KRL	Karnal(CSSRI)	**TTB**	Titabar
KTA	Kota	**USG**	Upper Shillong
KUL	Kaul	**VDG**	Vadagaon
LCK	Lucknow	**VRN**	Varanasi
LDN	Ludhiana	**VTL**	Vytilla
MLN	Malan	**WBL**	Wangbal (Imphal)
MDZ	Medziphema		

Annexure - V

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SOIL SCIENCE

Progress Report of Soil Science Coordinated Program
(*Rabi* and *Kharif* 2019)

SOIL SCIENCE

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5. SOIL SCIENCE

Summary

The coordinated program in soil science addressed the issues related to sustaining productivity of soil and crop systems on long-term basis, soil quality and productivity assessment for bridging the gap in farmers' fields, germplasm screening in sodic and acid soils and their management, testing/validation of computer based nutrient management tool, Nutrient Expert, developed by IPNI for site specific nutrient management in farmers' fields, residue management in rice based cropping systems, identification of genotypes having high nitrogen use efficiency and collaborative trials with Agronomy and Entomology in nutrient management and bio intensive pest management under organic farming. A total of 8 trials were conducted during *rabi* 2018-19 and *kharif* 2019 in 18 locations (funded as well as voluntary centres and at IIRR) representing typical soil and crop systems and important rice growing regions.

5.1. Long-term soil fertility management in rice-based cropping systems

In the 31st year of study on long term soil fertility management in RBCS, the treatments RDF+ FYM and RDF were at par and significantly superior to other treatments in both seasons at MTU and in *kharif* at TTB. Whereas, RDF+FYM was superior to all other treatments at MND during *kharif* and at TTB during *rabi*. FYM alone treatment was on par to RDF in *kharif* at MND and in both seasons at TTB. Nutrient omission and reduction to 50% resulted in yield reduction at all three centres in both seasons. At the end of *kharif* 2019, there was an improvement in important soil properties with INM and organics and with a significant reduction of NPK values in omission plots compared to RDF plots at all three locations. Supplementary use of organics recorded highest number of microbial populations as well as enzymatic activities. Additional dose of FYM @5t/ha along with RDF improved the productivity growth rate substantially at all three locations.

5. 2. Soil quality and productivity assessment for bridging the yield gaps in farmers' Fields

This trial in the form of a survey was conducted in farmers' fields around few selected centres – Chinsurah, Titabar, Karaikal and Pantnagar) representing Indo gangetic plains and the plateau region collected from farmer fields in *Kharif* 2019 to assess the variability in nutrient supply, its relationship with rice yields at farmers' fertilizer practices in some new farm sites. The *kharif* 2019 data received representing the irrigated and shallow lowland rice ecosystems revealed wide variations. Soil nutrient uptake varied between the sites matching with the grain yields. Sharp variations in grain yields recorded varied from 2.39 t /ha among low yielders to 5.0 t /ha among high yielders at Chinsurah, from 3.59 t /ha among low yielders to 4.67 t /ha among high yielders at Karaikal, varied from 2.63 t /ha among low yielders to 4.87 t /ha among high yielders at Titabar, 5.7 t/ha among high yielders at Pantnagar. Soil Parameters data were pooled

in different categories and the resulting soil quality index generated showed variations in the quality and health of the soil across different farmers categories.

5.3 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS

The trial on gypsum application in conjunction with NPK fertilization improved rice yields at Kanpur. The genotypes SRL-3, SRL-2, RMS-1, SRL-1 and MTP-1 produced the highest grain yields of 3.53 -3.76 t/ha, at Kanpur, under recommended NPK + 100% GR fertilization. Under native sodic conditions without gypsum amendment, the yields were higher in the following genotypes viz., SRL-3 (2.81 kg/ha), SRL-2 (2.7 kg/ha), RMS-1 (2.7 kg/ha) and SRL-1 (2.67 kg/ha) and MTP-1 (2.62 kg/ha). In unamended native sodic soils of Faizabad, the genotypes that produced the highest yields were recorded in RMS -2, RMS -7, RMS -6, RMS -8 and SRL -1 (5.06-6.5 t/ha). The genotypes MTP-1, Varadhan, VR-181, KRH-4 and RMS-5 exhibited better tolerance to sodicity at Mandya compared to other genotypes as demonstrated by their significantly higher yields (6.59-7.42 t/ha) without gypsum amendment. In Pusa, the genotypes GPV 2, GPV 1, GPV 3 SRL 1 and CNN 2 demonstrated tolerance to sodicity with yields ranging from 3.45 t/ha-3.92 t/ha.

5.4 Screening of rice genotypes for tolerance to soil acidity

The genotypes which performed better with yields ranging from 2-2.43 t/ha in unlimed acid soils of Harizibagh were: PUP-221, SRL-3, PS-344, SRL-2 and MTP-1. At Moncompu, RMS 4, KRH 4, RMS 5, PS 344 and RMS 1 recorded comparitively higher yields in unlimed tereatment (9.48 t/ha, 8.28 t/ha, 7.68 t/ha, 7.63 t/ha and 7.62 t/ha respectively). The highest grain yields at Ranchi in the treatment without liming was observed in RMS-4, RMS-5, RMS-1, GPV-2 and GPV-1 (6.99 t/ha , 6.94 t/ha, 6.87 t/ha , 6.86 t/ha) and 6.23 t/ha respectively). At Titabar, the genotypes with high yields in the treatment without liming and with recommended NPK alone were PUP-221, Varadhan, RMS-1, MTP-1, and GPV-1 (3.87 t/ha - 4t/ha). A 12.48% and 19.11% increase in yields were observed at Ranchi and Titabar due to liming. The genotypes responsive to liming at Ranchi were RMS-, GPV-1, RMS-5, Varadhan and RMS-1 with yields in the range of 7.3- 7.67 t/ha, while the highest yields of 4.63, 4.5, 4.43, and 4.4 t/ha, respectively, were recorded in the genotypes KRH-4, Varadhan, RMS-8, GPV-3 and MTP-1due to liming in Titabar.

5.5 Yield maximization in farmers' fields using Nutrient Expert software

A multi-locational trial was conducted to study the response of rice crop to varied degrees of edaphic factors derived from farmers' practices (T1), recommended dosages of fertilisers (T2) and recommendations emanated from Nutrient Expert software (T3). Testing centers included Chinsurah, Faizabad, Karaikal, Khudwani, Mandya, Maruteru, Pantnagar, Puducherry and Purulia with varied number of test sites.The analysis indicated the effect of sites, treatments and their interactions obtained through two factor analysis. In majority of sites the impact of treatments was insignificant except in three locations (Faizabad, Purulia and Khudwani) in which T3 was superior than the otherwith reference to rice grain yield. In two centers (Faizabad and Chinsurah) the effect of treatments could be seen with regards to straw yield where T3 was better in Faizabad, RFD proved better in Chinsurah. It is interesting to note the significant effects of site x treatment interactions in majority attributes when compared to individual effects of sites and treatments, which highlights inclusion in Site-Specific Nutrient Management. There is another dimension added to the performance is about different varieties leading to permutations and combinations of effects that required further experimentation at multiple locations. Probably, all these facts are needed to be included in realizing the best from SSNM.

5.6 Bio - Intensive Pest Management (BIPM) in rice under Organic Farming

From the fourth year of study on "Bio-intensive pest management", it can be summarized that out of three locations (CHN, IIRR and TTB), BIPM was significantly superior to FP at CHN and TTB, while at IIRR, farmer's practice of nursery and main field with insecticide schedule was significantly superior to all other treatments. Similar to previous years, in this fourth year also, most of the soil properties improved with organics in BIPM compared to FP.

5. 7 Residue management in rice based cropping systems

The disposal of huge quantity of paddy residues has become a big problem, particularly in North-West Indian states, resulting in farmers preferring to burn the residues *in-situ* leading to air pollution, smog and loss of appreciable amount of plant essential nutrients besides being deleterious to soil microbes. Keeping this in view, the present trial initiated in last *kharif* was conducted this year at ten centres. The results show that the crop residues can be deployed to substitute half of the recommended nitrogen without yield penalty. Nutrient uptake was highest under RDF [N (72-133 kg/ha), P (13-42 kg/ha) and K (43-170 kg/ha)]. The crop residue treatments were at par and didn't vary much in terms of grain yield, nutrient uptake and maintained higher nutrient use efficiencies over RDF. Post-harvest soil nutrient status was not influenced much by various residue treatments which were at par with each other.

5.8 Screening of rice germplasm for Nitrogen use efficiency (NUE)

In the first year of study on "Screening of rice germplasm for NUE, ten genotypes were evaluated at three nitrogen levels (0, 50 and 100% of recommended N) at nine locations. At all locations, grain yield was significantly higher at 100% RDN and the increase was in the range of 5-36% over 50% RDN and 21-110% over no N applilcation. Among the varieties, out of nine locations, ARRH7576, CNN5, CNN4 and Varadhan recorded higher yields of around 5.0 t/ha. Yield parameters and nutrients uptake almost followed similar trend as that of grain yield trend and no spectacular differences were noticed in soil properties after harvest.

DETAILED REPORT

5.1 Long term soil fertility management in rice-based cropping systems (RBCS)

Long-term studies with well-defined nutrient management treatments and cropping systems were initiated in 1989-90 at four selected locations representing major rice growing regions and cropping systems *viz*., Mandya (MND) in Karnataka (rice-cowpea, Deccan Plateau), Maruteru (MTU) in Andhra Pradesh (rice-rice, Delta system), Titabar (TTB) in Assam (rice-rice, Alluvial soils) and Faizabad (FZB) in Uttar Pradesh (rice – wheat, Indo Gangetic plains) to study the dynamics of soil and crop productivity in relation to management for identifying the constraints that affect the sustainability of a given production system. The trial at Faizabad was discontinued during 2007-08 for lack of manpower support and being continued at 3 centres only. Hence, the results of 31st year of cropping i.e., *rabi* 2018-19 and *kharif* 2019 are presented in Tables 5.1.1 to 5.1.11 and Figs. 5.1.1 to 5.1.4.

Crop productivity and soil fertility during *rabi* 2018-19

Grain and straw yields of *rabi* rice at MTU and TTB are presented in Table 5.1.2. At MTU, grain yield ranged from 3.99 (control) to 6.24 t/ha (RDF+FYM) with a mean of 5.26 t/ha. RDF and RDF+FYM treatments were at par. Omission of P,K,Zn and S resulted in yield reduction by 0.41 t/ha in -Zn to 1.08 t/ha in -P plots over RDF. At Titabar, grain yield ranged from 1.65 t/ha in control to 4.63 t/ha in RDF+FYM which was significantly superior to all other treatments while FYM alone treatment (3.95 t/ha) was on par to RDF (4.25 t/ha). Here also, omission of nutrients resulted in grain yield reduction by 20% in -S to 21% in - K plots over RDF. 50% reduction in RDF resulted in 78% yield reduction in silty clay soil of TTB compared to 20% reduction in clay loam soil of MTU over RDF. STCR recommendation was at par to 100% RDF at TTB and significantly lower than RDF at MTU. At MND, *rabi* crop, cowpea, grown on residual soil fertility recorded higher yields in plots where organics were added during *kharif*.

Total nutrient (NPK) uptake followed similar trend as that of grain yield with maximum uptake in RDF+ 5t FYM/ha at both centres, MTU and TTB (Table 5.1.3). With regard to soil fertility status, soil organic carbon and available nutrient status after harvest at Maruteru were higher when organic manures were added as a supplementary dose and control treatment recorded lowest values in most of the parameters (Table 5.1.4). In nutrient omission plots (-P and -K), there was a significant reduction in available P and K compared to plots with RDF+FYM .

Crop productivity and soil fertility status during *kharif* 2019

At MTU, RDF+FYM recorded maximum grain yield (6.63 t/ha) that was on par to RDF, FYM alone and 50% NPK+50% FYM (5.72-5.95 t/ha) (Table 5.1.5). Omission of major and micro nutrients resulted in significant yield loss (1.71 to 2.26 t/ha) compared to RDF. At TTB also, RDF+FYM (5.57 t/ha) recorded maximum yield and was at par with RDF(5.33 t/ha) and

FYM alone (5.23 t/ha). Here, response to NPKZn and S was significant with maximum yield loss due to omission of major nutrients. At MND, RDF+FYM recorded maximum yield (6.40 t/ha) which was on par to 50% NPK+25% GM-N+ 25% FYM-N (6.14 t/ha) and these two treatments were significantly superior to other treatments. Here also, omission plots recorded significantly lower yields by 8% in –Zn to 96% in –N than RDF except –Zn which was on par to RDF. Whereas, FYM alone (4.52 t/ha) was on par to RDF (4.48 t/ha). STCR recommendation resulted in significant yield reduction at MTU and TTB compared to RDF while at MND, STCR was on par to RDF. With regard to straw yield, the trend was almost similar to grain yield trend at all locations. The total nutrients (NPK) uptake by the above ground biomass was almost similar to that of grain yield trend at all locations (Table 5.1.6). Soil fertility status at the end of *kharif* 2019 (Table 5.1.7 and 5.1.8 and Fig. 5.1.4) indicated an improvement in most of the soil properties with addition of organics and omission plots recorded reduction in NPK values compared to RDF at all 3 locations. Higher OC values were observed with RDF+FYM, INM and FYM alone treatments at all 3 locations (0.59 – 1.62%) and control recorded the lowest values at all locations (0.18-1.05%).

Long term changes in crop productivity and soil fertility over a period of 31 years

The trends in mean grain yields over 31 years (1989-2019) of *kharif* and *rabi* rice at MND, MTU and TTB by fitting to linear function using actual yields and the per cent change in important soil properties in some important treatments were analysed and presented below.

Linear trends in crop productivity (Tables 5.1.9 and 5.1.10 and figs.5.1.1-5.1.3)

During *kharif* 2019, the treatment, RDF+5 t FYM/ha recorded maximum mean yield at all 3 locations (MND- 5.26; MTU-5.15 and TTB- 4.94 t/ha) with an average increase of 11, 4 and 14%, respectively, at MND, MTU and TTB by this treatment over RDF. Linear trends of productivity over the years with current RDF indicated slightly positive growth in the delta soils of MTU (6.0 kg grain/ha/year) and more positive growth in the acid alluvial soils of TTB (35 kg/ha/year). Additional dose of FYM @5t/ha along with RDF improved the growth rate substantially with 66 kg/ha/year at MTU and 79 kg/ha/year at TTB. Whereas, at MND, RDF recorded –ve growth rate (-38 kg/ha/yr) and RDF+FYM recorded more positive growth rate (86 kg/ha/yr).

During *rabi* (Table 5.1.10) also, RDF+5t FYM recorded maximum mean grain yield both at MTU (6.28 t/ha) and TTB (4.34 t/ha) and this treatment recorded growth rate of 18 and 54 kg/ha/year at MTU and TTB, respectively. Higher growth rate was observed in *kharif* season compared to *rabi* season.

Changes in soil fertility compared to initial values (Table 5.1.11)

The Organic carbon (OC) content increased in all treatments at MTU compared to initial values. At MND, it decreased in control and RDF but increased in INM treatments. At TTB, OC decreased in control but increased in RDF and other treatments. Maximum increase in OC was in FYM alone treatment at MTU and TTB while in INM treatment at MND. Available N decreased in all treatments at MTU but at MND, it decreased in control with an increase in INM and FYM alone treatments. With regard to available P, there was a build up in all treatments except control compared to initial value at MND and TTB and at MTU, there was a build up in P in all treatments including control. In case of available K, at MTU, there was a decrease in all treatments compared to initial value. But, at MND and TTB, decrease was seen in control and with accumulation in other treatments.

The per cent change in important soil fertility parameters compared to the initial values were presented in Table 5.1.11 for three locations. There was a maximum decline in OC in control treatment at MND (-49%) and TTB (-41%) and INM treatments recorded accumulation of OC with maximum value in FYM alone (35%) treatment at MTU (35%) and TTB (68%) and 50%NPK+25%GM+25%FYM at MND (69%). With regard to N, there was a decline in all treatments (-5 to -24.5%) at MTU and at MND, decline was in control only (-36%). P accumulation was very high at all three locations in P addition treatments (87-398%). In case of K also, change was -ve in all treatments at MTU (-4 to -26 %) and in control alone at MND (-43%) and TTB (-47%) with a positive change in other treatments.

Summary

From the results of 31st year of study on long term soil fertility management in RBCS, superior performance of RDF+FYM was noticed over other treatments in both seasons at all three locations (MND, MTU and TTB). FYM alone treatment was on par to RDF in both seasons at TTB and in *kharif* at MND and MTU. Omission of major nutrients resulted in maximum yield reduction compared to micronutrients at all three locations. In general, INM and organics alone treatments resulted in improvement of soil fertility parameters which had reflected positively in rice productivity at all locations. Microbial populations as well as soil enzyme activities were higher with addition of organics. In general, compared to initial values, changes in soil fertility showed –ve values in control at all 3 locations in all parameters and +ve in INM and organics alone treatments except at MTU where N and K values are –ve in all treatments.

Table 5.1.1: Long term soil fertility management in RBCS, 2019 -Soil and crop characteristics

Cropping system	Maruteru	Titabar	Mandya
	Rice-Rice	Rice-Rice	Rice-Rice
Variety - *Kharif*	MTU-1061	Gitesh	Thanu (KMP101)
Rabi	MTU-1010	Lachit	-
Recommended Fertilizer Dose (kg NPK /ha)			
Kharif	90:60:60:50 (Zn)	40:20:20	100:50:50:20 (Zn)
Rabi	180:90:60:50	40:20:20	-
STCR	112:60:40	-	-
Crop growth: *Kharif*	Satisfactory	-	Satisfactory
Rabi	Satisfactory	Good	Satisfactory
% Clay	38	42.0	11.1
% Silt	28	28.0	18.1
% Sand	34	30.0	62.8
Texture	Clay loam	Silty Clay	Sandy loam
pH (1:2)	6.10	5.4	5.87
Organic carbon (%)	1.24	1.1	0.30
CEC (cmol (p^+)/kg)	48.6	12.5	-
EC (dS/m)	0.64	0.10	0.28
Avail. N (kg/ha)	234	495	208
Avail. P_2O_5 (kg/ha)	61.2	22.4	19.7
Avail. K_2O (kg/ha)	294	112	118

Table 5.1.2: Long term soil fertility management in RBCS, *rabi* 2019 Grain and straw yields of rice and cowpea

Treatments	Grain yield (t/ha)			Straw yield (t/ha)	
	Mandya (cowpea-kg/ha)	Maruteru	Titabar	Maruteru	Titabar
Control	473.0	3.99	1.65	4.99	3.12
100% PK	437.0	6.24	3.65	7.86	5.77
100% NK	428.5	5.13	3.75	6.93	5.82
STCR recommendation	643.5	5.19	4.17	7.01	6.20
100% NP	522.0	5.58	3.53	7.81	5.63
100% NPKZnS6	672.5	6.21	4.25	7.77	6.17
100% NPKZnS + FYM/PM @ 5t/ha	719.0	6.24	4.63	7.86	6.73
100% NPK –Zn	625.5	5.80	3.62	7.82	5.70
100% NPK – S	597.0	5.63	-	8.16	-
100%NPK-S+1tlime/ha	-	-	3.55	-	5.70
100% N+50% PK	497.0	4.87	3.83	5.36	5.70
50 % NPK	440.0	5.18	3.53	6.21	5.50
50 % NPK + Biofertilizer	442.5	4.23	2.38	5.72	4.67
50%NPK+ 50% GM-N	748.5	5.37	3.67	6.77	5.70
50% NPK + 50% FYM-N	780.0	5.65	3.93	7.06	5.23
50% NPK + 25% GM-N+25% FYM-N	791.5	5.40	3.83	7.28	5.70
FYM @ 10 t/ha	757.5	4.23	3.95	5.71	5.92
FYM @ 10 t/ha + Split application	768.5	4.50	3.95	6.06	5.83
Expt. Mean	**608.5**	**5.26**	**3.64**	**6.84**	**5.59**
CD (0.05)	**97.3**	**0.36**	**0.33**	**0.47**	**0.58**
CV (%)	**7.5**	**4.2**	**5.59**	**4.2**	**6.3**

Table 5.1.3: Long term soil fertility management in RBCS, *rabi* 2019- Total Nutrient uptake (kg/ha)

Treatments	Maruteru			Titabar		
	N	**P**	**K**	**N**	**P**	**K**
Control	85.7	15.0	49.4	26.3	4.8	26.7
100% PK	134.5	26.5	91.1	58.9	13.7	56.4
100% NK	138.9	19.3	71.1	60.4	13.8	59.8
STCR recommendation	140.5	21.0	90.6	71.0	18.5	70.8
100% NP	145.4	24.4	84.2	55.5	12.9	49.2
100% NPKZnS	166.7	23.8	76.0	76.1	16.2	74.3
100% NPKZnS + FYM/PM @ 5t/ha	174.4	27.1	108.4	82.6	18.3	83.8
100% NPK – Zn	149.4	25.5	81.8	61.5	11.6	62.7
100% NPK – S	140.2	26.5	87.2	-	-	-
100%NPK-S+1tlime/ha	-	-	-	56.3	12.4	65.4
100% N+50% PK	116.1	21.1	63.9	63.8	13.2	65.7
50 % NPK	119.3	21.6	62.5	55.4	11.5	62.2
50% NPK + Biofertilizer	99.7	19.0	72.9	40.7	8.7	49.2
50% NPK+ 50% GM-N	123.7	23.2	82.9	58.8	12.2	67.0
50% NPK + 50% FYM-N	123.3	23.3	89.6	61.0	11.9	62.4
50% NPK + 25% GM-N+ 25% FYM-N	104.7	23.2	88.3	65.4	14.3	69.5
FYM @ 10 t/ha	89.0	18.6	71.9	62.0	14.0	70.2
FYM @ 10 t/ha + Split Vermi	97.3	20.2	73.1	68.5	17.8	74.1
Expt. Mean	126.4	22.3	79.1	60.3	13.3	62.9
CD (0.05)	**18.3**	**2.0**	**11.0**	**9.8**	**3.3**	**7.4**
CV (%)	**8.8**	**5.6**	**8.4**	**9.8**	**14.9**	**7.2**

Table 5.1.4: Long term soil fertility management in RBCS, *rabi* 2019 - Soil fertility status at harvest

Treatments	Maruteru					
	pH	**EC**	**Org C (%)**	**Avail. N (kg/ha)**	**Avail. P_2O_5 (kg/ha)**	**Avail. K_2O (kg/ha)**
Control	5.91	0.70	1.20	174	63.3	409
100% PK	5.64	0.67	1.30	198	87.4	390
100% NK	5.72	0.73	1.17	147	80.6	421
STCR recommendation	5.54	0.73	1.23	174	96.8	435
100% NP	5.58	0.67	1.20	184	73.1	294
100% NPKZnS	5.63	0.73	1.13	140	77.8	359
100% NPKZnS + FYM/PM @ 5t/ha	5.75	0.67	1.30	189	97.2	368
100% NPK – Zn	5.94	0.73	1.30	133	93.9	368
100% NPK – S	5.75	0.70	1.30	169	98.5	316
100%NPK-S+1t lime/ha	-	-	-	-	-	-
100% N+50% PK	5.46	0.67	1.30	153	97.6	358
50 % NPK	5.61	0.67	1.30	171	81.7	370
50% NPK + Biofertilizer	5.84	0.70	1.27	161	94.6	334
50% NPK+ 50% GM-N	5.72	0.67	1.27	180	85.2	401
50% NPK + 50% FYM-N	5.54	0.73	1.33	128	69.0	491
50% NPK + 25% GM-N+ 25% FYM-N	5.70	0.70	1.33	156	80.6	494
FYM @ 10 t/ha	5.71	0.67	1.30	177	70.0	324
FYM@10 t/ha + 3.0 t/ha Vermicompost +200 kg/ha oil cakes	5.98	0.70	1.33	160	100.1	329
Expt. Mean	5.70	0.70	1.26	164	85.1	380
CD (0.05)	**0.41**	**0.11**	**0.11**	**34**	**4.8**	**60**
CV (%)	**4.33**	**9.99**	**5.06**	**13**	**3.4**	**9**

Table 5.1.5: Long term soil fertility management in RBCS, *kharif* 2019 - Yield and yield parameters of rice

Treatments	Grain yield (t/ha)			Straw yield (t/ha)			Panicles/m^2	
	MTU	TTB	MND	MTU	TTB	MND	MTU	MND
Control	2.61	1.68	1.82	5.36	3.80	2.05	300	215
100% PK	3.96	4.30	2.29	6.24	6.68	2.56	302	236
100% NK	3.71	4.45	2.62	5.54	6.52	2.87	310	273
STCR recommendation	4.12	4.78	3.94	6.72	6.73	4.10	295	437
100% NP	3.69	4.33	2.84	6.50	6.23	3.00	324	323
100% NPKZnS	5.95	5.33	4.48	9.82	6.83	4.88	307	460
100% NPKZnS + FYM/PM @ 5 t/ha	6.63	5.57	6.40	9.53	7.20	6.31	299	539
100% NPK –Zn	3.87	4.47	4.16	6.66	6.40	4.32	315	442
100% NPK – S	4.24	-	3.84	6.31	-	3.93	309	430
100%NPK-S+ 1timelime/ha	-	4.42	-	-	6.30	-	-	-
100% N+50% PK	4.09	4.52	3.33	6.23	6.00	3.76	310	411
50 % NPK	4.16	3.53	3.16	6.26	5.43	3.33	304	343
50 % NPK + Biofertilizer	4.14	2.48	3.86	6.93	4.70	4.10	333	365
50% NPK+ 50% GM-N	5.16	4.13	5.38	6.33	6.00	5.70	308	507
50% NPK + 50% FYM-N	5.72	4.62	5.23	7.90	6.60	5.53	322	501
50% NPK + 25% GM-N+25% FYM-N	4.25	4.72	6.14	7.46	6.57	6.55	336	529
FYM @ 10 t/ha	5.74	4.85	4.52	9.04	6.63	4.85	325	462
FYM@10 t/ha + 3.0 t/ha Vermicompost +200 kg/ha oil cakes	3.97	5.23	5.07	5.67	6.96	5.49	298	485
Expt. Mean	4.47	**4.32**	4.06	6.98	**6.21**	4.31	311	409
CD (0.05)	**1.07**	**0.43**	**0.70**	**1.41**	**0.46**	**0.72**	**56**	**55**
CV (%)	**14.6**	**6.01**	**8.2**	**12.2**	**4.49**	**7.9**	**11**	**6.4**

MTU-Maruteru TTB-Titabar MND- Mandya

Table 5.1.6: Long term soil fertility management in RBCS, *kharif 2019*
Total Nutrient uptake (kg/ha) in total dry matter

Treatments	Maruteru			Titabar			Mandya		
	N (kg /ha)	**P (kg /ha)**	**K (kg /ha)**	**N (kg /ha)**	**P (kg /ha)**	**K (kg /ha)**	**N (kg /ha)**	**P (kg /ha)**	**K (kg /ha)**
Control	50.9	11.5	55.2	26.3	4.8	26.7	25.9	4.8	30.0
100% PK	75.8	14.9	65.1	58.9	13.7	56.4	34.6	6.8	42.5
100% NK	64.4	16.1	71.4	60.4	13.8	59.8	42.9	6.7	50.8
STCR recommendation	80.4	17.4	88.3	71.0	18.5	70.8	67.4	12.8	74.1
100% NP	67.0	17.9	84.8	55.5	12.9	49.2	47.7	9.0	45.8
100% NPK + Zn + S	91.0	29.2	128.1	76.1	16.2	74.3	80.4	15.8	92.6
100% NPK + Zn + S + FYM/PM @ 5 t/ha	119.4	30.7	137.0	82.6	18.3	83.8	114.4	23.6	128.4
100% NPK –Zn	69.5	18.2	78.4	61.5	11.6	62.7	71.9	14.4	82.1
100% NPK – S	77.8	19.1	76.8	-	-	-	65.4	13.2	74.5
100%NPK-S+ 1timelime/ha	-	-	-	56.3	12.4	65.4	-	-	-
100% N+50% PK	74.8	17.7	66.5	63.8	13.2	65.7	57.7	10.4	62.5
50 % NPK	71.5	18.4	78.5	55.4	11.5	62.2	50.0	9.7	54.3
50 % NPK + Biofertilizer	76.9	19.5	90.8	40.7	8.7	49.2	62.3	11.7	68.3
50% NPK+ 50% GM-N	90.3	21.1	84.3	58.8	12.2	67.0	95.3	19.2	110.2
50% NPK+ 50% FYM-N	101.0	25.3	108.6	61.0	11.9	62.4	93.0	18.7	108.1
50% NPK +25% GM-N +25% FYM-N	75.0	19.0	104.3	65.4	14.3	69.5	111.3	23.1	127.3
FYM @ 10 t/ha	99.4	27.4	99.4	62.0	14.0	70.2	80.6	15.3	93.7
FYM@10t/ha +3.0 t/ha Vermi+200 kg/ha oil cakes	63.6	18.1	61.2	68.5	17.8	74.1	91.9	17.7	105.8
Expt. Mean	**79.3**	**20.1**	**87.0**	**60.3**	**13.3**	**62.9**	70.2	**13.7**	**79.5**
CD (0.05)	**15.6**	**3.3**	**17.9**	**9.8**	**3.3**	**7.4**	**10.9**	**4.6**	**16.7**
CV (%)	**11.9**	**10.1**	**12.5**	**9.9**	**14.9**	**7.2**	**7.3**	**15.7**	**9.9**

Table 5.1.7: Long term soil fertility management in RBCS, *Kharif* 2019

Soil fertility status at harvest

Treatments	Maruteru				Titabar				
	Org. C (%)	Avail. N (kg/ha)	Avail P_2O_5 (kg/ha)	Avail. K_2O (kg/ha)	Soil pH	Org. C (%)	Avail. Zn (mg/kg)	Avail. P_2O_5 (kg/ha)	Avail. K_2O (kg/ha)
Control	1.05	228	55.6	301	5.37	0.56	0.56	11.6	78
100% PK	1.21	234	75.2	383	5.63	0.80	0.70	23.2	94
100% NK	1.11	243	67.1	267	5.73	0.88	0.83	26.6	112
STCR recommendation	1.09	270	74.8	306	5.67	0.95	0.87	35.2	96
100%NP	1.10	280	94.8	315	5.73	1.00	0.82	34.3	95
100% NPKZnS	1.08	273	101.6	353	5.77	1.22	0.95	39.2	151
100% NPKZnS + FYM/PM @ 5t/ha	1.18	283	99.9	390	5.63	1.52	1.22	41.2	161
100% NPK –Zn	1.09	316	77.6	354	5.63	1.62	0.82	37.7	148
100% NPK – S	1.13	295	81.1	378	-	-	-	-	-
100%NPK-S+ 1timelime/ha	-	-	-	-	5.93	0.86	0.88	36.5	151
100% N+50% PK	1.10	297	65.4	343	5.63	1.22	0.87	33.6	157
50 % NPK	1.11	252	82.6	336	5.70	0.73	0.75	26.8	161
50 % NPK + Biofertilizer	1.22	249	71.9	284	5.87	1.20	0.83	36.2	158
50% NPK+ 50% GM-N	1.16	191	90.1	356	5.60	1.38	0.85	36.4	168
50% NPK + 50% FYM-N	1.11	224	99.5	345	5.70	1.47	0.88	36.8	160
50% NPK + 25%GM-N+25%FYM-N	1.15	260	93.7	341	5.90	1.50	0.91	38.0	168
FYM @ 10 t/ha	1.20	225	89.6	373	5.90	1.50	1.00	38.8	168
FYM@10 t/ha +3.0 t/ha Vermicompost +200 kg/ha oil cakes	1.11	245	95.4	277	5.93	1.60	1.07	40.5	170
Expt. Mean	**1.13**	**256**	**83.3**	**335**	**5.74**	**1.18**	**0.87**	**33.7**	**141**
CD (0.05)	**0.15**	**27**	**6.3**	**36**	**0.33**	**0.18**	**0.15**	**2.5**	**14**
CV (%)	**8.1**	**6.4**	**4.6**	**6.4**	**3.46**	**9.12**	**10.1**	**4.4**	**5.9**

Table 5.1.8: Long term soil fertility management in RBCS, *Kharif* 2019
Soil fertility status at harvest (Mandya)

Treatments	Soil O.C. (%)	Avail. N (Kg ha^{-1})	Avail. P_2O_5 (Kg ha^{-1})	Avail. K_2O (Kg ha^{-1})
Control	0.18	185	10.1	100
100% PK	0.24	231	28.2	257
100% NK	0.29	235	16.2	246
STCR	0.34	264	30.8	270.5
100% NP	0.28	257	29.2	141
100% NPK + Zn + S	0.35	302	33.0	266
100% NPKZnS + FYM/PM	0.40	272	54.4	312
100% NPK – Zn	0.34	296	32.4	273
100% NPK – S	0.34	284	33.7	271
100% N + 50% PK	0.30	278	28.3	245
50% NPK	0.31	266	25.6	254
50% NPK + 50% GM-N	0.49	334	44.3	297
50% NPK + 50% FYM-N	0.49	339	46.7	315
50% NPK + 25% GM-N + 25% FYM-N	0.59	380	51.0	325
FYM @ 10 t/ha	0.54	342	39.9	292
FYM @ 10t.ha + 3 t/ha Vermi + 200 kg/ha oil cakes	0.55	347	39.4	297
Exp. Mean	**0.37**	**294**	**33.6**	**260**
CD (0.05)	**0.05**	**16.0**	**2.8**	**11.0**
CV (%)	**6.42**	**2.6**	**4.0**	**2.0**

Table 5.1.9: Long term soil fertility management in RBCS
Linear trends of changes in *kharif rice* yields (t/ha) from 1989 to 2019

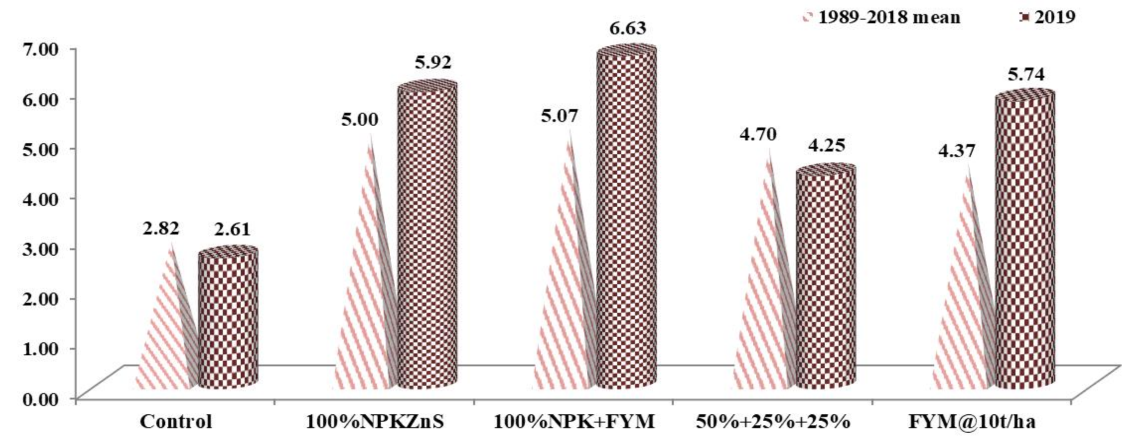
Treatments	MTU			TTB			MND		
	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)
Control	2.85	12.0	2.59	2.01	-60.0	3.00	2.25	-68.0	3.27
100% PK	3.59	38.0	2.85	3.18	39.0	2.56	2.78	-38.0	3.36
100% NK	3.96	-7.0	4.18	3.52	20.0	3.19	3.48	-84.0	4.75
100% NP	4.32	-20.0	4.78	3.72	17.0	3.45	3.89	-93.0	5.30
100% NPK + Zn + S	4.93	6.0	4.93	4.35	35.0	3.79	4.72	-38.0	5.30
100% NPKZnS + FYM	5.15	66.0	3.73	4.94	79.0	3.24	5.26	86.0	3.45
100% NPK – Zn	4.54	-17.0	4.92	4.14	20.0	3.82	4.55	-59.0	5.43
100% NPK – S	4.67	-2.0	4.76	4.12	3.0	4.08	4.46	-53.0	5.26
100% N + 50% PK	4.32	-7.0	4.53	3.64	-8.0	3.76	4.06	-84.0	5.33
50% NPK	4.27	-2.0	4.32	3.19	-40.0	3.83	3.77	-51.0	4.55
50% NPK + 50% GM-N	4.41	2.0	4.41	3.78	19.0	3.46	4.80	0.02	4.77
50% NPK + 50% FYM-N	4.75	12.0	4.54	3.92	28.0	3.47	4.87	0.15	4.64
50% NPK + 25% GM-N + 25% FYM-N	4.51	6.0	4.41	3.98	27.0	3.55	5.42	0.20	5.12
FYM @ 10 t/ha	4.38	5.0	4.34	4.04	53.0	3.19	4.17	0.29	3.73

Table 5.1.10: Long term soil fertility management in RBCS
Linear trends of changes in *rabi rice* yields (t/ha) from 1989 to 2019

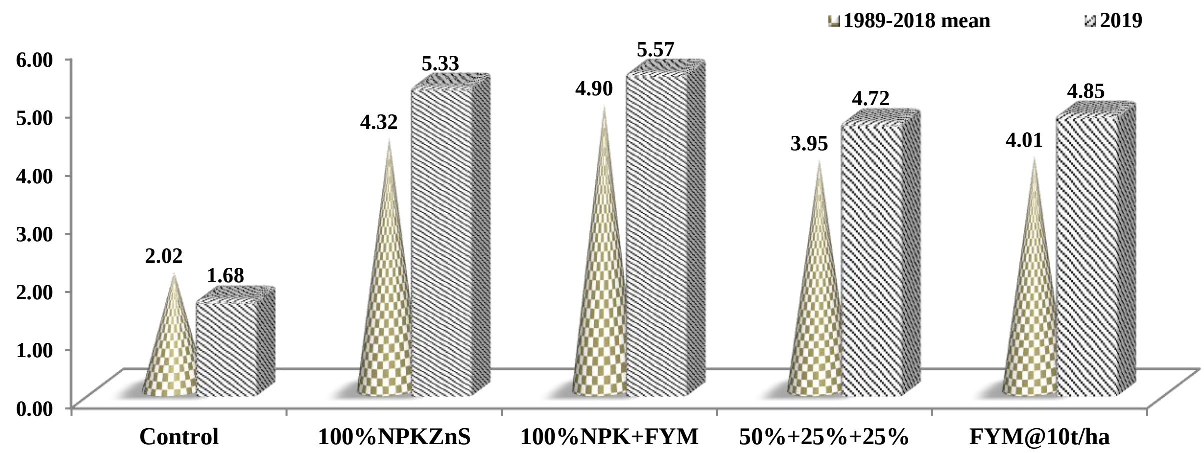
Treatments	MTU			TTB		
	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)	Mean yield (t/ha)	Slope (kg/ha/yr)	Intercept (t/ha)
Control	2.23	40.0	1.44	1.71	-36.0	2.24
100% PK	2.93	72.0	1.76	2.99	64.0	2.06
100% NK	4.08	34.0	3.53	3.25	31.0	2.80
100% NP	4.98	34.0	4.76	3.40	0.15	3.19
100% NPK + Zn + S	5.68	43.0	4.98	3.86	34.0	3.37
100% NPKZnS + FYM/PM	6.28	-18.0	6.66	4.34	54.0	3.30
100% NPK – Zn	5.18	24.0	4.78	3.64	17.0	3.40
100% NPK – S	5.28	26.0	4.85	3.53	15.0	3.32
100% N + 50% PK	5.17	25.0	4.77	3.33	5.0	3.27
50% NPK	4.26	18.0	3.96	2.83	0.0	2.84
50% NPK + 50% GM-N	4.85	-6.0	4.95	3.35	26.0	2.98
50% NPK + 50% FYM-N	5.12	31.0	4.62	3.45	37.0	2.91
50% NPK + 25% GM-N + 25% FYM-N	4.99	11.0	4.80	3.47	37.0	2.93
FYM @ 10 t/ha	4.03	25.0	3.62	3.48	42.0	2.87

Table: 5.1.11: Long term soil fertility management in RBCS
Changes (%) in soil fertility parameters over 1989 to 2019

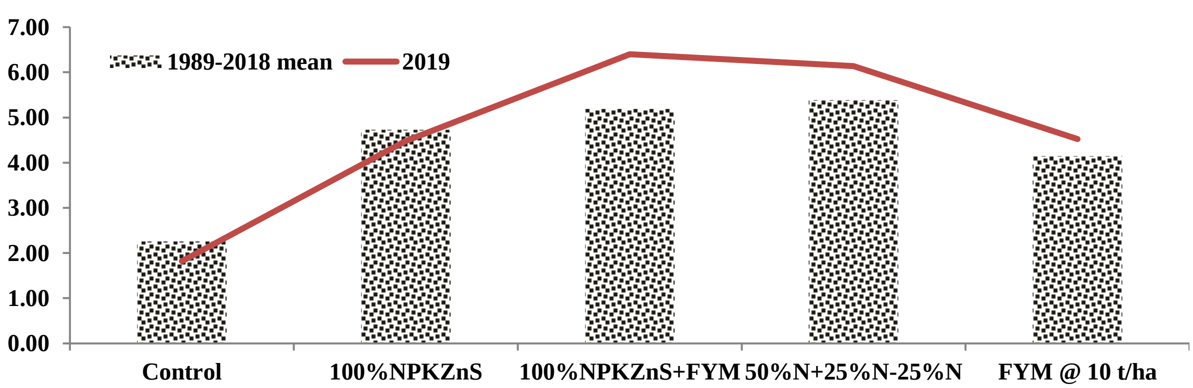
Treatments	Maruteru				Titabar			Mandya			
	OC	N	P	K	OC	P	K	O.C.	N	P	K
Control	18.0	-23.5	173	-25.9	-41.1	-12.1	-46.6	-48.6	-36.2	-42.6	-43.2
100% NPK + Zn + S	21.3	-8.4	398	-13.1	28.4	197.0	3.4	0.00	4.1	87.5	51.1
100% NPK + Zn + S + 5 t/ha FYM	32.6	-5.0	390	-3.9	60.0	212.1	10.3	14.3	-6.2	209.1	77.3
50% NPK + 25% GM-N + 25% FYM-N	29.2	-12.8	359	-16.0	57.9	187.9	15.1	68.6	31.0	189.8	84.7
FYM @ 10 t/ha	34.8	-24.5	339	-8.1	68.4	193.9	15.1	54.3	17.9	126.7	65.9



Grain Yield (t ha^{-1}) at Maruteru

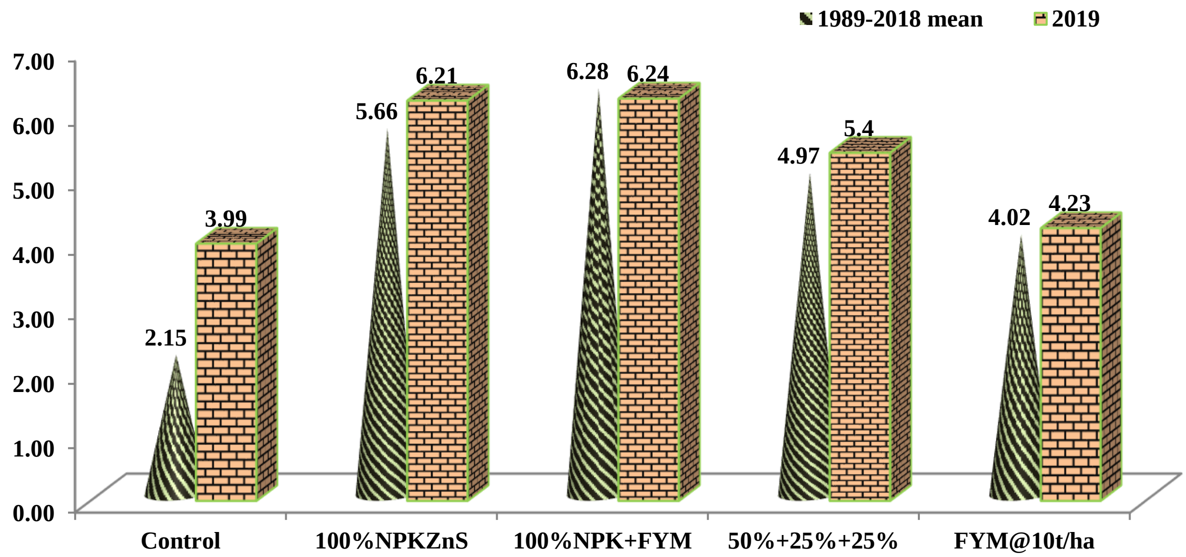


Grain Yield (t ha^{-1}) at Titabar

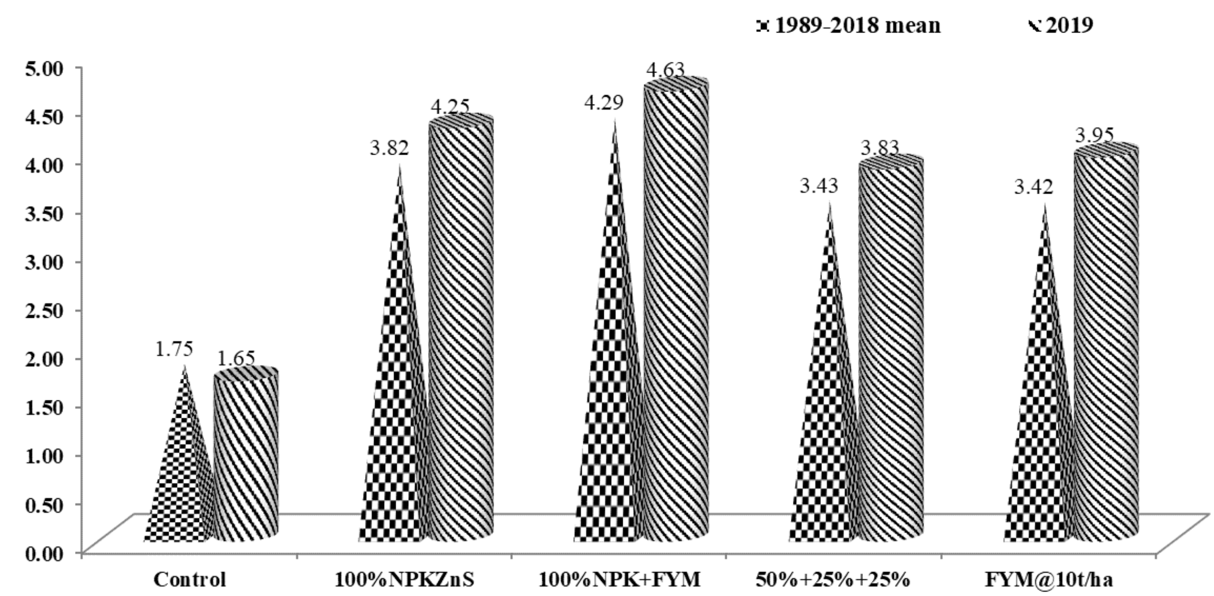


Grain Yield (t ha^{-1}) at Mandya

Fig. 5.1.1. Long term effect of nutrient management on rice grain yield –*Kharif*
(Mean of previous 30 years and current year grain yield)

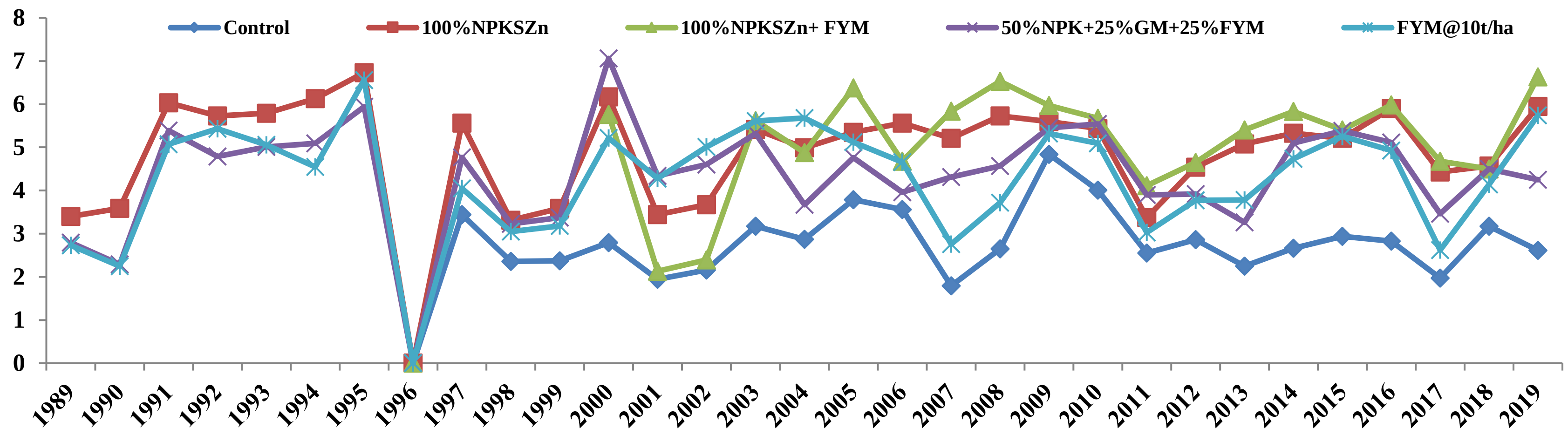


Grain Yield (t ha^{-1}) at Maruteru

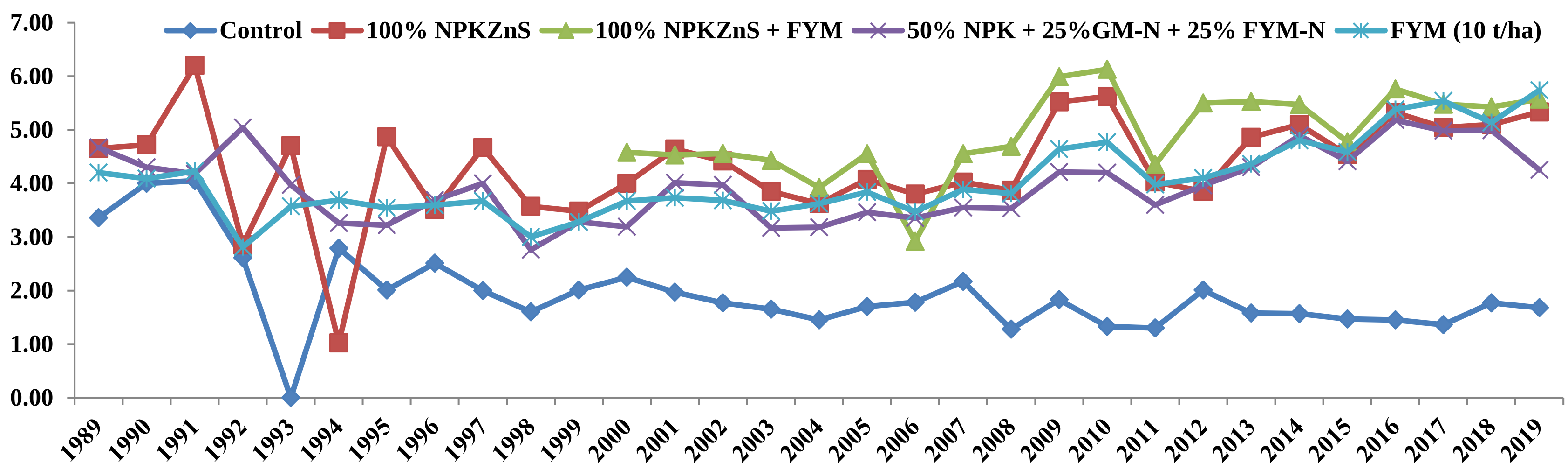


Grain Yield (t ha^{-1}) at Titabar

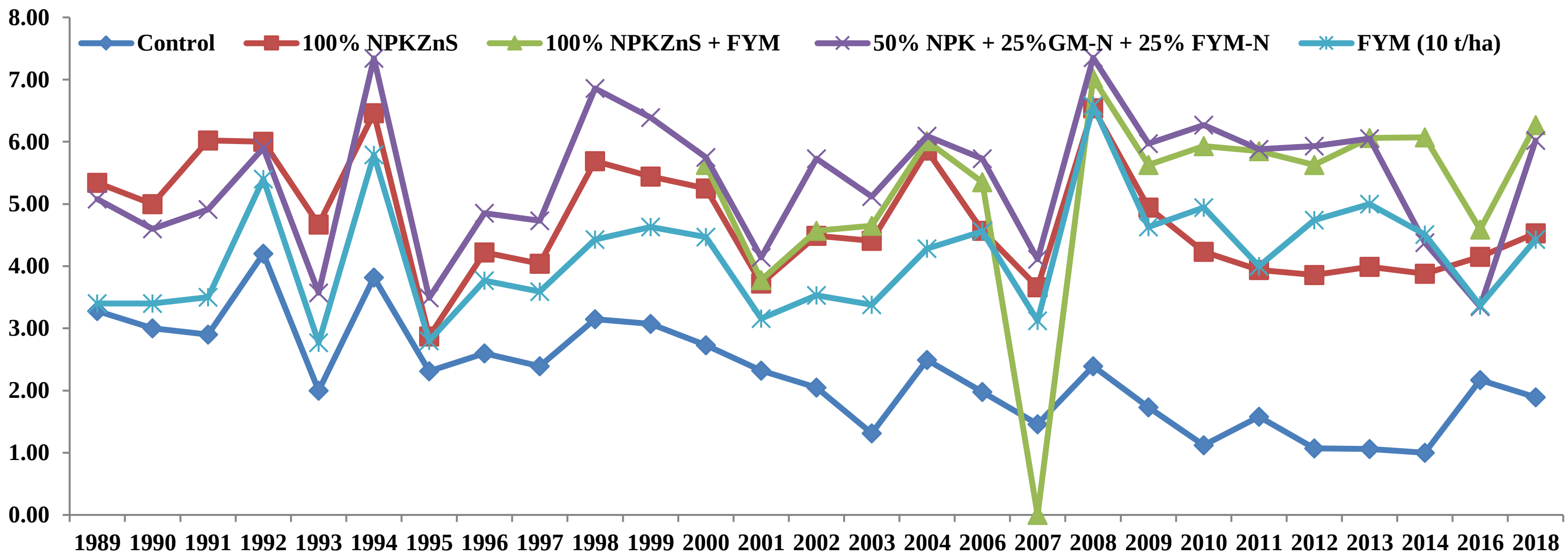
Fig. 5.1.2. Long term effect of nutrient management on rice grain yield –*Rabi*
(Mean of previous 30 years and current year grain yield)



Maruteru Kharif

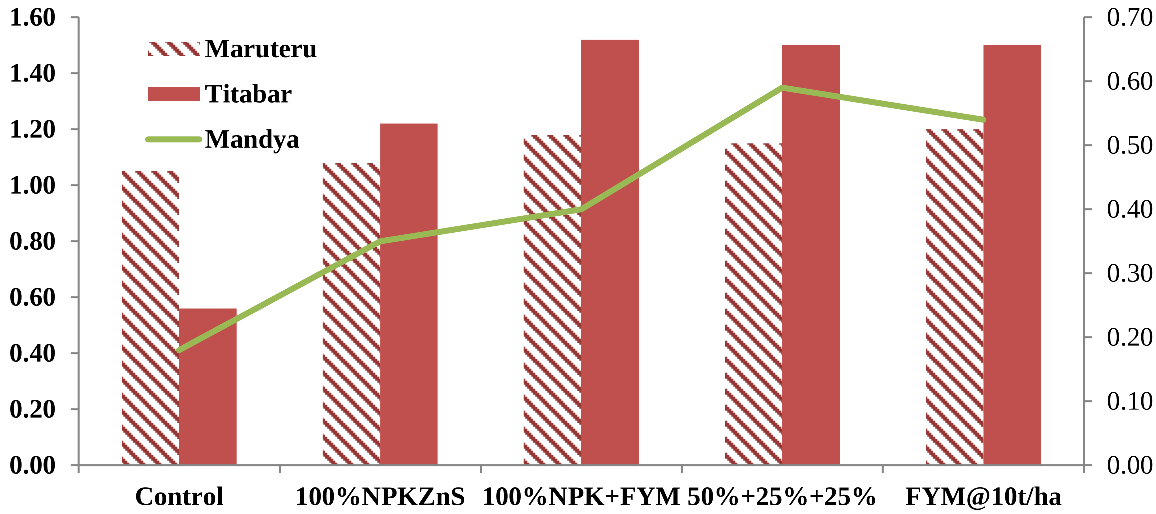


Titabar-Kharif

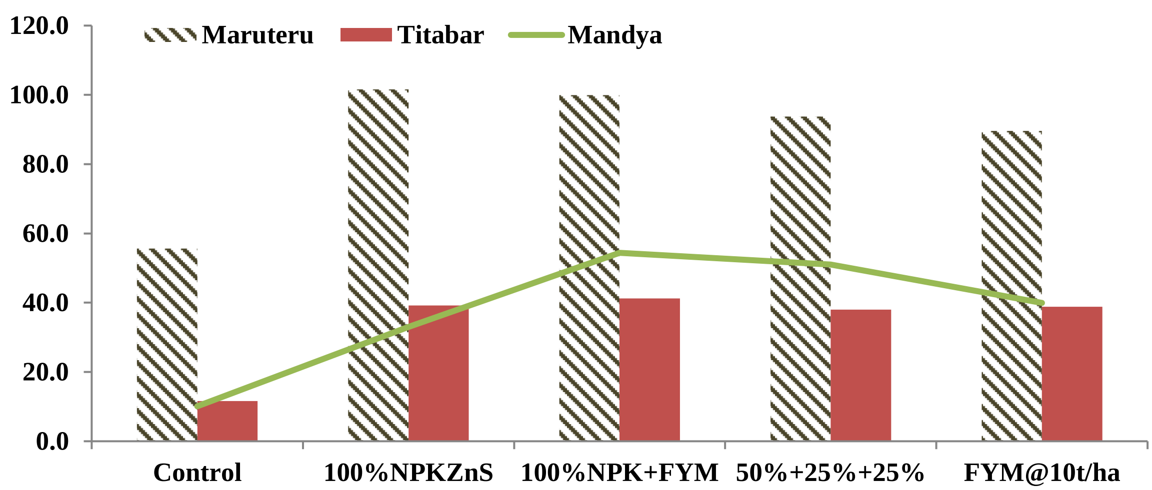


Mandya-Kharif

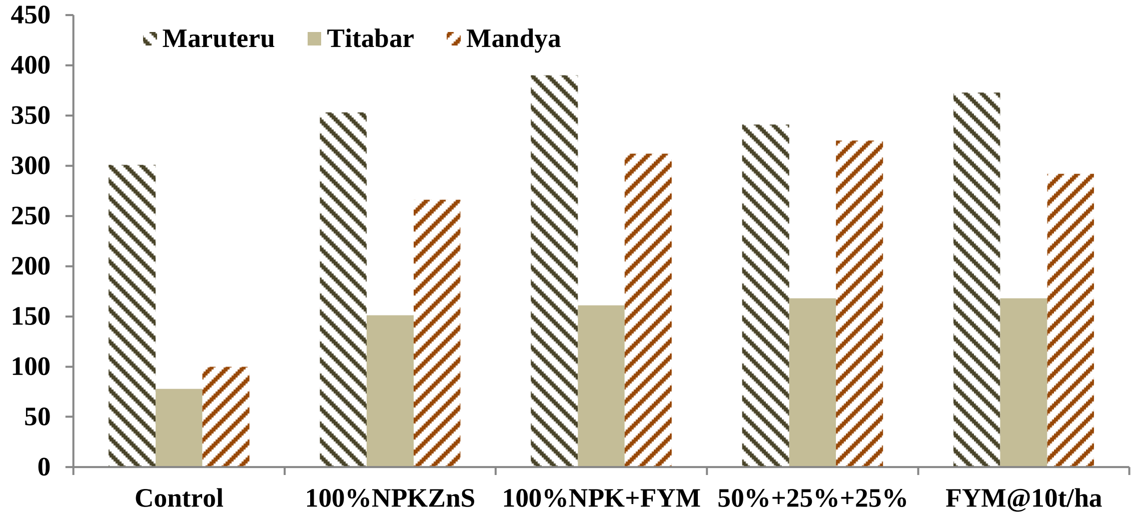
5.1.3. Long term effect of nutrient management on yield trend (Kharif)



Organic Carbon Content (%)



Available P_2O_5 Content (kg ha^{-1})



Available K_2O content

5.1.4. Long term effect of nutrient management on soil nutrient status (*Kharif* 2019)

5. 2. *Soil quality and productivity assessment for bridging the yield gaps in farmers' Fields*

Yield and Technology gap is a major problem in increasing paddy production in the diverse rice agro ecosystems in India. Farm yields and farmers income swing widely in irrigated ecosystems of the states. Usually, poor yielding farms are marginal lands which are defined as low fertility, resource poor, fragile, vulnerable or degraded lands. However, in real sense a land could be marginal or highly productive depending upon its cropping history, use of technologies in farming, levels of inputs applied to maintain fertility, other biophysical/institutional and socio-economic factors of the farmers. A tract of low fertile land is marginal for crop production for poor farmers and hence decline in yield is common, but highly productive for resource rich farmers . The nature, composition and interaction of the soil factors, can also differ widely. Also, there are number of soil factors that may make land from low fertility category to high fertility category. Hence, marginality is a dynamic process - a land unsuitable for poor rice growers due to low level of inputs/technologies adoption, lack of irrigation, could be made highly productive for the same farmers by utilizing all the resources and technological interventions .

A study was, therefore, proposed in *Kharif*, 2019, at few locations representing major rice growing regions to assess the nutritional status and productivity of the crop under farmer's current management practices in selected farmer fields for further improvement in rice productivity. Participatory rural appraisal, group discussion and transect walk were followed to explore the detail information of study area. The study, involved survey and record of all the package of fertilizer and crop management practices of the farmer, besides information about the nutrient status of the soils before cropping and the crop at maximum tillering stage including the crop productivity and dry matter yield. Simultaneously, the nutrient supply potential of the soil was also assessed at the research farm representing the area of study. Data received from four locations (Chinsurah, Titabar, Karaikal and Pantnagar) representing Indo gangetic plains and the plateau region collected from farmer fields in *Kharif* 2019 are presented in the Tables 5.2.1 to 5.2.3 and briefly discussed. The farmers from 46 farm sites of Gangetic Alluvial around Damra and Bishpara, Chandrahati-I, Hooghly from Chinsurah Centre cultivated Khitish, Shatabdi, Swarna applying a range of nutrient management levels of varying- 50-25-25, 60-30-30, 70-35-35, 80-40-40, 90-45-45, 120-80-80. Forty one farmers Golaghta district from Titabar centre representing Indo Gangetic and Brahamputra plains cultivated Ranjit sub 1, bahadur sub 1,Sharaboni applying 60:20:40 levels of NPK.

The questioner-based survey was conducted in twenty-four farmer's field spread across five villages of Karaikal at the end of the harvest season rabi (Samba), 2019-20 cultivating CR1009, BPT5204, ADT46,White Ponni, Kichadi samba, TKM 13 and applying Varying levels of NPK as -80:58:19, 80:58:10, 80:58:00,80:58:37,120:80:57,40:29:00,90:58:37, 90:53:75, 40:58:37, 90:10:29, 160:44:60. Sixty farmer's field from the tarai belt of Uttrakhand namely

Pantnagar cultivated PR1509,PR121,PR126,PD-10,PD-12,,PUSA-150,PUSA-154,HR-47, ,HR 147, Pusa Basmati,Sarjoo-52,Sarbati,Indrasan,Hybrid applying varying levels of NPK as - 180,60,40, 180,60,0 150,60,40, 200,60,40, 150,50,30, 150,0,40 (Table 5.2.1). The initial, post-harvest soil samples along with grain and straw samples were collected and analyzed for their soil characteristics and nutrient content, respectively. The co-ordinates of the farmers field selected for soil quality and productivity assessment were also recorded. For grouping the data for yield, two categories were formed as low yielders having below 4t/ha productivity and high yielders having >4t/ha productivity. Simultaneously the nutrient supply potential of the soil was also assessed at the research farm representing the study area to assess the variability in nutrient supply, its relationship with rice yields at current recommended and farmers' fertilizer practices.

Table 5.2.2 gives information collected in the new farm sites on yields obtained, nutrient uptake and Soil quality index calculated from all the soil samples collected from the farmers fields. Sharp variations in grain yields recorded varied from 2.39 t /ha among low yielders to 5.0 t /ha among high yielders at Chinsurah, from 3.59 t /ha among low yielders to 4.67 t /ha among high yielders at Karaikal, varied from 2.63 t /ha among low yielders to 4.87 t /ha among high yielders at Titabar, 5.7 t/ha among high yielders at Pantnagar. Soil Parameters data were pooled in different categories and the resulting soil quality index generated showed variations in the quality and health of the soil across different farmers categories. The poorest soil quality index was calculated for farmers from Pantnagar, due to considerable variation among the farm sites and soil test values. The soil quality index was much superior at Chinsurah and were at par for all other centers. Large variations were obtained for nutrient uptake between low yielders and high yields across the centres. Soil nutrient uptake for major nutrients varied widely among the sites. At all these locations wide variations in grain yields and nutrient uptake were recorded (Table 5.2.3), while soil test values did not match the yields recorded with rice yield and nutrient uptake at both the locations, suggesting perhaps less suitability of current soil testing methods for flooded soils. However, some centres reported soil quality index at par with their resulting grain yield and nutrient uptake patterns. Table 5.2.3 recorded the nutrient requirement per ton grain yield variations obtained at all the centres. Nutrient requirement calculations were an useful tool to know how the responses were for fertilizers applied per ton of the grain yield obtained. In the scenario of ever changing fertilizer management practices followed across rice fields in India, there cannot be a single blanket fertilizer formulations followed for diverse soil ecosystems with less importance given to management induced site variations which has been the major reason for nutrient imbalances and unsustainability. Fertilizer nutrient management not matching with the variability in soil fertility in the farmer fields is one of the important factors responsible for low rice productivity, imbalanced nutrition and unsustainability of the production system in some of the poor yielding farms. Variability in nutrient acquisition and its utilization by genotypes for yield expression is coupled with nutrient application in right proportions to meet the growth requirements of a genotype is vital for realizing the yield potential in any given farming situation. The study, thus indicated ample scope for improvement in nutrient use efficiency, precise assessment of nutrient requirements of such varieties and under each farmer's condition for arriving at the fertilizer prescriptions to ensure harvestable yield potential on sustainable basis besides optimizing input use.

Summary: This trial in the form of a survey was conducted in farmers' fields around few selected centres – Chinsurah, Titabar, Karaikal and Pantnagar) representing Indo gangetic plains and the plateau region collected from farmer fields in *Kharif* 2019 to assess the variability in nutrient supply, its relationship with rice yields at farmers' fertilizer practices in some new farm sites. The *kharif* 2019 data received representing the irrigated and shallow lowland rice ecosystems revealed wide variations. Soil nutrient uptake varied between the sites matching with the grain yields. Sharp variations in grain yields recorded varied from 2.39 t /ha among low yielders to 5.0 t /ha among high yielders at Chinsurah, from 3.59 t /ha among low yielders to 4.67 t /ha among high yielders at Karaikal, varied from 2.63 t /ha among low yielders to 4.87 t /ha among high yielders at Titabar, 5.7 t/ha among high yielders at Pantnagar. Soil Parameters data were pooled in different categories and the resulting soil quality index generated showed variations in the quality and health of the soil across different farmers categories.

Table 5.2.1 Rice productivity in relation to internal supply capacity of nutrients in farmers' fields, *kharif* 2019 - Soil, crop and weather data recorded prior to cultivation

Parameter	**Chinsurah**	**Karaikal**	**Titabar**	**Pantnagar**
Variety	**Khitish, Shatabdi, Swarna**	CR1009, BPT5204, ADT46,White Ponni, Kichadi samba, TKM 13	Ranjit sub 1, bahadur sub 1,Sharaboni	PR1509,PR121,PR126,PD-10,PD-12,,PUSA-150,PUSA-154,HR-47, ,HR 147, Pusa Basmati,Sarjoo-52,Sarbati,Indrasan,Hybrid
Crop growth	Good	Good	Good	Good
RFD (kg NPK/ha)	Varying- 50-25-25, 60-30-30, 70-35-35, 80-40-40, 90-45-45, 120-80-80	Varying-80:58:19, 80:58:10, 80:58:00, 80:58:37, 120:80:57, 40:29:00, 90:58:37, 90:53:75, 40:58:37, 90:10:29, 160:44:60	60:20:40	Varying-180,60,40, 180,60,0 150,60,40, 200,60,40, 150,50,30, 150,0,40
Soil Texture	Clay Loam	Sandy Loam, Loamy sand, Sandy Clay Loam		
pH	6.49-7.66	6.52-8.18	4.9-5.8	7.0-7.9
EC(dS/m)	0.2-0.29	0.01-1.79	0.02-0.18	0.2-0.55
Org. carbon (%)	0.85-1.1	0.32-0.85	0.63 – 1.25	0.2-0.65
Avai.N (kg/ha)	341-461	116.03-235.20	-	120-217
Avai.P_2O_5 (kg/ha)	81-99	28.18-79.15	18-29	5.9-23.6
Avai.K_2O (kg/ha)	255-296	147.84-635.04	75-95	105-230

Table 5.2.2 Rice productivity in relation to internal supply capacity of nutrients in farmers' fields, *kharif* 2019 - Soil nutrient supply potential vis a vis nutrient uptake assessed among different farmers categories

Categories/ Nutrient	**Chinsurah (total of 46 sites,** 12 low yielders and 34 high yielder sites)			**Karaikal** (Out of 40,30 sites, low yielders 10 and 20 high yielder sites)		
	Minimum	**Maximum**	**Mean***	**Minimum**	**Maximum**	**Mean****
Grain yield (t/ha)						
Low Yielders	1.76	3.1	2.39	3.41	3.72	3.59
High Yielders	4.1	5.62	5.00	4.03	6.20	4.67
Nutrient uptake (kg/ha)						
	Low Yielders					
N	-	-	-	45.6	56.0	49.5
P	-	-	-	39.2	60.8	47.3
K	-	-	-	67.8	128.6	98.9
	High Yielders					
N	-	-	-	**23.7**	**76.4**	**41.4**
P	-	-	-	**23.4**	**60.9**	**37.5**
K	-	-	-	**11.3**	**52.7**	**21.3**
Soil Quality Index						
Low Yielders	0.8 (High)	1.0 (High)	0.9 (High)	0.4 (Poor)	0.5 (Average)	0.45 (Poor)
High Yielders	0.8 (High)	1.0 (High)	0.9 (High)	0.5 (Average)	0.6 (Average)	0.55 (Average)
Categories/ Nutrient	**Titabar** (Out of 40,23 low yielders,7 high yielders)			**Pantnagar** (Out Of 60,60 high yielders)		
	Minimum	**Maximum**	**Mean***	**Minimum**	**Maximum**	**Mean****
Grain yield (t/ha)						
Low Yielders	1.8	3.8	2.63	-	-	-
High Yielders	4.26	5.6	4.87	4.0	7.0	5.7
Nutrient uptake (kg/ha)						
	Low Yielders					
N	8.51	27.42	18.24	-	-	-
P	6.43	12.83	9.97	-	-	-
K	38.93	190.91	116.63	-	-	-
	High Yielders					
N	30.12	55.84	42.31	**34.13**	**121.05**	**80.33**
P	17.15	21.73	19.13	**5.57**	**28.46**	**16.77**
K	274.64	410.	344.87	**46.21**	**108**	**72.70**
Soil Quality Index						
Low Yielders	0.4 (Poor)	0.5 (Average)	0.45 (Poor)	-	-	-
High Yielders	0.4 (Average)	0.6 (Average)	0.55 (Average)	0.2 (Poor)	0.6 (Medium)	0.4 (Average)

Table 5.2.3 Rice productivity in relation to internal supply capacity of nutrients in farmers' fields, *kharif* 2019 - Nutrient Requirement per ton grain yield

	Chinsurah			**Karaikal**		
Farmers categories	**Mean yield (t/ha)**	**Mean uptake (kg/ha)**	**Nutrient Requirement (kg/t grain)**	**Mean yield (t/ha)**	**Mean uptake (kg/ha)**	**Nutrient Requirement (kg/t grain)**
Low Yielders (12 sites)	2.4	-	-	3.59		
N		-	-		49.5	**13.7**
P		-	-		47.3	**13.17**
K		-	-		98.9	**27.54**
High Yielders (34 sites)	5.0	-	-	4.67		
N		-	-		**41.4**	**8.86**
P		-	-		**37.5**	**8.02**
K		-	-		**21.3**	**4.56**
	Titabar			**Pantnagar**		
Farmers categories	**Mean yield (t/ha)**	**Mean uptake (kg/ha)**	**Nutrient Requirement (kg/t grain)**	**Mean yield (t/ha)**	**Mean uptake (kg/ha)**	**Nutrient Requirement (kg/t grain)**
Low yielders	2.63			-		
N		18.24	6.93			
P		9.97	3.79			
K		116.63	44.34			
High yielders	4.87	-		5.7		
N		42.31	8.68		**80.33**	14.09
P		19.13	3.92		**16.77**	2.94
K		344.87	70.81		**72.70**	12.75

5.3 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS

Sodic soils have high soil pH (8.5 - 11.0) and exchangeable sodium percentage (ESP) of greater or equal to 15, low organic matter content and a preponderance of carbonates and bicarbonates of sodium or excess salt content. These soil characteristics strongly modify the availability of micronutrients and thereby crop productivity. Such soils can be managed in two ways viz. either by growing a crop variety suitable for a particular soil or by ameliorating the soil through the application of soil amendments. Keeping these points in view, a trial was initiated in *kharif* 2014 to screen germplasm for tolerance to sodicity and increased rice productivity under three levels of ameliorative gypsum application {(0, 50 and 100% gypsum recommendation (GR)] in addition to the recommended dose of NPK. From *kharif* 2019, the trial was modified to germplasm screening only. But, Kanpur followed as per the old treatments only. The results of the trial conducted in *rabi* 2018-19 and *kharif* 2019 at Faizabad, Kanpur, Mandya and Pusa are presented in Tables 5.3.1 to 5.3.9.

Wheat yields (*rabi* 2018-19)

Gypsum application increased rabi wheat yields at Kanpur (Table 5.3.2). The highest grain and straw yields were observed in 100% GR (4.18 and 5.01 t/ha) followed by 50% GR (3.10 and 3.68 t/ha). The lowest grain and straw yields were observed in the treatment without gypsum (1.56 t/ha and 1.83 t/ha, respectively).

Yield parameters (*kharif* 2019)

Significant differences were observed among rice genotypes for all the yield parameters when cultivated under natural sodic conditions at Faizabad (Table 5.3.3). Highest tillers/m^2 (326-353) and panicles /m^2 (322-349) were produced by genotypes RMS -8, RMS -7, SRL -1, RMS -6 and PS -344.

Gypsum application at 50% GR (437 panicles/m^2 and 1.60 g respectively) and 100% GR (465 panicles/m^2 and 1.76 g respectively) increased the panicles/m^2 and panicle weight of the genotypes (Table 5.3.4) evaluated at Kanpur compared to the treatment without gypsum (367 panicles/m^2 and 1.26 g respectively). The genotype SRL-3 produced the highest number of panicles (554/m^2) and also produced panicles with the highest weight (1.90 g) after application of gypsum at 100 % GR.

The yield parameters at Mandya were significantly influenced by varietal differences (Table 5.3.3). Highest tillers/m^2 and panicles/m^2 were observed in genotypes RMS-2, GPV-1, MTP-1, Varadhan, GPV-2 (652, 572, 564, 525, 514 tillers/m^2 and 587, 515, 508, 473, 463 panicles/m^2 respectively while the highest 1000 grain weights were recorded with MTU-1010 (27.99 g), PUP-221(27.4 g), CSR-23 (26.74g), VR-181(25.33g) and PS-344 (24.66 g). At Pusa, among the genotypes evaluated, GPV 2, GPV 3, GPV 1, RMS 3 and SRL 3 recorded the highest tillers/m^2 (11-14 tillers/m^2), while Varadhan, SRL 1, RMS 7, RMS 5 and KRH 4 produced highest (97-137) filled grains /panicle (Table 5.3.6). The genotypes that recorded the highest 1000 grain weight were RMS 1, RMS 6, CSR 23, GPV 2 and MTU 1010 (24.22-28.26 g).

Grain and Straw yields (*kharif* 2019)

Grain and straw yields of the genotypes were significantly influenced by the sodic conditions at Faizabad (Table 5.3.3). Among the genotypes evaluated, the highest grain and straw yields were recorded with the genotypes RMS -2 (6.5 and7.38 t/ha respectively), RMS -7

(6.33 and 7.16 t/ha respectively), RMS -6 (6.07 and 6.85 t/ha respectively), RMS -8 (6.04 and 6.8 t/ha respectively) and SRL -1 (5.06 and 5.73 t/ha respectively).

Application of gypsum in conjunction with recommended dose of NPK significantly influenced yields of *kharif* rice at Kanpur (Table 5.3.5). Grain and straw yields at 50% GR (3.25 and 3.87 t/ha) and 100% GR (3.77and 4.59 t/ha) increased over control without gypsum amendment (2.19 and 2.56 t/ha). The highest grain yields of 3.76, 3.65, 3.64, 3.58 and 3.53 t/ha were observed with SRL-3, SRL-2, RMS-1, SRL-1 and MTP-1, respectively under recommended NPK + 100% GR fertilization. Straw yield (4.16 -4.48 t/ha) also followed similar trends as grain yields. The same genotypes recorded the highest yields in unamended sodic soils of Kanpur (2.62-2.81t/ha).

Among the 26 genotypes (Table 5.3.3) evaluated at Mandya, MTP-1 (7.42 t/ha), Varadhan (7.17 t/ha), VR-181 (6.87 t/ha), KRH-4 (6.72 t/ha), and RMS-5 (6.59 t/ha) produced the highest yields. The straw yields generally followed the grain yield trends.

The genotypes viz., GPV 2 (3.92 t/ha), GPV 1 (3.79 t/ha), GPV 3 (3.76 t/ha), SRL 1 (3.5 t/ha) and CNN 2 (3.45 t/ha) recorded highest grain yields in sodic soils of Pusa (Table 5.3.6). The highest straw yields were observed in GPV 1 (5.48 t/ha), SRL 1 (5.48 t/ha), GPV 2 (5.32 t/ha), GPV 3 (4.87 t/ha), MTU 1010 (4.75 t/ha) and CNN 2 (4.65 t/ha) genotypes.

Nutrient uptakes (kharif 2019)

Nutrient uptake varied significantly between genotypes at Faizabad (Table 5.3.8). The genotypes that recorded the highest N uptake were RMS -7 (131.51kg N/ha), RMS -8 (128.86 kg N/ha) and RMS -2 (126.08 kg N/ha), while RMS -7 (50.2 kg P/ha), RMS -2 (45.93 kg P/ha), RMS -6 (43.13 kg P/ha) and RMS -2 (91.58 kg K/ha), RMS -7 (87.38 kg K/ha), RMS -6 (77.71 kg K/ha) showed the highest P and K uptake

Gypsum application and varietal differences contributed to the differences in nutrient uptake observed at Kanpur (Table 5.3.7). Gypsum applied at 50% GR and 100% GR rates in addition to the recommended doses of NPK increased nitrogen uptake (75.46 and 89.73 kg/ha respectively), phosphorus uptake (18.87 and 21.70 kg/ha respectively) potassium uptake (75.43 and 89.21 kg/ha respectively) and zinc uptake (41.41 and 41.75 g/ha respectively) compared to the control that received only NPK fertilization (N, P, K and Zn uptake of 49.93, 11.61, 49.52 kg/ha and 41.03 g/ha respectively). The genotype SRL-3 at 100% GR application, exhibited the highest N, P and K uptake of 112.96 kg N/ha, 28.97 kg P/ha, 111.41 kg K/ha and 42.98 g Zn//ha.

At Mandya, significant differences were observed among genotypes in nutrient uptake. The highest N, P and K uptake was observed in the genotype MTP-1 with values of 145.39, 23.08 and 163.60 8. kg/ha respectively. (Table 5.3.8).

Post harvest soil characteristics

Available N, P and K status (Table 5.3.9) of the soils at Mandya did not show significant differences due to cultivation of different genotypes, although an increase was observed compared to initial soil availability. No changes in pH and ESP (%) were observed at Mandya while marginal improvement in OC% and EC were observed after cultivation of 26 genotypes (Table 5.3.9). Soil OC% and pH did not vary significantly due to genotypes at Pusa (Table 5.3.9).

To summarize, gypsum application in conjunction with NPK fertilization improved rice yields at Kanpur. The genotypes SRL-3, SRL-2, RMS-1, SRL-1 and MTP-1 produced the highest grain yields of 3.53 -3.76 t/ha, at Kanpur, under recommended NPK + 100% GR fertilization. Under native sodic conditions without gypsum amendment, the yields were higher in the following genotypes viz., SRL-3 (2.81 kg/ha), SRL-2 (2.7 kg/ha), RMS-1 (2.7 kg/ha) and SRL-1 (2.67 kg/ha) and MTP-1 (2.62 kg/ha). In unamended native sodic soils of Faizabad, the genotypes that produced the highest yields were recorded in RMS -2, RMS -7, RMS -6, RMS -8 and SRL -1 (5.06-6.5 t/ha). The genotypes MTP-1, Varadhan, VR-181, KRH-4 and RMS-5 exhibited better tolerance to sodicity at Mandya compared to other genotypes as demonstrated by their significantly higher yields (6.59-7.42 t/ha) without gypsum amendment. In Pusa, the genotypes GPV 2, GPV 1, GPV 3 SRL 1 and CNN 2 demonstrated tolerance to sodicity with yields ranging from 3.45 t/ha-3.92 t/ha.

Table 5.3.1 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS -Soil and Crop Characteristics

Parameter	**Faizabad**	**Kanpur**	**Mandya**	**Pusa**
Cropping system	**Rice- Wheat**	**Rice - Wheat**	**Rice**	**Rice**
Variety				
Kharif (Rice)	25	25	26	25
Rabi (Wheat)	-	PBW-343	-	-
Kharif RFD (Kg NPKZn/ ha)	120:60:60:25	150:60:40:50	125:50:50:40	120:60:40:25
Gypsum requirement	-	16.0 t ha^{-1}		
% Clay	21	17	54.32	17.5
% Silt	55	34	31.42	31
% Sand	24	49	14.26	51.5
Soil Texture	Silty Clay	Clay Loam	Clay	Sandy loam
pH (1:1)	9.5	10.0	9.36	8.49
Organic carbon (%)	0.39	0.22	0.479	0.65
CEC [c mol(p^+)/kg]		12.57	36.4	-
EC (dS/m)	2.86	0.94	0.614	0.14
ESP (%)			28.95	
Available N (kg/ha)	215	146.8	347.5	197
Available P_2O_5 (kg/ha)	23.5	29.5	26.8	38
Available K_2O (kg/ha)	235.5	245.7	214.7	211
DTPA Zn (mg/kg)	-	0.23		0.48
Bulk density	-	1.44 mg m^{-3}		

Table 5.3.2 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS, *(Kanpur- Rabi 2018-19)* - Grain and Straw Yield of Rabi Wheat

Gypsum Req.	Grain yield (t/ha)	Straw yield (t/ha)
T1-No amendment	1.56	1.83
T2- 50% GR	3.10	3.68
T3- 100% GR	4.18	5.01

***T1-No amendment;T2- 50% GR; T3- 100% GR**

Table 5.3.3 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS Yield and yield parameters (Kharif 2019)

Variety/ Gypsum requirement	Faizabad				Mandya				
	Tillers/ m^2	Panicles /m^2	Grain yield (t/ha)	Straw yield (t/ha)	Tillers/m^2	Panicles/m^2	1000 grain weight(g)	Grain yield (t/ha)	Straw yield (t/ha)
	T1*	T1*	T1*	T1*	T1*	T1*	T1*	T1*	T1*
RMS -1	272	268	2.47	2.74	438	395	20.16	5.88	6.28
RMS -2	323	320	6.50	7.38	652	587	17.32	4.28	6.41
RMS -3	295	290	5.04	5.40	384	346	24.40	4.10	5.44
RMS -4	173	169	1.87	2.31	498	449	20.40	6.39	6.89
RMS -5	233	229	3.32	3.83	380	342	22.67	6.59	7.68
RMS -6	337	333	6.07	6.80	285	257	21.97	5.49	7.51
RMS -7	352	349	6.33	7.16	346	312	22.29	5.17	7.48
RMS -8	353	349	6.04	6.85	404	364	21.34	5.10	7.61
GPV -1	323	319	4.94	5.80	572	515	19.53	4.96	6.57
GPV -2	315	311	5.03	5.66	514	463	18.29	3.76	5.58
GPV -3	285	279	4.83	5.50	485	437	19.62	4.20	5.70
PUP -221	263	258	4.14	4.76	432	389	27.40	6.59	5.51
KRH -4	292	288	4.66	5.24	384	346	19.08	6.72	7.22
MTP -1	221	217	3.25	3.88	564	508	24.32	7.42	8.20
VR -181	244	242	4.23	4.88	512	461	25.33	6.87	6.94
PS -344	326	322	4.79	5.39	317	286	24.66	5.95	6.41
SRL -1	344	339	5.06	5.73	421	379	23.26	6.01	5.49
SRL -2	234	229	4.25	4.60	486	438	20.52	5.05	6.22
SRL -3	223	219	3.18	3.65	462	416	22.99	5.76	7.06
Varadhan	200	195	2.70	2.95	525	473	24.38	7.17	8.07
Rasi	205	200	2.42	2.80	402	362	23.13	6.05	6.38
MTU -1010	249	244	3.84	4.54	450	405	27.99	6.11	7.74
CSR -23	226	221	2.57	2.90	464	418	26.74	6.07	6.92
CNN -1	237	233	2.17	2.44	414	373	18.47	5.89	6.97
CNN -2	179	173	2.05	2.30	453	408	23.07	5.46	5.41
IR-30864					455	410	24.18	5.71	6.01
Mean	268	264	4.07	4.62	450	405	22.44	5.72	6.68
CD (0.05)	13.14	13.17	0.26	0.31	57.90	53.8	3.57	1.26	1.21
CV %	3.48	3.55	4.50	4.78	6.25	6.44	7.73	10.71	8.80

***T1-No amendment**

Table 5.3.4 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS - *(Kanpur- Kharif 2019)*

Yield Parameters

	Panicles /m^2				Panicle wt (g)			
Variety/ Gypsum requirement	**T1***	**T2**	**T3**	**Mean**	**T1***	**T2**	**T3**	**Mean**
SRL-3	458	506	554	506	1.30	1.65	1.81	1.59
SRL-2	441	487	544	491	1.29	1.65	1.81	1.58
RMS-1	442	492	539	491	1.29	1.64	1.80	1.58
SRL-1	439	482	532	485	1.29	1.64	1.80	1.57
MTP-1	432	475	524	477	1.28	1.64	1.79	1.57
PS-344	425	474	525	475	1.28	1.63	1.79	1.57
Rasi	421	475	515	470	1.28	1.63	1.78	1.56
RMS-6	411	467	514	464	1.28	1.62	1.77	1.56
GPV-2	425	462	503	464	1.27	1.62	1.77	1.55
Varadhan	394	451	489	445	1.27	1.61	1.77	1.55
CNN-1	401	446	479	442	1.27	1.61	1.76	1.54
PYP-221	392	442	471	435	1.26	1.60	1.75	1.54
RMS-4	391	434	455	427	1.26	1.60	1.77	1.54
GPV-3	350	431	443	408	1.26	1.60	1.76	1.54
RMS-2	352	431	435	406	1.26	1.59	1.76	1.53
RMS-5	330	420	428	393	1.25	1.59	1.75	1.53
RMS-3	328	418	423	390	1.25	1.58	1.74	1.52
RMS-8	312	415	419	382	1.25	1.58	1.74	1.52
GPV-1	306	411	418	378	1.24	1.57	1.74	1.52
CNN-2	303	406	413	374	1.24	1.57	1.73	1.51
KRH-4	266	388	412	362	1.24	1.57	1.73	1.51
VR-181	293	382	410	357	1.23	1.56	1.72	1.50
RMS-7	287	380	403	355	1.23	1.56	1.71	1.50
CSR-23	290	373	400	354	1.23	1.56	1.71	1.50
MTU-1010	278	367	382	342	1.22	1.55	1.70	1.49
Mean	367	437	465	423	1.26	1.60	1.76	1.54
CD (0.05)								
Main	6.17				0.002			
Sub	13.78				0.002			
Main x Sub	23.86				0.003			
Sub x Main	24.12				0.004			
CV %								
Main	3.22				0.29			
Sub	3.50				0.15			

***T1-No amendment, T2- 50% GR , T3- 100% GR**

Table 5.3.5 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS -(Kanpur- *Kharif 2019)*

Grain and Straw Yield

	Grain yield (t/ha)				Straw Yield (t/ha)			
Variety/ Gypsum requirement	**T1***	**T2**	**T3**	**Mean**	**T1***	**T2**	**T3**	**Mean**
SRL-3	2.81	3.86	4.62	3.76	3.26	4.63	5.54	4.48
SRL-2	2.70	3.71	4.54	3.65	3.13	4.45	5.40	4.33
RMS-1	2.70	3.75	4.47	3.64	3.13	4.46	5.36	4.32
SRL-1	2.67	3.66	4.40	3.58	3.11	4.38	5.28	4.26
MTP-1	2.62	3.59	4.38	3.53	3.05	4.29	5.13	4.16
PS-344	2.58	3.58	4.32	3.49	3.00	4.28	5.18	4.15
Rasi	2.54	3.58	4.23	3.45	2.97	4.28	5.07	4.11
RMS-6	2.47	3.51	4.20	3.40	2.89	4.21	5.04	4.05
GPV-2	2.45	3.47	4.11	3.34	2.86	4.14	4.93	3.98
Varadhan	2.37	3.38	3.98	3.24	2.76	4.02	4.78	3.85
CNN-1	2.39	3.35	3.89	3.21	2.81	3.96	4.67	3.81
PYP-221	2.34	3.30	3.78	3.14	2.73	3.92	4.61	3.76
RMS-4	2.30	3.24	3.69	3.08	2.75	3.84	4.50	3.70
GPV-3	2.08	3.20	3.57	2.95	2.43	3.80	4.36	3.53
RMS-2	2.00	3.19	3.50	2.90	2.45	3.79	5.27	3.84
RMS-5	1.97	3.10	3.47	2.85	2.30	3.69	4.16	3.38
RMS-3	1.94	3.08	3.40	2.81	2.27	3.66	4.12	3.35
RMS-8	1.85	3.05	3.38	2.76	2.16	3.63	4.05	3.28
GPV-1	1.81	3.00	3.35	2.72	2.12	3.57	4.04	3.24
CNN-2	1.79	2.97	3.30	2.69	2.09	3.52	3.98	3.20
KRH-4	1.76	2.82	3.26	2.61	2.05	3.35	3.98	3.13
VR-181	1.72	2.78	3.23	2.58	2.01	3.30	3.94	3.08
RMS-7	1.68	2.74	3.17	2.53	1.97	3.26	3.87	3.03
CSR-23	1.65	2.71	3.12	2.49	1.92	3.22	3.84	2.99
MTU-1010	1.61	2.65	2.99	2.42	1.91	3.16	3.64	2.90
Mean	2.19	3.25	3.77	3.07	2.56	3.87	4.59	3.67
CD (0.05)								
Main	0.03				0.12			
Sub	0.08				0.21			
Main x Sub	0.14				0.37			
Sub x Main	0.14				0.38			
CV %								
Main	2.44				7.11			
Sub	2.92				6.21			

***T1-No amendment, T2- 50% GR , T3- 100% GR**

Table 5.3.6 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS - *(Pusa- Kharif 2019)*

Yield and Yield Parameters

Variety/ Gypsum requirement	Tillers/m^2	Filled grains/panicle	1000 grain weight(g)	Grain yield (t/ha)	Straw yield (t/ha)
	T1*	T1*	T1*	T1*	T1*
GPV 1	12	79	23.25	3.79	5.48
GPV 2	14	93	24.26	3.92	5.32
GPV 3	13	48	23.34	3.76	4.87
SRL 3	11	50	22.07	3.35	4.42
RMS 4	9	59	20.01	2.74	4.14
RMS 5	8	102	19.35	2.61	3.74
CSR 23	8	66	24.55	2.51	3.33
KRH 4	8	97	21.85	3.01	4.34
Rasi	7	53	23.27	1.79	3.06
Varadhan	9	137	22.44	2.87	3.75
RMS 6	9	76	25.00	2.60	4.17
RMS 7	11	108	19.27	3.13	4.62
RMS 8	8	53	23.09	3.19	3.64
PVP 221	8	63	22.92	2.86	3.62
RMS 3	12	45	19.83	2.56	3.69
MTU 1010	9	73	24.22	3.10	4.75
CNN 1	9	84	19.97	2.94	4.59
CNN 2	9	81	23.47	3.45	4.65
VR 181	10	76	23.14	2.29	3.41
RMS 2	10	77	17.70	2.92	3.75
SRL 1	9	124	19.97	3.50	5.48
RMS 1	9	52	28.26	2.22	3.23
PS 344	10	86	18.83	2.98	4.65
MTP 1	9	45	18.29	2.52	3.60
SRL 2	8	63	20.04	2.16	3.28
Mean	10	76	21.94	2.91	4.14
CD (0.05)	2.84	2.93	1.64	1.16	1.57
CV %	18.10	2.36	4.56	24.27	23.02

***T1-No amendment**

Table 5.3.7 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS – *(Kanpur -Kharif 2019)* N, P, K, Zn Uptake

Variety/ GR	N uptake (kg/ha)				P uptake (kg/ha)				K uptake (kg/ha)				Zn uptake (g/ha)			
	T1*	**T2**	**T3**	**Mean**	**T1***	**T2**	**T3**	**Mean**	**T1***	**T2**	**T3**	**Mean**	**T1***	**T2**	**T3**	**Mean**
SRL-3	65.57	93.18	112.96	90.57	15.82	24.34	28.97	23.44	64.48	92.37	111.41	89.42	41.91	42.46	42.98	42.45
SRL-2	62.82	89.31	110.23	87.45	15.11	23.22	28.17	22.17	61.87	88.69	107.92	86.16	41.84	42.36	42.84	42.35
RMS-1	62.63	89.64	108.47	86.91	15.01	23.26	27.58	21.95	61.71	88.91	107.21	85.95	41.78	42.27	42.77	42.27
SRL-1	61.86	87.47	106.55	85.30	14.82	22.49	26.92	21.41	61.01	86.97	105.39	84.46	41.71	42.19	42.65	42.18
MTP-1	60.45	85.56	104.60	83.53	14.42	21.92	26.35	20.89	60.72	85.16	102.65	82.84	41.55	42.09	42.55	42.06
PS-344	59.36	84.91	103.90	82.72	14.05	21.63	25.94	20.54	58.68	84.66	102.86	82.07	41.48	42.01	42.45	41.98
Rasi	58.70	84.65	101.38	81.58	13.83	21.44	25.19	20.15	57.88	84.52	100.39	80.93	41.42	41.92	42.33	41.89
RMS-6	56.99	82.81	100.49	80.10	13.36	20.94	24.84	19.71	56.23	82.84	99.50	79.52	41.36	41.82	42.22	41.80
GPV-2	56.24	81.39	97.85	78.49	13.18	20.45	24.14	19.26	55.60	81.36	96.92	77.96	41.28	41.73	42.12	41.71
Varadhan	54.12	78.94	94.60	75.88	12.62	24.11	23.12	19.95	53.48	78.81	93.70	75.33	41.22	41.65	42.00	41.62
CNN-1	54.78	77.70	92.13	74.87	12.83	19.41	22.40	18.21	54.29	77.37	91.31	74.32	41.16	41.57	41.92	41.55
PYP-221	53.38	76.52	89.93	73.27	12.40	18.90	21.74	17.68	52.78	76.39	89.73	72.97	41.09	41.48	41.80	41.46
RMS-4	52.79	74.82	87.38	71.66	12.19	18.44	21.03	17.22	52.77	74.72	87.20	71.57	41.02	41.40	41.71	41.38
GPV-3	47.18	73.77	84.47	68.48	10.92	18.09	20.19	16.40	46.82	73.75	84.29	68.29	40.95	41.32	41.62	41.30
RMS-2	46.15	73.30	92.45	70.63	10.58	17.88	21.17	16.55	46.53	73.34	97.94	72.60	40.90	41.24	41.51	41.22
RMS-5	44.30	71.04	80.87	65.40	10.15	17.25	19.15	15.52	43.91	71.13	80.22	65.09	40.80	41.15	41.41	41.12
RMS-3	43.59	70.26	79.41	64.42	9.96	16.96	18.72	15.22	43.26	70.52	78.98	64.26	40.75	41.06	41.30	41.04
RMS-8	41.42	69.52	78.36	63.10	9.41	16.75	18.34	14.83	41.12	69.65	77.54	62.77	40.70	40.98	41.20	40.96
GPV-1	40.39	68.08	77.76	62.08	9.15	16.33	18.08	14.52	40.14	68.29	77.04	61.82	40.62	40.89	41.09	40.87

CNN-2	39.79	67.05	76.35	61.07	8.99	15.98	17.66	14.21	39.51	67.34	75.71	60.85	40.55	40.81	41.00	40.79
KRH-4	39.06	63.48	75.57	59.37	8.77	15.03	17.34	13.72	38.79	63.86	75.21	59.29	40.48	40.73	41.88	41.03
VR-181	38.03	62.40	74.63	58.36	8.52	14.72	17.07	13.44	37.81	62.79	74.35	58.32	40.21	40.64	40.79	40.54
RMS-7	37.11	61.28	72.95	57.12	8.28	14.39	16.57	13.08	36.92	61.78	72.81	57.17	40.36	40.56	40.68	40.53
CSR-23	36.15	60.35	71.83	56.11	8.04	14.13	16.38	12.85	36.02	60.84	71.91	56.26	40.31	40.49	40.57	40.46
MTU-1010	35.52	59.03	68.24	54.26	7.84	13.78	15.62	12.41	35.60	59.60	68.14	54.45	40.21	40.40	40.47	40.36
Mean	49.93	75.46	89.73	71.71	11.61	18.87	21.7	17.39	49.52	75.43	89.21	71.38	41.03	41.41	41.75	41.39
CD (0.05)																
Main	1.40				0.45				1.94				0.10			
Sub	2.46				0.94				3.50				0.20			
MxS	4.27				1.63				6.07				0.34			
SxM	4.39				1.66				6.23				0.35			
CV % Main	4.30				5.76				6.00				0.54			
Sub	3.69				5.82				5.27				0.51			

***T1-No amendment, T2- 50% GR , T3- 100% G**

Table 5.3.8 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS

Nutrient Uptake (kg/ha)

Variety/ Gypsum requirement	Faizabad			Mandya		
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium
	T1*	T1*	T1*	T1*	T1*	T1*
RMS-1	39.40	15.43	26.86	111.81	18.10	130.12
RMS-2	126.08	45.93	91.58	94.02	14.81	127.44
RMS-3	95.02	32.60	59.39	86.36	13.76	109.59
RMS-4	31.54	10.87	22.28	122.39	18.73	143.50
RMS-5	65.84	24.79	46.02	131.12	20.10	150.74
RMS-6	110.70	43.13	77.71	113.92	18.25	150.02
RMS-7	131.51	50.20	87.38	114.27	17.68	148.78
RMS-8	128.86	40.69	75.33	111.68	17.99	149.62
GPV-1	99.51	36.29	68.18	102.93	16.98	129.85
GPV-2	99.33	35.82	68.36	84.06	12.64	111.74
GPV-3	97.63	35.35	61.96	88.17	13.98	111.80
PUP-221	82.43	31.28	52.78	114.64	18.60	118.64
KRH-4	95.74	33.56	64.54	130.60	21.35	144.41
MTP-1	57.80	22.09	39.04	145.39	23.08	163.60
VR-181	83.31	30.79	62.34	128.96	20.68	144.60
PS-344	92.68	33.03	59.73	111.97	18.08	129.17
SRL-1	94.13	35.51	56.96	108.53	16.09	112.64
SRL-2	83.23	28.12	50.76	101.33	15.87	125.36
SRL-3	55.42	21.11	35.12	115.45	17.94	138.69
Varadhan	46.45	17.97	31.22	141.95	23.22	163.20
Rasi	41.86	15.86	27.76	114.51	17.87	127.05
MTU-1010	77.49	30.53	54.63	125.52	19.45	157.56
CSR-23	54.95	21.19	32.63	119.14	18.36	136.91
CNN-1	39.61	15.35	24.93	116.89	17.48	142.44
CNN-2	35.21	13.67	22.66	101.78	16.94	108.80
IR-30864				107.46	17.21	123.31
Mean	78.63	28.84	52.00	113.26	17.89	134.60
CD (0.05)	8.67	4.92	6.74	17.02	2.98	21.49
CV %	7.82	12.10	9.20	7.30	8.10	7.75

***T1-No amendment**

Table 5.3.9 Screening of Germplasm for Sodicity and Management of Sodic Soils in RBCS - Post Harvest Soil Characteristics

Variety/ Gypsum requirement	Mandya							Pusa	
	Available Nitrogen	Available Phosphorus	Available Potassium	OC(%)	pH	EC(dS/m)	ESP (%)	OC(%)	pH
	T1*	T1*	T1*	T1*	T1*	T1*	T1*	T1*	T1*
RMS-1	361.30	35.40	225.65	0.49	9.19	0.53	26.41	0.47	9.19
RMS-2	370.55	36.40	226.65	0.49	9.24	0.43	27.36	0.47	9.37
RMS-3	364.15	35.65	227.35	0.49	9.20	0.53	25.53	0.49	9.29
RMS-4	367.25	36.40	225.70	0.49	9.24	0.50	27.83	0.48	9.35
RMS-5	366.10	36.15	226.45	0.49	9.28	0.50	26.51	0.49	9.26
RMS-6	362.05	37.40	227.70	0.48	9.23	0.59	26.54	0.47	9.35
RMS-7	360.45	35.15	225.80	0.49	9.20	0.54	25.36	0.46	9.27
RMS-8	357.00	35.70	226.75	0.49	9.19	0.48	27.02	0.48	9.16
GPV-1	368.60	36.65	224.75	0.49	9.26	0.46	27.06	0.48	9.28
GPV-2	366.80	37.60	225.55	0.49	9.26	0.43	26.22	0.47	9.24
GPV-3	371.05	38.50	227.35	0.49	9.29	0.43	26.29	0.49	9.34
PUP-221	367.45	36.45	225.70	0.49	9.25	0.47	27.67	0.48	9.39
KRH-4	360.60	37.50	227.70	0.49	9.25	0.49	27.17	0.46	9.11
MTP-1	367.85	31.75	228.50	0.49	9.18	0.52	26.90	0.46	9.27
VR-181	365.75	32.60	225.65	0.49	9.24	0.49	25.91	0.48	9.43
PS-344	361.10	31.80	226.65	0.49	9.23	0.51	25.74	0.47	9.24
SRL-1	360.10	32.75	228.55	0.49	9.29	0.43	25.74	0.50	9.30
SRL-2	367.65	36.15	226.10	0.49	9.28	0.49	25.88	0.47	9.34
SRL-3	360.80	36.95	224.75	0.49	9.27	0.46	27.58	0.47	9.03
Varadhan	365.95	36.55	225.55	0.49	9.20	0.47	25.83	0.47	9.37
Rasi	367.20	37.55	225.80	0.48	9.19	0.49	26.64	0.49	9.42
MTU-1010	374.85	38.70	226.75	0.49	9.25	0.53	26.93	0.48	9.44
CSR-23	365.60	34.85	227.50	0.49	9.20	0.47	27.81	0.46	9.07
CNN-1	362.70	35.80	226.55	0.48	9.25	0.47	25.59	0.48	9.25
CNN-2	358.40	32.55	227.35	0.49	9.25	0.50	26.98	0.47	9.07
IR-30864	365.40	33.70	225.70	0.48	9.20	0.46	25.94		
Mean	364.87	35.640	226.48	0.49	9.23	0.49	26.55	0.48	9.27
CD (0.05)	NS	NS	NS	0.002	NS	0.04	NS	NS	NS
CV %	1.82	6.77	0.70	0.24	0.48	3.89	3.99	5.90	2.38

***T1-No amendment**

5.4 Screening of rice genotypes for tolerance to soil acidity

Acid soils are wide spread in Eastern, North Eastern and coastal regions of the Indian Peninsula. These soils are poor in soil fertility and are associated with toxicity of iron in lowlands, aluminum in the uplands, with depletion of Ca, Mg and K, deficiency of B, Mo and Si. The soils also fix large quantities of soluble P which lead to sub optimal productivity of crops. Management options include using amendments such as lime and growing acid tolerant genotypes to stabilize rice productivity. The trial was, therefore, conducted at four centres *viz.,* Moncompu (Kuttanad, Kerala), Ranchi (Dumka, Jharkhand), and Titabar (Assam) under low land conditions and at Hazaribagh (Jharkhand), under upland conditions during *kharif* 2019, screening between 14-23 genotypes at different centers. The results are presented in Tables 5.5.1 – 5.5.13.

Yield Parameters

Liming did not significantly influence crop characteristics (Days to 50% flowering and Toxicity score) and yield parameters at Hazaribagh and Moncompu (Table 5.4.2-5.4.4) though significant genotypic differences were observed at the centers. At Hazaribagh, the highest grains per panicle was observed in PS-344, GPV-1 and MTP-1 (84.67 -123.3) and the lowest number of chaffy grains in recorded in PUP-221,SRL-2 and SRL-3 (15.6 -22). The highest grains per panicle was observed in the genotypes RMS 7, RMS 4 and KRH 4 (220 - 225) and the lowest number of chaffy grains were recoreded with RMS 1, RMS 6 and GPV 1 (10.5 -14.33) at Moncompu.

Grain and straw yields

Grain yields at Harizibagh and Moncompu were not influenced by liming (Table 5.4.5-5.4.6). The highest grain yields at Harizibagh was observed in PUP-221, SRL-3, PS-344, SRL-2 and MTP-1 with grain yields of 2.43, 2.4, 2.33, 2.1 and 2t/ha while at Moncompu, the genotypes with higher grain yields were RMS 4 (9.48 t/ha), KRH 4 (8.28 t/ha), RMS 5 (7.68 t/ha), PS 344 (7.63 t/ha) and RMS 1 (7.62 t/ha). Lime application significantly influenced the grain yields at Ranchi and Titabar (Table 5.4.7-5.4.8) by enchancing the yields by 12.48% and 19.11% over unlimed control treatment. The genotypes with highest grain yield due to liming at Ranchi were RMS-4, GPV-1, RMS-5, Varadhan and RMS-1 with yields of 7.67, 7.62, 7.59, 7.5 and 7.3 t/ha respectively. Among the 14 genotypes evaluated, the genotypes RMS-4 (6.99 t/ha), RMS-5 (6.94 t/ha), RMS-1(6.87 t/ha), GPV-2(6.86 t/ha) and GPV-1(6.23 t/ha) recorded the highest grain yields in unlimed soils of Ranchi. The genotypes KRH-4, Varadhan, RMS-8, GPV-3 and MTP-1 recorded the highest yields due to liming (4.63, 4.5, 4.43, and 4.4 t/ha respectively) in Titabar. The genotypes that yielded higher in the unlimed acid soils of Titabar were PUP-221 (4 t/ha), Varadhan (3.97 t/ha), RMS-1 (3.9 t/ha), MTP-1 (3.9 t/ha) and GPV-1 (3.87 t/ha).

Nutrient uptakes

N, P and K uptake by crop at Titabar significanlty increased by 27.7%, 31.9% and 32.5% respectively due to supplementation of lime along with recommended NPK (Table 5.4.9). Genotypic differences were also observed for nutrient uptake at Titabar. Similarly, recommended NPK + liming also increased the grain Fe and Zn content by 40.4% and 8.3% respectively (Table 5.4.10).

Post harvest soil characteristics

Post harvest soil characteristics viz., available P, K, S, Fe, Zn, B, pH and OC% was not significantly influenced by liming and genotypes at Moncompu (Table 5.4.11-5.4.13).

Summary

The genotypes which performed better with yields ranging from 2-2.43 t/ha in unlimed acid soils of Harizibagh were: PUP-221, SRL-3, PS-344, SRL-2 and MTP-1. At Moncompu, RMS 4, KRH 4, RMS 5, PS 344 and RMS 1 recorded comparitively higher yields in unlimed tereatment (9.48 t/ha, 8.28 t/ha, 7.68 t/ha, 7.63 t/ha and 7.62 t/ha respectively). The highest grain yields at Ranchi in the treatment without liming was observed in RMS-4, RMS-5, RMS-1, GPV-2 and GPV-1 (6.99 t/ha , 6.94 t/ha, 6.87 t/ha , 6.86 t/ha) and 6.23 t/ha respectively). At Titabar, the genotypes with high yields in the treatment without liming and with recommended NPK alone were PUP-221, Varadhan, RMS-1, MTP-1, and GPV-1 (3.87 t/ha - 4t/ha). A 12.48% and 19.11% increase in yields were observed at Ranchi and Titabar due to liming. The genotypes responsive to liming at Ranchi were RMS-, GPV-1, RMS-5, Varadhan and RMS-1 with yields in the range of 7.3-7.67 t/ha, while the highest yields of 4.63, 4.5, 4.43, and 4.4 t/ha, respectively, were recorded in the genotypes KRH-4, Varadhan, RMS-8, GPV-3 and MTP-1due to liming in Titabar.

Table 5.4.1 Screening of rice genotypes for tolerance to soil acidity (*kharif* 2019)

Soil and Crop data

Parameters	**Hazaribagh**	**Moncompu**	**Ranchi (Dumka)**	**Titabar**
Number of varieties evaluated	20	23	14	20
Treatments	• NPK (RD) • NPK (RD) + Lime@ 5 Q/ha	• NPK (RD) • NPK (RD) + Lime@ 6Q /ha	• NPK (RD) • NPK (RD) + Lime @ 4 Q/ha	• NPK (RD) • NPK (RD) + Lime @ 1t/ha • N (RD) + double PK
Rec. fert. Dose (kg N,P_2O_5 and K_2O/ha)	60-30-30	90-45-45	100-50-25	40-20-40
Soil				
% Clay			23	42
% Silt			34	28.5
% Sand			43	29.5
Soil texture			-	Silty clay
pH	4.8	4.3	5.2	5.2
Org.carbon (%)	0.4	3.73	0.65	1.05
CEC (me/100g)			16	
EC ds/m			-	0.05
Avail.N (kg/ha)			320	405
Avail. P_2O_5 (kg/ha)		19.09	28.4	18
Avail. K_2O (kg/ha)		218.4	185	145
Avail.S (mg/kg)				12
DTPA –Zn (mg/kg)				0.9
DTPA –Fe (mg/kg)				28.5
DTPA –Mn (mg/kg)				12.5
DTPA –Cu (mg/kg)				
1 M HCl –Zn (mg/kg)		6.11		
1 M HCl –Fe (mg/kg)		452.6		
1 M HCl –Mn (mg/kg)		3.97		
1 M HCl –Cu (mg/kg)		0.379		

Table 5.4.2. Screening of rice genotypes for tolerance to soil acidity (Hazaribagh- *kharif* 2019)

Crop Characteristics

Variety	**Days to 50% flowering**			**Toxicity Score**		
	T1*	**T2**	**Mean**	**T1***	**T2**	**Mean**
RMS-1	106	104	105	3.67	3.33	3.50
RMS-2	116	116	116	3.00	4.00	3.50
RMS-3	99	97	98	3.67	3.33	3.50
RMS-4	117	113	115	2.33	3.33	2.83
RMS-5	119	117	118	2.67	4.00	3.33
RMS-6	118	118	118	2.33	3.33	2.83
RMS-7	118	118	118	2.67	3.33	3.00
RMS-8	116	116	116	2.67	3.67	3.17
GPV-1	92	98	95	2.67	4.00	3.33
GPV-2	116	116	116	3.67	4.33	4.00
GPV-3	118	117	117	2.67	4.00	3.33
PUP-221	80	81	81	4.33	4.33	4.33
KRH-4	100	116	108	4.00	3.33	3.67
MTP-1	87	84	85	3.67	3.00	3.33
VR-181	86	86	86	3.67	3.67	3.67
PS-344	86	87	87	4.33	3.67	4.00
SRL-1	97	97	97	3.00	3.67	3.33
SRL-2	78	76	77	4.67	3.33	4.00
SRL-3	72	78	75	5.00	3.67	4.33
Varadhan	91	96	93	3.67	3.00	3.33
Mean	101	102	101	3.42	3.62	3.52
CD (0.05)						
Main	NS			NS		
Sub	2.5			0.82		
Main x Sub	3.54			1.17		
Sub x Main	4.94			1.20		
CV%						
Main	5.06			16.21		
Sub	2.15			20.51		

T1=Recommended NPK, T2= Recommended NPK + Lime

Table 5.4.3. Screening of rice genotypes for tolerance to soil acidity (Hazaribagh- *kharif* 2019)

Yield Parameters

Variety	No of Grains/panicle			No of Chaff/panicle			1000 Grain weight (g)		
	T1*	**T2**	**Mean**	**T1***	**T2**	**Mean**	**T1***	**T2**	**Mean**
RMS-1	53.33	56.20	54.77	64.47	53.20	58.83	17.67	17.55	17.61
RMS-2	54.07	53.40	53.73	47.07	69.67	58.37	14.82	12.16	13.49
RMS-3	74.33	54.00	64.17	39.60	42.53	41.07	18.31	17.77	18.04
RMS-4	82.40	50.80	66.60	60.40	147.67	104.03	16.92	14.76	15.84
RMS-5	37.80	40.00	38.90	122.73	111.73	117.23	12.54	16.19	14.37
RMS-6	43.87	7.00	25.43	106.40	86.73	96.57	15.69	12.36	14.03
RMS-7	15.60	16.60	16.10	131.07	120.80	125.93	11.39	11.11	11.25
RMS-8	46.33	66.47	56.40	72.47	76.13	74.30	16.34	15.93	16.13
GPV-1	89.47	96.00	92.73	55.67	48.93	52.30	17.02	18.36	17.69
GPV-2	68.33	9.87	39.10	77.07	164.33	120.70	15.55	13.29	14.42
GPV-3	4.00	15.87	9.93	129.07	125.13	127.10	9.56	14.29	11.92
PUP-221	66.33	89.00	77.67	21.80	22.20	22.00	24.20	24.63	24.41
KRH-4	97.67	58.73	78.20	74.20	91.60	82.90	16.74	15.30	16.02
MTP-1	94.67	74.67	84.67	23.47	30.13	26.80	21.05	22.34	21.69
VR-181	62.00	82.00	72.00	32.20	22.27	27.23	21.41	22.16	21.79
PS-344	120.33	126.27	123.30	33.07	28.00	30.53	20.97	21.99	21.48
SRL-1	87.87	47.13	67.50	38.53	49.33	43.93	19.87	21.20	20.54
SRL-2	89.87	70.80	80.33	14.80	22.93	18.87	20.52	24.34	22.43
SRL-3	82.33	72.00	77.17	18.93	12.27	15.60	20.42	21.79	21.10
Varadhan	70.93	76.67	73.80	30.47	37.53	34.00	20.86	22.92	21.89
Mean	67.08	58.17	62.62	59.67	68.16	63.91	17.59	18.02	17.80
CD (0.05)									
Main	NS			NS			NS		
Sub	15.9			17.21			1.8		
Main x Sub	22.61			24.35			2.59		
Sub x Main	23.61			28.47			2.89		
CV%									
Main	20.26			36.31			11.71		
Sub	22.21			23.43			8.96		

T1=Recommended NPK, T2= Recommended NPK + Lime

Table 5.4.4 Screening of rice genotypes for tolerance to soil acidity (Moncompu- *kharif* 2019)

Yield Parameters

Variety	Grains/panicle			Chaff/panicle			Test weight of grain (g)		
	T1*	**T2**	**Mean**	**T1***	**T2**	**Mean**	**T1***	**T2**	**Mean**
RMS 1	160	190	175	14.33	6.67	10.50	2.20	2.20	2.20
RMS 2	115	241	178	15.00	22.00	18.50	1.77	1.81	1.79
RMS 3	119	166	142	16.67	16.67	16.67	2.23	2.05	2.14
RMS 4	207	235	221	18.00	18.67	18.33	2.19	1.89	2.04
RMS 5	200	189	195	15.33	15.67	15.50	2.44	2.29	2.37
RMS 6	188	203	196	12.33	16.00	14.17	2.38	2.29	2.33
RMS 7	225	226	225	19.67	14.67	17.17	2.47	1.99	2.23
RMS 8	170	222	196	21.00	19.00	20.00	2.14	2.26	2.20
GPV 1	206	168	187	13.67	15.00	14.33	1.96	2.36	2.16
GPV 2	159	189	174	24.00	25.33	24.67	2.01	2.12	2.06
GPV 3	174	196	185	35.33	45.00	40.17	1.94	2.01	1.97
PUP 221	168	161	165	24.00	27.33	25.67	2.27	2.19	2.23
KRH 4	211	229	220	15.67	37.00	26.33	1.94	2.02	1.98
MTP 1	122	212	167	16.67	23.33	20.00	2.35	2.50	2.43
VR 181	107	119	113	8.33	20.67	14.50	2.14	2.10	2.12
PS 344	121	145	133	10.00	27.33	18.67	2.45	2.17	2.31
SRL 1	144	156	150	14.00	19.00	16.50	2.33	2.51	2.42
SRL 2	155	116	136	23.67	24.67	24.17	2.20	2.19	2.20
SRL 3	115	84	99	11.33	22.00	16.67	2.40	2.09	2.24
Varadhan	116	140	128	20.00	18.67	19.33	2.48	2.85	2.67
Pratyasa	163	251	207	17.00	16.00	16.50	2.55	2.64	2.60
Uma	130	175	152	17.67	14.33	16.00	2.56	2.57	2.57
Pournami	136	157	147	11.67	8.67	10.17	2.46	2.46	2.46
Mean	157	181	169	17.19	20.59	18.89	2.25	2.24	2.25
CD (0.05)									
Main	NS			NS			NS		
Sub	52.4			13.3			0.32		
Main x Sub	NS			NS			NS		
Sub x Main	NS			NS			NS		
CV%									
Main	31.76			86.95			12.98		
Sub	27.02			61.37			12.36		

T1=Recommended NPK, T2= Recommended NPK + Lime

Table 5.4.5. Screening of rice genotypes for tolerance to soil acidity (Hazaribagh- *kharif* 2019)

Grain and Straw Yields

Variety	Grain yield (t/ha)			Straw yield (t/ha)		
	T1*	T2	Mean	T1*	T2	Mean
RMS-1	2.59	0.30	1.44	8.90	8.51	8.70
RMS-2	0.36	1.31	0.83	7.77	6.85	7.31
RMS-3	0.65	0.35	0.50	10.18	5.22	7.70
RMS-4	1.50	0.26	0.88	6.68	6.22	6.45
RMS-5	0.40	0.04	0.22	6.48	7.18	6.83
RMS-6	0.21	0.04	0.12	7.77	9.07	8.42
RMS-7	0.67	0.09	0.38	7.29	8.33	7.81
RMS-8	0.50	0.33	0.41	9.25	8.88	9.07
GPV-1	1.49	0.81	1.15	7.47	9.27	8.37
GPV-2	1.16	0.35	0.75	9.44	8.55	8.99
GPV-3	0.48	0.70	0.59	7.96	7.88	7.92
PUP-221	2.90	1.96	2.43	7.29	7.62	7.46
KRH-4	1.00	0.10	0.55	6.66	6.29	6.48
MTP-1	2.25	1.75	2.00	7.75	7.42	7.59
VR-181	1.48	1.30	1.39	10.58	8.99	9.79
PS-344	2.37	2.29	2.33	10.23	8.40	9.31
SRL-1	0.89	0.47	0.68	11.58	3.74	7.66
SRL-2	1.96	2.24	2.10	10.06	9.49	9.78
SRL-3	2.74	2.05	2.40	10.06	6.97	8.52
Varadhan	1.28	0.94	1.11	7.64	6.36	7.00
Mean	1.34	0.88	1.11	8.55	7.56	8.06
CD (0.05)						
Main	NS			NS		
Sub	0.42			1.62		
Main x Sub	0.60			2.30		
Sub x Main	0.77			2.57		
CV%						
Main	66.54			23.06		
Sub	32.93			17.55		

T1=Recommended NPK, T2= Recommended NPK + Lime

Table 5.4.6. Screening of rice genotypes for tolerance to soil acidity (Moncompu- *kharif* 2019)

Grain and Straw Yields

Variety	Grain yield (t/ha)			Straw yield (t/ha)		
	T1*	T2	Mean	T1*	T2	Mean
RMS 1	8.11	7.13	7.62	12.59	12.95	12.77
RMS 2	5.64	5.42	5.53	7.03	8.26	7.64
RMS 3	6.30	6.81	6.55	13.03	9.51	11.27
RMS 4	9.04	9.93	9.48	12.57	11.72	12.14
RMS 5	7.24	8.13	7.68	11.33	10.98	11.15
RMS 6	5.11	4.85	4.98	10.49	9.99	10.24
RMS 7	5.04	5.20	5.12	11.14	8.22	9.68
RMS 8	5.67	6.13	5.90	14.17	10.60	12.38
GPV 1	6.35	6.58	6.47	14.33	13.63	13.98
GPV 2	6.25	6.69	6.47	11.25	8.43	9.84
GPV 3	6.39	6.28	6.33	13.11	9.94	11.53
PUP 221	5.80	6.56	6.18	6.23	9.96	8.10
KRH 4	7.75	8.81	8.28	18.92	12.58	15.75
MTP 1	6.92	6.19	6.55	10.38	11.42	10.90
VR 181	6.19	5.54	5.87	8.18	6.33	7.25
PS 344	7.83	7.42	7.63	11.03	7.93	9.48
SRL 1	5.68	5.91	5.79	8.68	6.91	7.80
SRL 2	4.78	4.38	4.58	9.42	7.33	8.38
SRL 3	4.28	3.22	3.75	5.64	4.69	5.17
Varadhan	7.08	6.37	6.73	10.21	11.84	11.03
Pratyasa	7.19	7.34	7.27	12.76	10.60	11.68
Uma	7.64	6.23	6.94	12.49	14.41	13.45
Pournami	5.85	5.96	5.90	14.10	13.81	13.95
Mean	6.44	6.39	6.42	11.26	10.09	10.68
CD (0.05)						
Main	NS			NS		
Sub	1.55			3.8		
Main x Sub	NS			NS		
Sub x Main	NS			NS		
CV%						
Main	16.43			30.07		
Sub	21.03			31.04		

****T1=Recommended NPK, T2= Recommended NPK + Lime***

Table 5.4.7. Screening of rice genotypes for tolerance to soil acidity

(Ranchi -*kharif* 2019)

Grain and Straw Yields

Variety	Grain yield (t/ha)			Straw yield (t/ha)		
	T1*	T2	Mean	T1*	T2	Mean
RMS-1	6.87	7.30	7.08	7.90	8.29	8.10
RMS-2	5.18	6.40	5.79	5.29	6.67	5.98
RMS-3	5.46	6.52	5.99	5.76	6.74	6.25
RMS-4	6.99	7.67	7.33	7.23	7.90	7.56
RMS-5	6.94	7.59	7.27	7.47	7.94	7.71
GPV-1	6.23	7.62	6.92	6.64	8.39	7.51
GPV-2	6.86	7.27	7.06	9.12	10.10	9.61
GPV-3	6.02	6.31	6.16	8.79	9.40	9.09
PUP-221	5.28	5.78	5.53	7.57	8.67	8.12
KRH-4	4.90	5.04	4.97	5.53	5.66	5.60
MTP-1	4.79	5.68	5.23	5.13	6.07	5.60
PS-344	5.38	6.23	5.81	5.65	6.54	6.10
Varadhan	6.19	7.50	6.85	6.50	8.03	7.27
MTU 7029	4.86	5.28	5.07	5.01	5.44	5.23
Mean	5.85	6.58	6.22	6.69	7.56	7.12
CD (0.05)						
Main	0.55			0.69		
Sub	0.56			0.63		
Main x Sub	NS			NS		
Sub x Main	NS			NS		
CV%						
Main	9.37			10.27		
Sub	7.76			7.68		

T1=Recommended NPK, T2= Recommended NPK + Lime

Table 5.4.8. Screening of rice genotypes for tolerance to soil acidity (Titabar- *kharif* 2019)

Grain and Straw Yields

	Grain yield (t/ha)				Straw yield (t/ha)			
	T1*	**T2**	**T3**	**Mean**	**T1***	**T2**	**T3**	**Mean**
RMS-1	3.90	4.03	3.17	3.70	5.77	6.00	5.20	5.66
RMS-2	3.27	3.57	2.53	3.12	5.17	5.67	4.50	5.11
RMS-3	3.45	3.97	2.97	3.46	5.53	6.03	4.87	5.48
RMS-4	2.97	3.80	3.17	3.31	5.07	5.83	5.03	5.31
RMS-5	2.48	3.97	3.07	3.17	4.68	6.03	4.93	5.22
RMS-6	3.53	4.08	2.60	3.41	5.70	5.53	4.60	5.28
RMS-7	2.83	4.10	3.10	3.34	4.60	6.03	5.07	5.23
RMS-8	3.37	4.43	2.97	3.59	5.57	6.33	4.97	5.62
GPV-1	3.87	4.27	3.50	3.88	5.97	6.27	5.40	5.88
GPV-2	3.27	3.90	3.33	3.50	5.37	6.00	5.53	5.63
GPV-3	2.97	4.43	3.00	3.47	5.03	6.37	4.97	5.46
PUP-221	4.00	4.10	3.77	3.96	6.03	5.70	5.77	5.83
KRH-4	3.80	4.63	3.93	4.12	5.90	6.13	5.70	5.91
MTP-1	3.90	4.40	3.30	3.87	5.77	6.07	5.20	5.68
VR-181	2.70	3.83	3.37	3.30	4.73	5.77	5.27	5.26
PS-344	3.83	3.90	3.43	3.72	5.93	5.80	5.57	5.77
SRL-1	2.80	3.63	3.10	3.18	4.90	5.40	5.13	5.14
SRL-2	3.80	3.77	3.20	3.59	5.80	5.67	5.17	5.54
SRL-3	3.20	3.60	3.20	3.33	4.97	5.50	5.17	5.21
Varadhan	3.97	4.50	4.02	4.16	5.97	6.43	5.60	6.00
Mean	3.40	4.05	3.24	3.56	5.42	5.93	5.18	5.51
CD (0.05)								
Main	0.26				0.16			
Sub	0.32				0.35			
Main x Sub	0.56				0.61			
Sub x Main	0.60				0.61			
CV%								
Main	14.38				5.62			
Sub	9.74				6.82			

T1=Recommended NPK, T2= Recommended NPK + Lime, T3= Recommended N + double PK

Table 5.4.9. Screening of rice genotypes for tolerance to soil acidity (Titabar- *kharif* 2019)

Uptake of N, P and K

	Total N uptake (kg/ha)				Total P uptake (kg/ha)				Total K uptake (kg/ha)			
	T1*	T2	T3	Mean	T1*	T2	T3	Mean	T1*	T2	T3	Mean
RMS-1	52.40	58.79	40.36	50.52	8.65	9.94	8.59	9.06	66.99	69.81	51.33	62.71
RMS-2	47.27	55.61	31.35	44.74	8.40	9.28	7.05	8.24	56.85	68.48	42.38	55.90
RMS-3	54.84	58.77	33.29	48.97	7.68	10.77	8.36	8.94	63.22	72.54	47.30	61.02
RMS-4	48.53	60.46	36.98	48.66	7.10	9.88	8.99	8.66	55.27	66.07	52.21	57.85
RMS-5	39.97	60.43	35.87	45.42	6.61	10.44	9.37	8.81	51.83	72.27	49.52	57.87
RMS-6	51.79	61.90	31.98	48.56	8.69	10.48	7.90	9.03	57.85	67.43	47.41	57.56
RMS-7	41.54	71.08	38.33	50.32	6.78	10.98	9.43	9.07	46.29	74.50	50.53	57.10
RMS-8	50.24	72.80	37.91	53.65	7.74	11.41	9.28	9.48	54.50	76.40	46.88	59.26
GPV-1	59.15	69.61	42.48	57.08	9.00	11.37	11.10	10.49	57.78	80.02	53.77	63.86
GPV-2	49.93	64.73	41.84	52.17	8.64	10.07	9.40	9.37	53.40	74.67	52.34	60.13
GPV-3	46.58	74.08	37.24	52.63	7.52	11.43	10.01	9.65	48.54	80.02	52.19	60.25
PUP-221	57.56	67.61	43.96	56.38	9.68	11.44	12.46	11.19	58.57	72.85	61.00	64.14
KRH-4	54.89	71.34	49.24	58.49	9.13	12.33	13.74	11.74	58.78	76.40	63.93	66.37
MTP-1	55.45	69.28	40.78	55.17	9.81	12.68	10.30	10.93	59.95	80.20	57.81	65.99
VR-181	42.15	62.03	39.29	47.83	7.54	11.25	9.90	9.56	45.66	72.02	54.82	57.50
PS-344	59.02	65.25	45.12	56.46	10.16	12.31	10.07	10.85	60.53	73.85	62.88	65.76
SRL-1	44.42	58.79	41.84	48.35	7.38	8.66	9.48	8.50	47.26	69.28	54.27	56.94
SRL-2	55.89	60.68	40.36	52.31	9.58	11.34	10.64	10.52	58.77	71.77	52.09	60.87
SRL-3	47.84	58.22	42.86	49.64	7.71	10.17	10.95	9.61	48.17	68.92	52.09	56.39
Varadhan	60.49	77.85	52.89	63.75	10.04	15.07	15.02	13.38	62.53	86.62	65.93	71.69
Mean	51.00	64.97	40.20	52.05	8.39	11.07	10.10	9.85	55.64	73.71	53.53	60.96
CD (0.05)												
Main	2.86				0.70				2.46			
Sub	4.42				1.04				5.07			
Main x Sub	7.66				1.80				8.80			
Sub x Main	7.95				1.88				8.90			
CV%												
Main	10.83				13.94				7.97			
Sub	9.10				11.32				8.92			

T1=Recommended NPK, T2= Recommended NPK + Lime, T3= Recommended N + double PK

Table 5.4.10. Screening of rice genotypes for tolerance to soil acidity

(Titabar- *kharif* 2019)

Zn and Fe content in grain (g/ha)

	Zn				**Fe**			
	T1*	**T2**	**T3**	**Mean**	**T1***	**T2**	**T3**	**Mean**
RMS-1	71.60	83.20	53.90	69.57	996	975	796	922
RMS-2	59.10	82.50	41.93	61.18	763	835	643	747
RMS-3	58.97	86.03	56.43	67.14	829	913	742	828
RMS-4	50.63	89.73	57.50	65.96	751	886	794	810
RMS-5	48.77	78.20	53.37	60.11	632	954	807	798
RMS-6	70.40	80.12	47.50	66.01	940	899	656	831
RMS-7	53.30	84.73	47.63	61.89	709	964	776	816
RMS-8	66.03	101.90	52.43	73.46	883	1020	741	881
GPV-1	74.80	88.60	66.53	76.64	971	963	897	944
GPV-2	76.93	88.13	65.70	76.92	893	912	880	895
GPV-3	54.37	90.97	63.40	69.58	772	1055	777	868
PUP-221	67.20	90.60	73.87	77.22	1051	1001	976	1009
KRH-4	63.07	94.27	81.53	79.62	1011	1065	979	1018
MTP-1	62.77	95.23	56.30	71.43	972	995	795	921
VR-181	44.93	87.73	64.67	65.78	694	916	791	800
PS-344	55.10	94.60	56.20	68.63	1002	878	823	901
SRL-1	46.37	72.47	52.43	57.09	725	813	714	751
SRL-2	70.07	66.63	58.13	64.94	977	919	773	890
SRL-3	51.40	71.87	52.27	58.51	804	827	786	806
Varadhan	88.63	106.33	61.93	85.63	1037	1065	991	1031
Mean	61.72	86.69	58.18	68.87	870.51	942.59	806.77	873.29
CD (0.05)								
Main	3.08				63.05			
Sub	9.64				101.73			
Main x Sub	16.70				176.20			
Sub x Main	16.55				182.11			
CV%								
Main	8.83				14.24			
Sub	15.00				12.47			

T1=Recommended NPK, T2= Recommended NPK + Lime, T3= Recommended N + double PK

Table 5.4.11. Screening of rice genotypes for tolerance to soil acidity (Moncompu- *kharif* 2019)

Available P K and S status (kg/ha) after harvest

Variety	P			K			S		
	T1*	T2	Mean	T1*	T2	Mean	T1*	T2	Mean
RMS 1	7.79	6.28	7.03	460	331	396	24.64	27.20	25.92
RMS 2	11.12	8.47	9.79	383	354	368	22.67	27.55	25.11
RMS 3	8.01	7.04	7.53	524	387	456	22.32	20.42	21.37
RMS 4	15.20	8.65	11.92	436	429	432	26.44	19.31	22.88
RMS 5	7.49	7.26	7.37	504	378	441	31.39	29.21	30.30
RMS 6	6.73	7.94	7.34	461	417	439	19.31	28.45	23.88
RMS 7	6.13	8.32	7.22	570	462	516	22.24	27.86	25.05
RMS 8	10.59	10.59	10.59	446	363	405	27.17	21.43	24.30
GPV 1	5.94	12.78	9.36	343	408	376	30.14	30.57	30.35
GPV 2	13.01	11.57	12.29	439	379	409	21.35	30.73	26.04
GPV 3	9.53	8.17	8.85	504	364	434	22.42	27.37	24.90
PUP 221	6.35	8.40	7.38	345	362	353	21.87	27.44	24.66
KRH 4	9.45	8.85	9.15	436	311	373	25.26	24.78	25.02
MTP 1	7.26	9.39	8.33	387	380	384	17.44	29.35	23.40
VR 181	9.98	5.90	7.94	401	407	404	29.80	31.95	30.88
PS 344	10.06	10.59	10.32	473	380	426	26.65	28.34	27.50
SRL 1	7.18	10.44	8.81	432	439	435	20.59	26.61	23.60
SRL 2	7.94	7.56	7.75	545	330	438	18.55	28.03	23.29
SRL 3	9.30	8.39	8.85	431	454	443	20.97	31.04	26.01
Varadhan	8.17	8.85	8.51	391	354	373	32.63	28.52	30.58
Pratyasa	7.18	7.49	7.34	442	298	370	24.46	29.66	27.06
Uma	7.48	7.56	7.52	400	383	392	28.83	23.01	25.92
Pournami	8.25	11.80	10.02	453	455	454	27.41	27.96	27.69
Mean	8.70	8.79	8.75	444	384	414	24.55	27.25	25.90
CD (0.05)									
Main	NS			NS			NS		
Sub	NS			NS			NS		
Main x Sub	NS			NS			NS		
Sub x Main	NS			NS			NS		
CV%									
Main	96.45			48.51			44.56		
Sub	33.13			21.51			23.24		

T1=Recommended NPK, T2= Recommended NPK + Lime

Table 5.4.12. Screening of rice genotypes for tolerance to soil acidity (Moncompu- *kharif* 2019)

Available Fe, Zn and Boron (mg/kg)

Variety	Fe			Zn			B		
	T1*	T2	Mean	T1*	T2	Mean	T1*	T2	Mean
RMS 1	1171	956	1063	6.50	3.32	4.91	0.83	1.24	1.04
RMS 2	1010	833	921	6.13	4.81	5.47	1.15	1.08	1.12
RMS 3	1079	694	886	11.59	4.23	7.91	1.26	1.28	1.27
RMS 4	953	750	851	5.25	3.56	4.41	1.02	1.35	1.19
RMS 5	972	759	866	4.41	4.21	4.31	1.74	1.42	1.58
RMS 6	1024	683	853	7.00	3.35	5.18	2.04	1.55	1.79
RMS 7	690	821	756	7.41	4.94	6.18	1.28	1.62	1.45
RMS 8	1028	777	903	6.93	4.39	5.66	1.20	1.01	1.10
GPV 1	965	804	884	5.77	3.19	4.48	1.04	0.93	0.98
GPV 2	1103	756	929	5.72	5.11	5.42	1.11	1.60	1.35
GPV 3	1032	607	820	5.16	6.08	5.62	0.84	1.38	1.11
PUP 221	1233	717	975	4.18	3.31	3.75	1.04	1.39	1.21
KRH 4	987	766	876	6.26	3.86	5.06	1.31	1.36	1.33
MTP 1	834	885	859	5.17	3.88	4.53	0.98	1.25	1.11
VR 181	794	613	703	5.36	5.68	5.52	1.04	1.42	1.23
PS 344	738	874	806	5.04	5.39	5.22	0.69	1.49	1.09
SRL 1	932	929	930	6.78	7.89	7.34	0.76	1.11	0.94
SRL 2	1158	819	989	4.52	5.74	5.13	0.98	1.84	1.41
SRL 3	989	748	868	4.64	7.39	6.02	1.03	1.72	1.37
Varadhan	1111	679	895	5.55	5.61	5.58	0.80	1.37	1.08
Pratyasa	1073	805	939	6.62	5.57	6.10	1.53	1.32	1.42
Uma	896	935	915	6.05	4.56	5.30	1.46	1.56	1.51
Pournami	948	571	760	6.28	3.73	5.01	0.78	1.84	1.31
Mean	988	773	880	6.02	4.78	5.40	1.13	1.40	1.26
CD (0.05)									
Main	NS			NS			NS		
Sub	NS			NS			NS		
Main x Sub	NS			NS			NS		
Sub x Main	NS			NS			NS		
CV%									
Main	6.98			152.23			59.24		
Sub	21.14			35.55			36.97		

****T1=Recommended NPK, T2= Recommended NPK + Lime***

Table 5.5.13. Screening of rice genotypes for tolerance to soil acidity (Moncompu - *kharif* 2019)

Post harvest soil pH and Organic Carbon

Variety	pH			OC%		
	T1*	T2	Mean	T1*	T2	Mean
RMS 1	4.62	4.38	4.50	2.18	2.95	2.57
RMS 2	4.66	4.15	4.41	0.31	3.94	2.13
RMS 3	4.39	4.15	4.27	1.76	1.92	1.84
RMS 4	4.68	4.51	4.59	2.18	1.24	1.71
RMS 5	4.54	4.28	4.41	0.78	0.98	0.88
RMS 6	4.61	3.97	4.29	1.09	1.81	1.45
RMS 7	3.91	4.10	4.01	1.04	1.76	1.40
RMS 8	4.32	4.33	4.32	0.83	1.35	1.09
GPV 1	4.15	4.82	4.49	0.83	2.85	1.84
GPV 2	4.42	4.36	4.39	3.00	2.44	2.72
GPV 3	4.21	4.34	4.27	1.87	1.04	1.45
PUP 221	4.53	3.78	4.16	0.73	2.07	1.40
KRH 4	4.57	4.71	4.64	2.44	2.49	2.46
MTP 1	4.23	4.16	4.19	0.99	0.83	0.91
VR 181	4.16	4.32	4.24	1.04	0.88	0.96
PS 344	4.26	4.44	4.35	0.62	2.33	1.48
SRL 1	4.07	4.90	4.48	0.88	2.38	1.63
SRL 2	4.50	4.71	4.61	1.87	2.12	2.00
SRL 3	4.42	4.52	4.47	1.56	1.40	1.48
Varadhan	4.53	4.22	4.38	1.45	2.59	2.02
Pratyasa	4.38	4.42	4.40	1.66	2.90	2.28
Uma	4.56	4.43	4.50	2.02	3.63	2.82
Mean	4.40	4.37	4.39	1.39	2.13	1.76
CD (0.05)						
Main	NS			NS		
Sub	NS			NS		
Main x Sub	NS			NS		
Sub x Main	NS			NS		
CV%						
Main	28.60			22.14		
Sub	10.07			77.38		

5.5 Yield maximization in farmers' fields using Nutrient Expert software (*Kharif*)

Edaphic stresses constitute a set of factors within a group of abiotic stressors, which need specific address as the conventional blanket fertilizer recommendation causes low fertilizer use efficiency and imbalanced use of fertilizers where both deficit and excess nutrients pose problems. Added to that estimation of field specific fertilizer requirements needs site-specific knowledge of crop nutrient requirements, indigenous nutrient supply, and the efficiency to recover the applied fertilizer. The site-specific nutrient management (SSNM) approach emphasizes 'feeding' plants with nutrients as and when needed and to enable the farmers to optimally fill the deficit between the nutrient needs of a high-yielding crop. For more rapid adoption of SSNM technology by farmers, efforts were made in the consolidation of SSNM research conducted over the last decade across Asia into a simple delivery system by International Plant Nutrition Institute (IPNI) in the form of a software Nutrient Expert (NE). It is an easy to use interactive computer-based decision tool that can rapidly provide nutrient recommendations for farmers in the presence or absence of soil testing data. For validation of this tool, a collaborative (Soil Science & Agronomy) trial was constituted along with IPNI during *Kharif 2019* at different centers namely, Chinsurah (CHN), Faizabad (FZB), Karaikal (KRK), Khudwani (KHD), Maruteru (MTU), Mandya (MND), Pantnagar (PNT), Pudhcherry (PDU) and Purulia (PUR) with three treatments in a randomized block design in three replications at different sites. There was only one site in Mandya, while five sites were tested in Faizabad, Marteru, Pantnagar, Puduchery and Karaikal, six sites in Chinsurah (five different sites along with station) and ten sites in Khudwani centers. The treatments included Farmer's practice (T1), recommended dose of fertilizer (RDF) (T2) and SSNM based on Nutrient expert, which varies with each location (T3). The data were analysed by two factor ANOVA method to understand the impact of treatments, sites and site x treatment interactions to aid in understanding the effect of edaphic factors, which are a part of G x E interactions. The results were presented in tables 5.5.1 to 5.5.7.

Crop growth conditions

The available experimental soil conditions prior to cropping in five centers were presented in Table 5.5.1 along with plant varieties grown. The attempt to describe the soil properties of different sites and centers is to highlight the inherent problems and potentials of crop production. The contents given in the table are self-explanatory in terms of variability in the soil reaction, electrical conductivity, organic matter content and available N, P and K coupled with varieties grown. This information sets the stage to consider the site-specific nutrient management to realize the uniform best.

The details were given considering all sites irrespective of the testing center. The soil pH was ranging from 6.6 to 7.7 while the electrical conductivity widely ranging from 0.18 to 13.6 dS m^{-1} where inter-center variability was more than the intra-center values. Organic carbon content was ranging from as low as 0.3 to 1.2 %. The contents of available nitrogen, phosphorus and potassium were in the range of 154 to 510, 1 to 62 and 80 to 563, respectively. Besides the variability in edaphic factors, varieties were also different where the list include Swarna-sub1, NDR 2065, Pant Dhan 12, BPT 5204, ADT 46, CO-50, IR-64 and MTU7029 (Maruteru) and the details from four centers were not available.

Grain yield

The data in Table 5.5.2 clearly established the significant differences in the effects of sites, treatments and their interactions based on LSD values derived from two factor analysis. For instance, test sites recorded yield differences in Faizabad region with a mean ranging from 3475 to 5089, 4289 to 5929 and 5632 to 6456 kg/ha in T1, T2 and T3, respectively where the supremacy of T3 is clearly established. Supremacy of T3 was seen in three centers while in other centers the effect of treatments was insignificant. Similarly, within each site, the differences among treatments were significant, for instance in Site 2 (Faizabad), the mean rice grain yield was 3673, 4289 and 6258 kg/ha in T1, T2 and T3, respectively. However, in certain cases, the differences in treatments, sites and their interactions were insignificant, like in Karaikal while in others, the significant differences were noticed either among treatments, or sites or their interactions or in combinations. Although, the rice grain yield is a net expression of influence of sites, treatments and their interactions, there could be a way to establish regional differences too. One site in all regions, for example Site 1, registered the mean rice grain yield (across treatments) differently i.e. 4303 (Purulia) < 4741 (Karaikal) < 5061 (Puducherry) < 5161 (Pantnagar) < 5381 (Chinsurah) < 5521 (Marureru), 5825 (Faizabad) < 7029 (Khudwani) < 7485 kg/ha (Mandya) highlighting site specific responses of crop plants.

Straw yield

Like in grain yield, differential responses were noticed in straw yield too to sites, treatments and their interactions (**Table 5.5.3**). In Faizabad center, the straw yield across sites was in the range of 5451 to 6867, 6324 to 7461and 7098 to 8202 kg/ha in T1, T2 and T3, respectively. The means across sites were 6092, 6785 and 7780 kg/ha, respectively for T1, T2 and T3. LSD indicated that the differences in sites, treatments and site x treatment interactions were significant and supremacy of T3.Superiority of T3 was seen in Faizabad and that of T2 in Chinsurah while in other centers, the effect of treatments was insignificant.

Yield components

The data on tillers/m^2 indicated significant difference among sites, for example, in Faizabad, Karaikal and Purulia (Table 5.5.4) while that of treatments was evident only in Faizabad. There were significant differences in site x treatment interactions in Faizabad, Karaikal, Pantnagar and Purulia. There were significant differences in mean straw production among treatments (across sites) in Faizabad center with 273, 296 and 319 tillers/m^2 in T1, T2 and T3, respectively. Likewise, Site 1 (for example) also had differences in mean straw production across treatments; 173 (Pantnagar) < 260 (Puducherry) < 299 (Faizabad) < 360 (Chinsurah) < 414 (Purulia) < 490 (Karaikal) = 490 (Maruteru) highlighting the inter-center differences and site-specific responses of crop plants.

Number of panicles per square meter significantly varied in Faizabad, Karaikal, Khudwani, Maruteru, and Purulia while treatments had significant differences in Faizabad and Purulia centers (Table 5.5.5). Site x treatments caused significant differences in Faizabad, Karaikal, Khudwani, Maruteru and Purulia centers indicating the synergistic effects of both sites and site x treatment interaction. The means of three treatments across sites was 267, 290 and 312 tillers/m^2 in Faizabad center while the means across treatments were 293, 278, 302, 281 and 296 tillers/m^2, respectively for sites 1 to 5. The differences in one test site (for example, Site 1) across treatments in all seven centers followed the order: 127 (Pantnagar) < 293 (Faizabad) < 308 (Karaikal) = 308 (Puducherry < 314 (Purulia) < 317 (Chinsurah) < 357 (Khudwani) indicating the inter-center differences.

With reference to 1000 grain weight (Table 5.5.6), sites, treatments and site x treatment interactions caused significant differences in Faizabad center while sites and site x treatment interaction variations in Karaikal center. Mean treatment differences across sites in Faizabad were 23.55, 24.17 and 24.82 g of 1000 grains while the means of sites across treatments were 24.48, 23.38, 24.53, 24.21 and 24.04, respectively from sites 1 to 5. Similarly, one site (Site 1) in different centers recorded the 1000 grain weight in the order; 18.09 (Karaikal)<20.9 (Pantnagar) < 24.48 (Faizabad) < 30.0 (Khudwani) highlighting inter-center differences due to varietal differences.

Nutrients uptake

Data on uptake by grains were presented in **Table 5.5.6**.Total uptake of rice grain N was mostly influenced by site x treatment interactions in Faizabad, Pantnagar and Puducherry while treatments could bring about significant changes in Puducherry. There were significant differences in P uptake by grains in Karaikal and Maruteru centers, while site x treatment interactions caused significant changes in Faizabad, Karaikal, Maruteru and Puducherry. In case of K uptake by grain, sites in Maruteru and Pantnagar centers brought in significant differences while sites x treatments yielded significant differences in Faizabad, Maruteru, Pantnagar and Puducherry.

Sites in Karaikal and Pantnagar centers caused some significant differences in uptake of N by straw while site x treatment interactions could bring in significant changes in Faizabad, Karaikal, Pantnagar and Puducherry centers (**Table 5.5.7**). With regards to P uptake by straw, sites in Karaikal, site x treatment interactions in Faizabad and Pantnagar yielded significant differences. Significant differences were caused by sites in Maruteru and Pantnagar and site x treatment interactions in Faizabad and Maruteru centers.

The understanding

It is a fact that when the supply potential of the soil in relation to plant requirement is understood, better management is a possibility. In general, soil-based crop management is followed, but when the situation warrants crop-based soil management is required and we ought to know more to do more. It is in this direction; site specific nutrient management is expected to help realization of the uniform best from crop plants. In the present exercise, the site x treatment interaction effects were also added, which in fact contributed better particularly when neither sites nor treatments could describe. However, this data set could not establish the superiority of Nutrient Expert in every center calling for upgradation by including more crop production factors considering the varietal behavior.

Summary

A multi-location trial was conducted in Chinsurah (five sites), Faizabad (five sites), Karaikal (five sites), Khudwani (ten sites), Mandya (one site), Maruteru (five sites), Pantnagar (five sites), Puducherry (five sites)and Purulia (five sites) with three treatments namely, Farmers' practices (T1), Recommended dosage of fertilizers (RDF) (T2) and Nutrient Expert (NE) based fertilizer recommendations (T3) to identify the better performing treatment. Two factor analysis using sites, treatments LSD was derived for all attributes namely grain and straw yields, yield components and total uptake by grain and straw. In three centers (Faizabad, Khudwani and Purulia) only there were significant impacts of treatments on grain yield where T3 was superior. In case of straw yield, treatments could bring in significant changes in Faizabad and Chinsurah. But sites and site x treatment interactions in fact described the variance in better terms, which put together gave a different dimension of understanding fertilizer management. Treatments imposed in Faizabad could bring in differences significantly both in tiller and panicles per m^2 while in Purulia only panicles/m^2 were impacted. With reference to 1000 grain weight, treatments caused significant differences only in Faizabad. Nowhere the influence of treatments was seen on the uptake of N, P and K by grain and straw which would have been controlled by some thing else. In any case the influence of site x treatment interactions was visible in many instances in comparison with both or either of sites and treatments the phenomenon of which needs attention in any method of fertilizer management.

Table 5.5.1: Yield maximization of rice through site specific Nutrient Management *(Kharif 2019)*: Soil and crop characteristics

Centre	Site No.	pH	EC dS/m	OC(%)	Av. N Kg/ha	Av.P Kg/ha	Av. K Kg/ha	Variety
Chinsurah	Site 1	6.9	0.39	1.2	502	43	266	Swarna-sub1
	Site 2	6.9	0.35	1.1	510	49	299	
	Site 3	6.6	0.22	1.1	510	44	304	
	Site 4	6.7	0.43	NA	430	24	224	
	Site 5	7.1	0.27	1.2	498	34	250	
Faizabad	Site 1	7.4	13.6	0.42	210	26	235	NDR 2065
	Site 2	7.6	13.5	0.39	215	26	239	
	Site 3	7.5	13.6	0.45	225	27	235	
	Site 4	7.6	13.4	0.40	210	25	220	
	Site 5	7.5	13.5	0.42	220	25	230	
Pantnagar	Site 1	7.6	0.38	0.51	173	10	189	Pant Dhan-12
	Site 2	7.5	0.37	0.48	177	10	176	
	Site 3	7.6	0.37	0.46	193	11	177	
	Site 4	7.7	0.50	0.30	179	10	182	
	Site 5	7.6	0.40	0.57	177	10	202	
Karaikal	Site 1	6.4	0.23	0.98	229	62	563	BPT 5204
	Site 2	7.7	0.39	0.70	169	37	491	BPT 5204
	Site 3	7.7	1.07	0.93	154	45	327	ADT 46
	Site 4	7.2	0.42	0.90	167	37	270	BPT 5204
	Site 5	6.9	0.18	0.95	166	20	270	CO-50
Mandya	Site 1	7.7	0.37	0.55	306	12	80	IR-64

Table 5.5.2: Yield maximization of rice through site specific Nutrient Management *(kharif 2019)*: Grain yield

		Site 1	Site 2	Site 3	Site 4	Site 5	Mean - T
Faizabad	T1	5,089	3,673	4,661	3,475	4,463	4,272
	T2	5,929	4,289	5,501	4,858	5,425	5,200
	T3	6,456	6,258	6,143	5,632	6,077	6,113
	Mean -S	5,825	4,740	5,435	4,655	5,322	
	LSD	S = 253	T= 196	SxT= 438			
Chinsurah	T1	5,560	5,545	5,376	5,388	5,375	5,449
	T2	5,245	5,468	5,216	5,530	5,529	5,398
	T3	5,338	5,393	5,415	5,367	5,381	5,379
	Mean -S	5,381	5,469	5,336	5,428	5,428	
	LSD	S = NS	T= NS	SxT = 183.8			
Karaikal	T1	5,757	5,390	4,803	6,331	4,813	5,419
	T2	4,308	5,634	4,204	5,361	5,062	4,914
	T3	4,158	5,586	4,542	4,889	5,965	5,028
	Mean -S	4,741	5,537	4,517	5,527	5,280	
	LSD	S = NS	T = NS	SxT = NS			
Maruteru	T1	5,762	5,496	5,506	6,169	6,055	5,797
	T2	5,320	5,982	5,735	5,998	5,793	5,765
	T3	5,481	5,952	5,782	5,534	5,826	5,715
	Mean -S	5,521	5,810	5,674	5,900	5,891	
	LSD	S = 197	T = NS	SxT = 340			
Puducherry	T1	5,287	5,793	4,883	4,240	4,753	4,991
	T2	4,837	3,857	5,227	4,903	5,113	4,787
	T3	5,060	5,107	5,363	4,733	4,293	4,911
	Mean -S	5,061	4,919	5,158	4,626	4,720	
	LSD	S = 377	T = NS	SxT = 654			
Pantnagar	T1	5,133	5,217	5,183	5,147	5,133	5,163
	T2	5,117	5,133	5,233	5,203	5,117	5,161
	T3	5,233	5,143	5,133	5,167	5,143	5,164
	Mean -S	5,161	5,164	5,183	5,172	5,131	
	LSD	S = NS	T = NS	SxT = NS			
Purulia	T1	4,616	3,907	4,344	4,262	4,238	4,273
	T2	4,311	4,266	4,475	4,992	3,857	4,380
	T3	3,980	4,815	4,158	4,255	4,490	4,340
	Mean -S	4,302	4,329	4,326	4,503	4,195	
	LSD	S = 81.2	T = 62.9	SxT =140.6			

Mandya

S.No	GrYld	StrYld	Tillers/m^2	Panicles/m^2
T1	6972	7986	553	492
T2	7385	7850	582	527
T3	8099	8621	612	562
Mean	7485	8152	582	791

Khudwani

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
T1	6,117	6,950	7,017	5,900	7,633	6,950
T2	6,853	6,883	7,233	6,873	6,883	7,050
T3	8,117	6,950	7,367	7,017	6,850	6,567
Mean-S	7,029	6,928	7,206	6,597	7,122	6,856
	Site 7	Site 8	Site 9	Site 10	Mean - T	
T1	7,067	6,883	6,333	6,083	6,693	
T2	6,483	7,067	6,600	6,483	6,841	
T3	6,113	6,850	6,350	6,600	6,878	
Mean S	6,554	6,933	6,428	6,389		
LSD	S = 332	T = 236	SxT = 574			

Table 5.5.3: Yield maximization of rice through site specific Nutrient Management *(Kharif 2019)*: Straw yield Khudwani

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
T1	9,233	8,467	8,483	8,800	9,233	8,432
T2	8,450	7,917	8,433	9,117	8,617	8,850
T3	9,133	8,583	9,117	8,483	8,483	8,550
Mean-	8,939	8,322	8,678	8,800	8,778	8,611
	Site 7	Site 8	Site 9	Site 10	Mean - T	
T1	9,067	8,517	7,567	8,483	8,628	
T2	8,967	9,250	7,957	8,567	8,612	
T3	8,517	8,917	7,800	8,267	8,585	
Mean	8,850	8,894	7,775	8,439		
LSD	S = 332	T = 236	S T = 574			

		Site 1	Site 2	Site 3	Site 4	Site 5	**Mean - T**
Faizabad	**T1**	6,867	5,830	6,380	5,451	5,929	6,092
	T2	7,461	6,324	7,032	6,390	6,719	6,785
	T3	8,202	8,004	7,707	7,098	7,889	7,780
	Mean -S	7,510	6,720	7,040	6,313	6,846	
	LSD	S = 236	T = 183	SxT = 408			
Chinsurah	**T1**	6,482	6,467	6,287	6,313	5,880	6,286
	T2	6,143	6,387	6,261	6,749	6,745	6,457
	T3	6,183	6,332	6,333	5,946	6,287	6,216
	Mean -S	6,269	6,395	6,294	6,336	6,304	
	LSD	S = NS	T= 176.4	SxT= 394.4			
Karaikal	**T1**	9,075	6,380	9,634	7,058	6,105	7,651
	T2	10,753	8,819	5,830	7,517	6,142	7,812
	T3	5,632	8,433	5,849	9,845	6,994	7,351
	Mean -S	8,487	7,877	7,104	8,140	6,414	
	LSD	S= 926	T= NS	SxT= 1604			
Maruteru	**T1**	7,202	6,870	6,882	7,711	7,568	7,247
	T2	6,650	7,477	7,169	7,497	7,242	7,207
	T3	6,852	7,440	7,227	6,918	7,283	7,144
	Mean -S	6,901	7,262	7,093	7,375	7,364	
	LSD	S = 246	T= NS	SxT= 425			
Puducherry	**T1**	7,873	8,433	7,867	8,140	7,823	8,027
	T2	8,850	7,043	7,443	8,723	8,573	8,127
	T3	8,003	8,423	7,990	8,297	8,130	8,169
	Mean -S	8,242	7,967	7,767	8,387	8,176	
	LSD	S= NS	T= NS	SxT= NS			
Pantnagar	**T1**	6,017	6,317	6,333	6,233	6,633	6,307

	T2	6,333	6,250	6,600	5,933	6,347	6,293
	T3	6,583	6,000	6,317	6,283	6,133	6,263
	Mean -S	6,311	6,189	6,417	6,150	6,371	
	LSD	S= 82.5	T = NS	SxT =142.8			
Purulia	**T1**	5,607	4,744	5,372	5,209	5,241	5,234
	T2	5,200	5,245	5,477	6,014	4,717	5,331
	T3	4,929	5,855	5,028	5,189	5,416	5,283
	Mean -S	5,245	5,281	5,292	5,471	5,125	
	LSD	S = 100.9	T= NS	SxT = 174.9			

Table 5.5.4: Yield maximization of rice through site specific Nutrient Management *(Kharif 2019)*: Tillers/m^2

		Site 1	Site 2	Site 3	Site 4	Site 5	**Mean - T**
Faizabad	**T1**	280	257	296	252	281	273
	T2	300	276	305	299	299	296
	T3	316	321	323	309	325	319
	Mean -S	299	284	308	287	302	
	LSD	S= 7.6	T= 5.9	SxT= 13.1			
Chinsurah	**T1**	365	360	391	377	372	373
	T2	357	389	393	371	368	376
	T3	359	359	359	370	382	366
	Mean -S	360	369	381	373	374	
	LSD	S = NS	T= NS	SxT = NS			
Karaikal	**T1**	635	315	501	590	352	479
	T2	513	664	323	543	314	471
	T3	323	573	310	535	582	464
	Mean -S	490	517	378	556	416	
	LSD	S = 34.5	T= NS	SxT = 59.7			
Maruteru	**T1**	496	499	496	503	503	499
	T2	472	501	501	484	501	492
	T3	503	495	493	494	500	497
	Mean -S	490	498	497	494	501	
	LSD	S= NS	T= NS	SxT= NS			
Puducherry	**T1**	272	249	244	267	242	255
	T2	255	259	252	276	241	256
	T3	252	273	266	260	244	259
	Mean -S	260	260	254	268	242	
	LSD	S = NS	T = NS	SxT = NS			
Pantnagar	**T1**	177	168	172	163	168	170
	T2	177	167	164	182	167	171
	T3	165	182	168	175	162	170
	Mean -S	173	172	168	173	166	
	LSD	S = NS	T = NS	SxT = 10.7			
Purulia	**T1**	441	385	424	410	403	413
	T2	408	406	420	452	366	411
	T3	392	443	395	418	443	418
	Mean -S	414	412	413	427	404	
	LSD	S = 8.3	T = NS	SxT = 14.5			

Table 5.5.5: Yield maximization of rice through site specific Nutrient Management (*Kharif 2019*): Panicles/m²

		Site 1	Site 2	Site 3	Site 4	Site 5	**Mean - T**
Faizabad	**T1**	274	251	290	247	274	267
	T2	294	270	301	293	295	290
	T3	310	314	315	303	318	312
	Mean -S	293	278	302	281	296	
	LSD	S = 6.8	T = 5.2	SxT = 11.7			
Chinsurah	**T1**	318	316	328	330	321	323
	T2	316	338	329	321	320	325
	T3	319	312	309	321	329	318
	Mean -S	317	322	322	324	323	
	LSD	S = NS	T = NS	S xT = NS			
Karaikal	**T1**	352	287	313	408	291	330
	T2	289	451	289	317	273	324
	T3	283	345	277	297	396	320
	Mean -S	308	361	293	341	320	
	LSD	S = 37.1	T= NS	SxT = 64.3			
Maruteru	**T1**	419	420	384	448	433	421
	T2	367	428	434	433	444	421
	T3	418	425	432	398	461	427
	Mean -S	401	424	417	426	446	
	LSD	S = 22.9	T= NS	SxT = 39.6			
Puducherry	**T1**	307	311	290	317	257	296
	T2	305	306	298	317	298	305
	T3	311	316	320	297	298	308
	Mean -S	308	311	303	310	284	
	LSD	S = NS	T= NS	SxT = NS			
Pantnagar	**T1**	122	132	129	133	135	130
	T2	129	133	133	127	135	131
	T3	128	125	133	133	136	131
	Mean -S	127	130	132	131	135	
	LSD	S = NS	T = NS	SxT = NS			
Purulia	**T1**	338	281	320	313	311	312
	T2	317	313	326	360	276	319
	T3	287	350	303	312	333	317
	Mean -S	314	315	316	328	307	
	LSD	S= 5.7	T= 4.4	SxT= 9.8			

Khudwani

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
T1	339	337	337	347	387	353
T2	351	343	321	365	348	357
T3	381	338	358	363	378	357
Mean-S	357	339	339	358	371	355
	Site 7	Site 8	Site 9	Site 10	Mean - T	
T1	415	299	403	373	359	
T2	388	437	415	362	369	
T3	340	422	397	328	366	
Mean S	381	386	405	354		
LSD	S= 23	T= NS	SxT = 40			

Table 5.5.5: Yield maximization of rice through site specific Nutrient Management (*Kharif 2019*): 1000 grain weight (g)

Khudwani

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
T1	29.8	30.3	29.9	29.8	29.1	30.5
T2	30.2	29.2	29.4	29.0	29.7	29.6
T3	30.0	30.5	29.8	29.8	29.5	30.0
Mean-S	30.0	30.0	29.7	29.6	29.4	30.1
	Site 7	Site 8	Site 9	Site 10	Mean - T	
T1	30.0	29.9	30.4	30.3	30.0	
T2	30.1	30.2	29.3	29.7	29.6	
T3	29.3	27.3	29.9	30.1	29.6	
Mean S	29.8	29.1	29.8	30.0		
LSD	S = NS	T = NS	SxT = NS			

		Site 1	Site 2	Site 3	Site 4	Site 5	**Mean - T**
Faizabad	**T1**	24.13	22.90	23.90	23.50	23.33	23.55
	T2	24.53	23.60	24.63	24.33	24.27	24.27
	T3	24.77	24.93	25.07	24.80	24.53	24.82
	Mean - S	24.48	23.81	24.53	24.21	24.04	
	LSD	S = 0.15	T = 0.12	SxT = 0.26			
Karaikal	**T1**	17.0	26.0	15.8	16.5	23.3	19.7
	T2	15.9	16.8	23.2	16.7	25.2	19.6
	T3	23.9	16.4	25.2	15.5	16.2	19.4
	Mean - S	18.9	19.7	21.4	16.2	21.5	
	LSD	S = 0.74	T = NS	SxT = 1.23			
Pantnagar	**T1**	21.7	21.8	21.1	21.1	20.5	21.3
	T2	20.4	20.5	20.9	21.6	22.3	21.2
	T3	20.5	21.6	22.2	20.8	21.3	21.3
	Mean - S	20.9	21.3	21.4	21.2	21.4	
	LSD	S = NS	T = NS	SxT = NS			

Table 5.5.6: Yield maximization of rice through site specific Nutrient Management *(Kharif 2019)*: Uptake- Grain (kg/ha)

	Faizabad				Karaikal				Maruteru				Pantnagar				Puducherry			
Grain N																				
	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T
Site 1	66.8	53.8	64.0	61.5	57.2	30.4	39.2	42.2	51.1	53.4	55.9	53.5	48.0	52.4	47.9	49.4	69.1	62.9	64.6	65.5
Site 2	52.2	63.8	67.1	61.0	54.6	48.8	52.1	51.8	51.6	52.6	58.4	54.2	50.2	46.6	50.1	49.0	70.8	39.1	60.4	56.8
Site 3	54.7	61.4	54.3	56.8	38.6	39.5	46.2	41.4	54.8	63.3	57.6	58.6	50.1	50.3	49.5	50.0	59.6	71.0	65.2	65.3
Site 4	59.8	69.6	51.7	60.4	58.6	50.3	42.2	50.4	54.8	59.5	54.3	56.2	47.4	51.2	50.5	49.7	44.4	57.6	61.0	54.3
Site 5	60.2	50.2	59.2	56.6	46.7	49.6	56.0	50.8	63.1	53.6	51.3	56.0	51.0	50.4	48.1	49.8	59.0	62.2	43.7	54.9
Mean-S	58.8	59.8	59.3		51.1	43.7	47.1		55.1	56.5	55.5		49.4	50.2	49.2		60.6	58.6	59.0	
LSD	S=NS	T = NS	SxT = 9.9		S= NS	T = NS	SxT = NS		S = NS	T = NS	SxT = NS		S = NS	T = NS	SxT = 2.9		S = 5.3	T = NS	SxT = 9.2	
Grain P																				
Site 1	27.6	20.0	23.9	23.8	37.1	32.9	37.4	35.8	13.5	13.1	12.3	13.0	6.0	5.3	6.1	5.8	13.8	13.9	12.1	13.2
Site 2	20.9	24.4	28.1	24.5	47.8	56.7	41.8	48.7	16.0	16.8	14.4	15.7	6.1	5.8	5.9	5.9	20.4	9.6	14.1	14.7
Site 3	20.2	22.9	21.1	21.4	36.0	37.7	40.7	38.1	13.6	16.0	16.9	15.5	6.0	6.5	6.2	6.2	12.4	15.4	22.7	16.8
Site 4	22.1	29.5	19.0	23.5	60.2	39.3	33.3	44.3	18.3	14.5	14.4	15.7	6.1	19.7	6.2	10.7	11.6	13.8	14.5	13.3
Site 5	22.4	18.8	22.1	21.1	45.4	43.6	55.5	48.2	14.4	17.5	16.9	16.3	6.3	5.8	6.0	6.1	14.8	15.7	10.2	13.6
Mean-S	22.7	23.1	22.8		45.3	42.0	41.7		15.2	15.6	15.0		6.1	8.6	6.1		14.6	13.7	14.7	
LSD	S NS	T=NS	SxT = 5.3		S= 8.4	T = NS	SxT = 14.5		S = 1.54	T = NS	SxT = 2.67		S = NS	T = NS	SxT = NS		S = NS	T = NS	SxT = 5.5	
Grain K																				
Site 1	31.2	24.8	30.9	29.0	33.8	28.1	25.3	29.1	17.2	15.0	20.8	17.7	20.6	20.3	22.7	21.2	21.2	17.7	25.7	21.5
Site 2	25.9	31.7	31.8	29.8	33.2	37.6	32.0	34.3	19.1	21.3	18.3	19.6	22.5	24.9	21.0	22.8	26.9	15.7	22.4	21.7
Site 3	24.9	29.3	26.5	26.9	29.9	24.1	27.5	27.2	16.9	22.4	20.5	20.0	20.0	26.8	23.1	23.3	19.0	21.4	25.2	21.9
Site 4	28.9	32.9	23.5	28.4	39.9	32.7	29.6	34.1	23.0	17.1	15.8	18.6	25.8	21.5	20.7	22.7	17.7	18.5	18.5	18.2
Site 5	28.2	24.2	29.0	27.1	27.7	30.9	39.9	32.8	22.9	21.8	21.1	21.9	24.8	25.0	26.7	25.5	16.6	18.9	16.4	17.3
Mean-S	27.8	28.6	28.3		32.9	30.7	30.9		19.8	19.5	19.3		22.8	23.7	22.8		20.3	18.4	21.6	
LSD	S = NS	T = NS	SxT = 6.4		S = NS	T = NS	SxT = NS		S = 2.1	T = NS	SxT = 3.6		S = 2.6	T = NS	SxT = 5.4		S = NS	T = NS	SxT = 5.5	

Table 5.5.7: Yield maximization of rice through site specific Nutrient Management *(Kharif 2019)*: Uptake- Straw (kg/ha)

Straw N																				
	Faizabad				Karaikal				Maruteru				Pantnagar				Puducherry			
	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T	T1	T2	T3	Mean-T
Site 1	80.6	72.5	76.7	76.6	68.4	67.6	32.1	56.0	45.6	42.5	43.1	43.7	33.2	32.8	32.8	32.9	32.1	48.2	36.5	38.9
Site 2	66.7	74.9	81.3	74.3	28.1	57.0	61.5	48.9	44.4	43.8	49.8	46.0	41.9	40.3	33.4	38.5	40.4	27.9	33.9	34.1
Site 3	70.7	75.3	67.9	71.3	58.9	35.5	25.3	39.9	44.7	1646.3	48.6	579.9	34.7	35.5	39.8	36.6	38.9	32.8	40.1	37.3
Site 4	72.8	83.3	68.0	74.7	43.7	53.0	60.5	52.4	50.1	45.4	44.5	46.7	37.2	34.5	38.8	36.8	34.8	36.2	36.8	35.9
Site 5	74.2	63.9	73.2	70.4	33.1	28.9	42.8	34.9	49.0	48.7	45.8	47.8	38.1	40.2	41.3	39.8	33.0	33.4	30.5	32.3
Mean-S	73.0	74.0	73.4		46.5	48.4	44.4		46.7	365.3	46.4		37.0	36.6	37.2		35.8	35.7	35.6	
LSD	S=NS	T=NS	SxT=8.9		S=8.1	T=NS	SxT = 14.0		S = NS	T = NS	SxT = NS		S = 3.3	T = NS	SxT = 5.7		S = NS	T = NS	SxT = 1.5	
Straw P																				
Site 1	29.6	23.2	25.8	26.2	49.0	58.5	26.1	44.5	9.2	8.4	8.9	8.8	7.9	8.7	8.6	8.4	12.6	17.9	11.7	14.1
Site 2	23.2	24.5	30.0	25.9	30.4	56.0	51.3	45.9	7.8	9.8	9.7	9.1	10.1	10.9	7.6	9.5	15.9	12.0	16.2	14.7
Site 3	23.5	24.6	22.9	23.7	59.5	24.9	33.4	39.3	9.3	9.6	9.6	9.5	9.3	8.2	11.6	9.7	14.1	11.8	15.2	13.7
Site 4	22.8	30.8	21.9	25.2	45.3	43.0	50.5	46.3	10.5	8.8	8.5	9.3	10.6	7.9	9.4	9.3	16.7	15.8	16.8	16.4
Site 5	24.6	20.7	23.1	22.8	25.5	33.3	41.6	33.4	9.6	9.3	10.0	9.6	8.2	10.2	9.8	9.4	13.8	15.5	12.3	13.9
Mean-S	24.7	24.8	24.7		41.9	43.2	40.6		9.3	9.2	9.3		9.2	9.2	9.4		14.6	14.6	14.4	
LSD	S = NS	T = NS	SxT = 5.9		S = 7.5	T = NS	SxT = 12.9		S = NS	T = NS	SxT = NS		S = NS	T = NS	SxT = 1.8		S = NS	T = NS	SxT = NS	
Straw K																				
Site 1	52.5	45.3	48.8	48.9	167.1	238.5	101.7	169.1	97.7	97.6	96.8	97.4	42.1	43.4	47.3	44.3	81.7	98.7	78.1	86.1
Site 2	44.5	51.0	53.2	49.5	119.8	165.9	157.7	147.8	105.7	117.8	105.8	109.8	46.6	45.5	42.1	44.7	84.2	71.7	96.0	84.0
Site 3	44.4	47.0	44.3	45.2	219.0	108.0	117.5	148.2	100.5	105.3	112.9	106.2	47.5	47.4	48.5	47.8	55.1	78.0	83.5	72.2
Site 4	48.7	54.1	42.2	48.3	138.5	144.0	220.2	167.6	119.6	103.4	101.0	108.0	45.4	39.6	45.8	43.6	80.2	103.5	79.4	87.7
Site 5	46.3	41.2	49.0	45.5	110.4	116.5	135.8	120.9	110.7	113.2	113.4	112.4	48.7	48.7	47.2	48.2	68.3	86.1	80.3	78.3
Mean-S	47.3	47.7	47.5		151.0	154.6	146.6		106.8	107.5	106.0		46.1	44.9	46.2		73.9	87.6	83.5	
LSD	S = NS	T = NS	SxT = 6.6		S = NS	T = NS	SxT = 64.1		S = 7.5	T = NS	SxT = 13.1		LSD	S = 3.4	T = NS	SxT = NS	S = NS	T = NS	SxT = NS	

5.6 Bio - Intensive Pest Management (BIPM) in rice under Organic Farming

This trial was initiated during *kharif* 2015 in collaboration with Entomologists to study the influence of organic farming on productivity, grain quality, soil health and pest dynamics in rice and also to develop a package of bio-intensive pest management (BIPM) practices in organic farming. There are two treatments here viz., BIPM block and Farmers Practice (FP) block. In BIPM block, all organic farming practices involving from seed treatment, nursery application, nutrient and pest management using organic sources only were practiced as per the technical programme. Whereas, in FP block, general POP with RDF and need based application of insecticides were practiced. Each main block was divided into 6 smaller blocks and observations on pest incidence, yield parameters and grain yield were recorded. Plant nutrient (NPK) uptake was calculated using nutrient concentration and dry matter yield. Soil samples were collected before conducting experiment and after harvest and were analysed for important soil properties. The trial was conducted at three locations viz., [IIRR, Chinsurah (CHN) and Titabar (TTB)] during *kharif* 2019 and *Boro* at CHN. The results are presented in Tables 5.6.1 to 5.6.5.

Grain and straw yields

During *kharif* 2019, Among the three locations, grain yield (Table 5.8.2) was significantly superior in BIPM block compared to FP at CHN and TTB locations by recording 29-76% higher grain yield in BIPM over FP, respectively. While at IIRR, farmer's practice of nursery and main field (with insecticide schedule) was significantly superior to all other treatments (Table 5.8.3).At CHN, during *boro* season also, BIPM recorded significantly higher values of yield parameters over FP and it reflected in significantly higher grain yield by 13% (Table 5.8.4). Straw yield followed the similar trend as that of grain yield at all locations. Observations on pest incidence are given in Entomology report.

Soil Properties after harvest

The important soil properties after harvest at CHN locations are presented in Table 5.8.5. Almost all soil properties were superior in BIPM compared to FP treatment, in both *Kharif* and *boro* season, an improvement in soil available N,P and K was noticed in BIPM compared to FP.

Summary

From the fourth year of study on “Bio-intensive pest management”, it can be summarized that out of three locations (CHN, IIRR and TTB), BIPM was significantly superior to FP at CHN and TTB, while at IIRR, farmer's practice of nursery and main field with insecticide schedule was significantly superior to all other treatments. Similar to previous years, in this fourth year also, most of the soil properties improved with organics in BIPM compared to FP.

Table 5.6.1 Bio-intensive Pest Management (BIPM) in Rice under Organic farming Soil, Crop and weather data - *Kharif* 2019

Parameter	Chinsurah	Titabar
Cropping system	Rice-Rice	Rice-Rice
Variety	Swarna-Sub1	
RDF (kg NPK/ha)	60-30-30	
Crop growth	Satisfactory	Good
% clay	-	-
% silt	-	-
% sand	-	-
Soil Texture	Clay loam	Silty Clay
pH (1:1)	7.43	5.6
Org.carbon (%)	0.97	1.15
EC (dS/m)	0.19	-
Avail.N (kg/ha)	518	395
Avail. P_2O_5 (kg/ha)	132	28.5
Avail. K_2O (kg/ha)	347	165
Max. Temp (ºC)	-	-
Min. Temp (ºC)	-	-
Total Rainfall(mm)	-	-
RH(%)	-	-

Table 5.8.2: Bio-intensive Pest Management (BIPM) in Rice under Organic farming Grain yield (kg/ha) at different locations - *kharif* 2019

Treatments	Grain yield (kg/ha)		Straw Yield (kg/ha)
	Chinsurah	Titabar	Chinsurah
BIPM	5081	5321	6199
FP	3933	3020	4829
t – test	**	**	**

Table 5.8.3: Bio-intensive Pest Management (BIPM) in Rice under Organic farming Grain yield (kg/ha) at IIRR - *kharif* 2019

Treatments	Grain yield (kg/ha)
Farmer's practice of Nursery and Main field (with Insecticide Schedule)	6144
Treated Nursery with Treated seed (Trichoderma)	4342
Treated Nursery with Treated seed (Pseudomonas)	4444
Treated Nursery with Untreated seed	3917
Normal practice of Nursery and Planting (Un treated control)	3899
t – test	**

Table 5.8.4: Bio-intensive pest management (BIPM) in Rice under Organic farming Boro rice (Location: Chinsurah)

Treatments	Grain yield (kg/ha)	Panicle/m^2	1000 grain weight(g)	Tillers/m^2	Straw Yield (kg/ha)
BIPM	5650	290	3.2	336	6611
FP	5018	263	3.0	308	5793
t-test	**	**	**	**	**

Table 5.8.5: Bio-intensive pest management (BIPM) in Rice under Organic farming Soil properties after harvest atdifferent locations– K*harif and boro* 2019

Treat ments	pH	EC	Org. C. (%)	Available Nitrogen (kg/ha)	Available P_2O_5 (kg/ha)	Available K_2O (kg/ha)
Chinsurah (K*harif*)						
BIPM	7.0	0.19	1.14	524	151	360
FP	7.01	0.23	1.2	485	103	296
Chinsurah (*boro*)						
BIPM	7.02	0.25	1.09	520	152	333
FP	6.87	0.21	0.87	422	90	274

5. 7 Residue management in rice based cropping systems

In India, about 371 million tons (mt) crop residues are produced annually of which wheat and paddy residues constitute 27–36% and 51–57% respectively. The disposal of such huge quantity of paddy residues has become a big problem, particularly in North-West Indian states, mainly due to the use of combine harvester and narrow time gap (one to three weeks) between paddy harvesting and planting of wheat in NW India, resulting in farmers preferring to burn the residues in-situ. Burning biomass not only pollutes environment by depleting air quality, emitting green house gases (GHGs), but also causes smog in the environment, results in loss of appreciable amount of plant essential nutrients besides being deleterious to soil microbes. The incineration of crop residues contributes to emissions of harmful air pollutants, which can cause severe impacts on human health too. Thus, proper residue management is of utmost important as it contains plant nutrients and improves the soil-plant-atmospheric continuum. As an alternative strategy, these crop residues can be used for mulching, compost making and in-situ incorporation for improving soil fertility.

Keeping this in view, the present trial was initiated, in *kharif* 2018, to study the influence of rice/wheat residue on rice crop productivity, soil health, pest dynamics and grain quality in rice based cropping systems (RBCS). In the current year, the trial was conducted at ten centres *viz*., Ghaghraghat (GHG), Kanpur (KNP), Karaikal (KRK), Khudwani (KHD), Maruteru (MTU), Pantnagar (PNT), Puducherry (PDU), Pusa (PSA), Raipur (RPR) and IIRR

The treatments (8) consisted of application of crop residues in combination with either chemical fertilizers, green manure (GM)/green leaf manure (GLM), vermicompost (VC), efficient microbial culture (MC) or *Trichoderma* culture (TC) to supply the N requirement on equal basis (50%:50%) in addition to Control and recommended dose of N. The data from ten locations are presented in Tables 5.7.1 to 5.7.7. The test varieties were NDGR-201 at GHG, NDR-2064 at KNP, ADT 46 at KRK, SR-4 at KHD, MTU-1061 & MTU 1153 at MTU, Pant Dhan-12 at PNT, ADT 53 at PDU, Rajendra Bhagwati at PSA, TCDM-1 at RPR and MTU 1153 at IIRR. The details of crop, soil and weather parameters of the experimental sites (Table 5.7.1) show variation in soil characteristics with reference to pH, organic carbon content, soil texture and available nutrient status.

Rice productivity

Data presented in Tables 5.7.2 & 5.7.3 shows that the rice productivity significantly varied with the source of nitrogen application. In *Kharif* 2019, supplementation of 100% N through RDF resulted in significantly highest grain yield at KHD (6.53 t/ha), PNT and PSA (8.61 t/ha) while Control maintained the lowest grain yield values. However, combined application of residues (50% N) with RDF (50% N) + $ZnSO_4$ + Borax gave highest yield at KNP (5.70 t/ha) while it yielded (5.21 t/ha) on par with RDF (100% N) (5.12 t/ha) and Crop residue (50% N) + RDF (50% N) (4.94 t/ha) at PDU. At MTU, PSA and RPR, the treatments consisting of various combinations of crop residues with either RDF, GM, VC, MC or *Trichoderma* were on par not only with each other and but also with RDF (100% N) in terms of grain yield. The results prove that the crop residues can be deployed to substitute half of the recommended nitrogen without yield penalty. Similar trend was also observed for straw yield as well. At GHG and IIRR, the effect of crop residues was not significant.

In *rabi* too, the highest grain yield was obtained under RDF (100% N) which was on par with combinations of crop residues with either GM/GLM, VC or MC/BM.

Nutrient uptake and use efficiency

Data presented in Table 5.7.4 show significant effect of source of N application on nutrient uptake. RDF recorded the highest N (72-133 kg/ha), P (13-42 kg/ha) and K (43-170 kg/ha) uptake while control maintained the lowest values. The crop residue treatments were at par and didn't vary much.

Data presented in Table 5.7.6 show lower nutrient use efficiencies in RDF as compared to crop residue treatments which were mostly at par with each other.

Post harvest soil nutrient status:

The available nutrient status (N, P and K) of soils at are presented in Table 5.7.7 & 5.7.8. The data reveals that the soil nitrogen, phosphorus and potassium contents after harvest of the crop were not influenced much by various residue treatments and were at par with each other.

Summary

Supplementing half of the recommended N through residues (50% N) in addition to either RDF (50% N) or GM, VC/ MC or *Trichoderma* yielded at par not only with each other and but also with RDF (100% N) in terms of grain yield. The results show that the crop residues can be deployed to substitute half of the recommended nitrogen without yield penalty. RDF recorded the highest N (72-133 kg/ha), P (13-42 kg/ha) and K (43-170 kg/ha) uptake while control maintained the lowest values. The crop residue treatments were at par and didn't vary much in terms of nutrient uptake and maintained higher nutrient use efficiencies over RDF. Post-harvest soil nutrient status was not influenced much by various residue treatments which were at par with each other.

Table: 5.7.1 Residue management in RBCS
Crop and soil characteristics

Parameter	GHG [1]	KNP [2]	KRK [3]	KHD [4]	MTU [5]	PNT [6]	PDU [7]	PSA [8]	RPR [9]	IIRR [10]
Cropping system	Rice-Wheat	Rice-Wheat	Rice-Rice	Rice-Wheat	Rice-Rice	Rice-Wheat	Rice-Rice	Rice-Wheat	Rice-Wheat	Rice-Rice
Variety										
Kharif	NDGR-201	NDR-2064	-	SR-4	MTU-1061	Pant Dhan-	ADT 53	Bhagwati	TCDM-1	MTU1153
Rabi	PBW15	PBW-	ADT 46	-	MTU-	-			-	-
RFD (Kg NPK/ha)										
Kharif	80:60:4	120:60:	-	-	90:60:6	120:60:	120:40:	120:60:	100:60:	120:60:
Rabi	120:60:	120:60:	150:50:	-	180:90:	-	-	-	-	-
Crop growth										
Kharif	Good	Good	-	Good	Good	Good	Good	Good	Good	Good
Rabi	Good	Good	Good	-	Good	-	-		-	-
Soil data										
% clay	27	21	17	41	38	26	-	18	45	-
% silt	31	22	2	37	28	61	-	31	35	-
% sand	42	57	81	22	34	13	-	51	20	-
Soil Texture	Sandy Loam	Sandy Loam	Sandy loam	Silty clay	Clay loam	Silty clay	Clay loam	Sandy loam	Clay	Clay
pH (1:1)	8.2	7.9	6.91	6.93	5.96	7.6	7.16	8.49	7.3	8.1
Org. carbon	0.4	0.42	0.51	0.85	1.34	0.65	0.29	0.65	0.49	-
CEC [c mol	-	23.9	8.2	-	48.6	23.5	-	-	-	-
EC (ds/m)	-		0.07	-	0.69	0.39	0.24	0.14	0.42	-
Avail.N	210	206	251	212	179	150	134	198	144	119
Avail. P_2O_5	10	18	35	12.8	50	9.6	22	38	13	85
Avail. K_2O	242	194	161	225	350	190	142	212	472	615

Table: 5.7.2 Residue management in RBCS
Grain and straw yields (*Kharif* 2019)

Treatment	Grain yield (t/ha)									Straw yield (t/ha)								
	GHG	KNP	KHD	MTU	PNT	PDU	PSA	RPR	IIRR	GHG	KNP	KHD	MTU	PNT	PDU	PSA	RPR	IIRR
Control	3.60	2.20	4.26	4.55	1.96	3.23	2.91	3.31	3.76	4.42	2.58	5.90	5.68	1.93	5.09	2.66	3.14	3.50
RDF (100%)	5.03	5.45	6.53	7.86	8.61	5.12	4.19	5.15	4.50	6.37	6.70	8.98	9.82	5.83	7.77	4.32	6.38	4.14
Crop residue (50% N) + RDF (50% N)	4.17	5.10	5.29	6.86	7.02	4.94	3.90	4.78	5.06	5.49	6.22	7.85	8.57	4.93	8.34	3.99	4.61	5.19
Crop residue (50% N) + GM (50% N)	4.44	4.70	4.56	7.13	6.15	4.47	3.81	3.80	4.92	5.73	5.64	6.65	8.92	4.16	7.50	3.50	4.23	4.80
Crop residue (50% N) + VC (50% N)	4.63	4.85	4.76	6.92	6.34	4.62	3.69	4.83	4.55	6.10	5.87	6.98	8.65	4.31	7.24	3.41	5.70	4.05
Crop residue (50% N) + RDF (50% N) + $ZnSO_4$ + Borax	4.61	5.70	5.54	6.38	7.20	5.21	3.98	4.00	3.29	5.84	7.03	8.32	7.97	5.17	7.51	3.49	4.30	2.96
Crop residue (100% N) + MC	4.93	4.20	4.42	6.87	4.32	4.19	3.59	4.64	-	6.12	5.00	6.43	8.59	3.15	6.25	3.09	4.91	-
Crop residue (100% N) + TC	4.88	3.90	4.99	7.26	4.39	4.07	3.44	5.08	-	6.15	4.60	7.58	9.07	3.28	5.92	2.73	3.93	-
Expt. Mean	**4.54**	**4.51**	**5.04**	**6.72**	**5.75**	**4.48**	**3.69**	**4.45**	**4.35**	**5.78**	**5.46**	**7.34**	**8.40**	**4.10**	**6.95**	**3.40**	**4.65**	**4.11**
CD (0.05)	**NS**	**0.13**	**0.69**	**1.28**	**0.10**	**0.41**	**0.60**	**0.67**	**NS**	**NS**	**0.15**	**0.95**	**1.60**	**0.04**	**1.25**	**0.49**	**0.72**	**NS**
CV (%)	**11.5**	**1.62**	**7.79**	**10.83**	**1.03**	**5.26**	**9.22**	**8.61**	**35.93**	**12.11**	**1.60**	**7.36**	**10.84**	**0.54**	**10.27**	**8.29**	**8.83**	**31.42**

Table: 5.7.3 Residue management in RBCS
Grain and straw yields (*Rabi* 2018-19 and 2019-20)

Treatment	Grain yield (t/ha)				Straw yield (t/ha)			
	GHG	KNP	KRK (2019-20)	MTU	GHG	KNP	KRK (2019-20)	MTU
Control	2.83	0.98	5.22	3.75	11.56	1.14	8.83	4.69
RDF (100%)	4.72	2.13	6.17	6.31	19.75	2.55	9.56	7.88
Crop residue (100%N)	3.43	1.19	5.72	4.16	13.55	1.40	9.06	5.20
Crop residue (150%N)	3.58	1.28	5.83	3.90	14.15	1.51	9.00	4.87
Crop residue (50% N) + GM/GLM (50% N)	4.22	1.45	6.17	4.23	17.32	1.72	10.78	5.29
Crop residue (75% N) + GM/GLM (75% N)	3.83	1.62	5.44	3.99	15.65	1.92	9.78	5.00
Crop residue (50% N) + VC (50% N)	4.28	1.57	5.55	4.82	17.65	1.86	11.50	6.02
Crop residue (75% N) + VC (75% N)	4.27	1.72	-	4.93	17.20	2.05	-	6.16
Crop residue (100% N) + MC/BM	-	1.26	-	-	-	1.49	-	-
Crop residue (150% N) + MC/BM	-	1.42	-	-	-	1.69	-	-
Expt. Mean	**3.90**	**1.46**	**5.73**	**4.51**	**15.85**	**1.73**	**9.79**	**5.64**
CD (0.05)	**0.82**	**0.09**	**0.43**	**0.47**	**1.01**	**0.11**	**1.27**	**0.58**
CV (%)	**12.08**	**3.68**	**4.18**	**5.94**	**3.65**	**3.63**	**7.32**	**5.9**

Table: 5.7.4 Residue management in RBCS
Nutrient uptake (kg/ha) in total dry matter (*Kharif* 2019)

Treatment	GHG			KNP			MTU			PNT			PDU			PSA			RPR			IIRR		
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
Control	58	22	20	50	10	47	63	15	69	25	5	28	61	15	66	37	14	44	45	7	78	66	6	73
RDF (100%)	106	42	43	133	33	133	102	27	170	126	25	101	117	32	122	72	28	88	83	13	160	84	8	86
Crop residue (50% N) + RDF (50% N)	71	29	30	123	30	122	94	23	136	85	18	80	112	29	125	60	23	77	73	11	124	107	9	114
Crop residue (50% N) + GM (50% N)	77	34	31	111	27	109	97	19	140	75	14	66	95	27	98	64	22	70	57	9	115	87	8	98
Crop residue (50% N) + VC (50% N)	86	32	36	116	29	114	89	21	126	84	21	73	95	28	104	62	23	69	96	13	161	92	7	89
Crop residue (50% N) + RDF (50% N) + $ZnSO_4$ + Borax	81	37	35	140	35	141	79	21	117	99	20	86	126	30	123	65	22	69	71	11	112	63	5	41
Crop residue (100% N) + MC	99	37	37	98	24	95	100	23	139	62	12	53	86	23	92	51	19	59	81	11	130	-	-	-
Crop residue (100% N) + TC	93	31	38	90	22	87	101	21	135	67	14	61	80	21	79	50	17	51	83	11	106	-	-	-
Expt. Mean	**83.8**	**33.1**	**33.8**	**108**	**26.3**	**106**	**90.5**	**21.2**	**129**	**77.9**	**16.2**	**68.5**	**96.5**	**25.8**	**101**	**57.7**	**20.9**	**66.0**	**73.8**	**10.7**	**123**	**83.1**	**7.22**	**83.5**
CD (0.05)	**16.8**	**6.5**	**6.8**	**3.4**	**0.63**	**3.2**	**21.1**	**6.6**	**44.2**	**4.1**	**2.9**	**7.7**	**14.8**	**4.6**	**21.4**	**6.74**	**2.59**	**11.9**	**13.3**	**2.8**	**28.4**	**NS**	**NS**	**NS**
CV (%)	**11.9**	**11.3**	**11.5**	**1.8**	**1.4**	**1.7**	**13.3**	**17.8**	**19.6**	**3.0**	**10.4**	**6.4**	**8.7**	**10.1**	**12.1**	**6.67**	**7.04**	**10.3**	**10.3**	**14.7**	**13.2**	**27.2**	**30.9**	**32.9**

Table: 5.7.5 Residue management in RBCS
Nutrient uptake (kg/ha) in total dry matter (*Rabi* 2018-19 and 2019-20)

Treatment	KRK (*Rabi* 2019-20)			MTU (*Rabi* 2018-19)		
	N	**P**	**K**	**N**	**P**	**K**
Control	305	80	150	74	15	49
RDF (100%)	389	102	239	134	26	80
Crop residue (100%N)	283	86	199	74	18	60
Crop residue (150%N)	333	84	246	78	17	55
Crop residue (50% N) + GM/GLM (50% N)	340	107	286	66	19	61
Crop residue (75% N) + GM/GLM (75% N)	312	97	283	68	19	56
Crop residue (50% N) + VC (50% N)	388	121	253	87	23	74
Crop residue (75% N) + VC (75% N)	-	-	-	93	22	69
Expt. Mean	**335.6**	**96.6**	**236.5**	**84.3**	**19.9**	**63.06**
CD (0.05)	**102**	**9.2**	**58.2**	**14.3**	**4.0**	**10.5**
CV (%)	**17.1**	**5.3**	**13.8**	**9.7**	**11.6**	**9.5**

Table: 5.7.6 Residue management in RBCS
Nutrient use efficiency (kg grain/kg uptake) (*Kharif* 2019)

Treatment	GHG			KNP			MTU			PNT			PDU			PSA			RPR			IIRR		
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
Control	62	161	179	44	221	47	72	315	66	77	368	71	53	213	50	78	206	67	73	453	43	57	643	52
RDF (100%)	47	119	116	41	165	41	77	304	47	68	343	86	44	164	43	58	150	48	62	399	32	54	602	55
Crop residue (50% N) + RDF	59	143	137	41	168	42	73	305	50	82	400	88	44	169	40	65	171	51	65	446	39	47	560	44
Crop residue (50% N) + GM (50% N)	58	132	144	42	172	43	75	369	52	83	442	93	47	169	47	59	177	55	66	413	33	55	590	52
Crop residue (50% N) + VC (50% N)	54	145	127	42	170	42	79	331	56	75	309	87	49	167	45	60	161	54	51	382	30	49	616	54
Crop residue (50% N) + RDF (50% N) + $ZnSO_4$ + Borax	57	124	134	41	164	40	82	301	56	73	353	83	42	176	42	61	182	57	56	377	36	52	609	91
Crop residue (100% N) + MC	50	134	134	43	174	44	69	293	50	69	374	81	49	186	46	70	185	61	57	428	36	-	-	-
Crop residue (100% N) + TC	53	156	129	43	176	45	75	351	54	66	306	72	51	197	52	70	199	67	61	475	48	-	-	-
Expt. Mean	**55.0**	**139**	**137**	**42.3**	**176**	**43.1**	**73.2**	**321**	**53.9**	**7.2**	**362**	**82.8**	**47.3**	**180**	**45.5**	**65.2**	**179**	**57.4**	**61.4**	**421**	**37.1**	**52.3**	**603**	**57.9**
CD (0.05)	**1.1**	**2.6**	**3.5**	**0.18**	**1.68**	**0.34**	**NS**	**NS**	**NS**	**3.13**	**74.6**	**9.66**	**NS**	**27.5**	**NS**	**6.76**	**28.1**	**11.0**	**3.4**	**NS**	**5.23**	**NS**	**NS**	**NS**
CV (%)	**1.2**	**1.1**	**1.4**	**0.24**	**0.54**	**0.45**	**8.79**	**9.41**	**11.1**	**2.42**	**11.8**	**6.67**	**8.58**	**8.82**	**12.1**	**5.93**	**8.95**	**11.0**	**3.17**	**9.10**	**8.15**	**8.11**	**12.1**	**38.5**

Table: 5.7.6 Residue management in RBCS
Nutrient use efficiency (kg grain/kg uptake) (*Rabi* 2018-19 and 2019-20)

Treatment	KRK (*Rabi* 2019-20)			MTU (*Rabi* 2018-19)		
	N	P	K	N	P	K
Control	17	66	35	50	254	77
RDF (100%)	16	61	26	47	240	79
Crop residue (100%N)	20	68	29	56	233	69
Crop residue (150%N)	18	69	24	50	228	71
Crop residue (50% N) + GM/GLM (50% N)	20	58	22	65	225	69
Crop residue (75% N) + GM/GLM (75% N)	17	57	20	59	214	72
Crop residue (50% N) + VC (50% N)	14	46	22	55	212	65
Crop residue (75% N) + VC (75% N)	-	-	-	53	222	72
Expt. Mean	**17.6**	**60.6**	**25.4**	**54.5**	**228**	**71.8**
CD (0.05)	**NS**	**8.81**	**4.99**	**8.25**	**NS**	**6.54**
CV (%)	**18.76**	**8.18**	**11.05**	**8.65**	**8.57**	**5.20**

Table: 5.7.7 Residue management in RBCS
Available nutrient status of soils (kg/ha) (*Kharif* 2019)

Treatment	KNP			KHD			MTU			PNT			PDU			PSA		
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
Control	205	18	192	194	13	225	201	48	274	147	10	195	164	16	131	148	21	165
RDF (100%)	208	19	198	230	17	285	267	63	384	146	10	196	190	16	146	212	32	229
Crop residue (50% N) + RDF (50% N)	212	22	204	212	16	279	204	68	290	145	10	195	213	19	144	203	25	203
Crop residue (50% N) + GM (50% N)	216	24	206	200	15	269	262	68	347	146	10	196	198	21	134	197	26	205
Crop residue (50% N) + VC (50% N)	213	22	206	201	15	272	244	77	305	143	10	195	216	28	136	208	31	213
Crop residue (50% N) + RDF (50% N) + $ZnSO_4$ + Borax	218	26	209	216	17	282	279	69	329	144	10	197	194	21	131	214	31	222
Crop residue (100% N) + MC	210	20	201	197	14	231	254	62	331	146	10	195	217	25	154	188	23	200
Crop residue (100% N) + TC	210	21	202	207	16	277	274	58	295	145	10	197	201	25	152	187	24	198
Expt. Mean	**211**	**21.4**	**202**	**207**	**15.3**	**265**	**248**	**64.1**	**319**	**145**	**10.1**	**196**	**199**	**21.4**	**141**	**195**	**26.6**	**204**
CD (0.05)	**1.53**	**1.23**	**1.55**	**11.9**	**0.54**	**15.2**	**44.3**	**13.8**	**46.0**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**11.1**	5.9	18.2
CV (%)	**0.41**	**3.28**	**0.44**	**3.28**	**2.03**	**3.27**	**10.2**	**12.3**	**8.23**	**1.61**	**2.69**	**1.21**	**16.8**	**24.1**	**7.04**	**3.25**	**12.7**	**5.1**

Table: 5.7.8 Residue management in RBCS
Available nutrient status of soils (kg/ha) (*Rabi* 2018-19 and 2019-20)

Treatment	KRK (*Rabi* 2019-20)			MTU (*Rabi* 2018-19)		
	N	P	K	N	P	K
Control	102	38	164	170	50	370
RDF (100%)	83	34	169	156	66	351
Crop residue (100%N)	69	34	186	142	69	418
Crop residue (150%N)	97	28	201	165	67	409
Crop residue (50% N) +	79	31	169	190	75	422
Crop residue (75% N) +	90	30	168	194	72	397
Crop residue (50% N) + VC	73	21	182	206	65	447
Crop residue (75% N) + VC	-	-	-	181	60	433
Expt. Mean	**85**	**31**	**177**	**176**	**66**	**406**
CD (0.05)	**18.0**	**8.63**	**NS**	**28.6**	**12.1**	**26.0**
CV (%)	**11.96**	**15.75**	**11.19**	**9.29**	**10.53**	**3.66**

5.8 Screening of rice germplasm for Nitrogen use efficiency (NUE)

Among the essential nutrients, nitrogen (N) is the major element which is required in large quantities by rice. The most limiting nutrient in irrigated rice is nitrogen and N recovery efficiency is only about 25-40% of applied N in most farmers' fields and N is mostly lost by leaching, gaseous loss through volatilization and surface run off. Now a day's consumption of N fertilizer is in the increasing trend, but its use efficiency is low in most of the production systems. Nitrogen use efficiency depends not only on the efficient fertilizer management, but also on the cultivar that is used. Genetic variation in nitrogen use efficiency in rice was reported by several workers. Keeping this in view, the present trial was formulated to evaluate the nitrogen use efficiency (NUE) of a few popular rice varieties in addition to the varieties developed for high NUE. Here, 10 entries were tested across 9 locations viz., Kanpur (KNP), Karaikal (KRK), Maruteru (MTU), Mandya (MND), Pantnagar (PNT), Purulia (PUR), Pusa (PSA), Raipur (RPR) and Titabar (TTB) at three nitrogen levels (N0, N1 and N2 where 0, 50 and 100% of recommended dose of N, respectively). The results are presented in Tables 5.8.1 to 5.8.5 and discussed below.

Yield and yield parameters

At Titabar (TTB), grain yield at N1 and N2 did not differ and N3 recorded significantly higher yields over N1 and N2 by 37 and 36%, respectively. Among the varieties, at all 3 N levels, MTU1010 and ARRH7576 recorded higher yields with overall mean maximum yield by ARRH7576. Whereas, CNN5 at N1 and N2 and CNN1 at N3 were on par to MTU 1010 and ARRH7576.

At Mandya (MND), significantly higher yield was recorded at N3 by 56 and 16% over N1 and N2, respectively. Among the varieties, CNN1 was significantly superior to other varieties while ARRH7576 was at par to CNN1, CNN4 and Varadhan. ARRH7576 recorded maximum yield (5.84 t/ha) at N1 and CNN5, Varadhan and CNN1 were at par and recorded higher yields at N3 (7.63-7.81 t/ha).

At Kanpur (KNP), N3 recorded significantly higher yield than N1 and N2 by 24 and 19%, respectively. Among the varieties, CNN1, CNN4 and CNN5 recorded higher yields (4.00-4.06 t/ha0 and the yield difference among other varieties was marginal by about 0.17-0.38 t/ha.

At Purulia (PUR) also, N3 recorded significantly higher yield than N1 and N2 by 22 and 7%, respectively. Among the varieties, ARRH7576 recorded maximum yield (5.21 t/ha) that was significantly superior to all varieties except Varadhan which was on par with 4.81 t/ha.

The grain yield at Raipur (RPR) was significantly high at N3 compared to N2 and N1 for all varieties. N3 recorded higher yield by 80 and 12%, over N1 and N2, respectively. Among the varieties, ARRH7576 recorded significantly higher yield at all N levels (4.3-6.3 t/ha) than all other varieties (2.1-5.9 t/ha) and next in the order are, Varadhan, CNN5, CNN1 and MTU 1010.

At Karaikal (KRK), the yield difference between N levels was not significant though there was an incremental increase of about 0.6 t/ha at N2 and N3 levels. Among the varieties, ARRH7576 recorded mean maximum yield (5.98 t/ha) followed by Varadhan (5.80 t/ha) and CNN4 (5.36 t/ha) which were at par and these were superior without external N application.

In case of Maruteru (MTU), though N3 recorded significantly higher yield than N1 (by 21%) and N2 (by 5%), the difference between N2 and N3 is only marginal. Among the varieties, CNN4(6.42 t/ha) and CNN5 (6.05 t/ha) were at par and significantly superior to all other varieties. Next in the order was CNN2 with 5.42 t/ha.

At Pantnagar (PNT), there was gradual response up to N3 in case of all varieties that responded significantly at N3 (5.8 t/ha) over N2 (4.8 t/ha) and N1 (2.76 t/ha). Among the varieties, at N1, Varadhan, CNN5 and TI93 were superior. At N2, Varadhan, ARRH7576 and CNN5 and at N3, CNN3, CNN4 and Rasi were superior. Here, at each N level, the differences among the varieties was only marginal (0.2-0.45 t/ha).

At Pusa, grain yields in general were low compared to other centres ranging from 2.06 t/ha at N1 level to 2.76 t/ha at N3 level. Among the varieties, ARRH7576 and CNN2 (2.64 and 2.72 t/ha, respectively) at N1 level; Varadhan, ARRH7576 and CNN2 (2.72-3.06 t/ha) at N2; and CNN3, Varadhan and CNN1 (3.61-3.77 t/ha) at N3 level recorded higher yields.

Averaged over nine locations, pooled over varieties, the mean yield data at different N levels indicated an increase at N3 (4.92 t/ha) over N2 (4.26 t/ha) and N1 (3.24 t/ha) to an extent of 31 and 51%, respectively. Among the varieties, pooled over three N levels, mean maximum yield across nine locations was recorded by ARRH7576 (4.72 t/ha) that recorded a minimum of 7.0% increase over CNN4 (4.41 t/ha) and Varadhan (4.41 t/ha) and maximum of 41% increase over Rasi (3.34 t/ha).

Straw yields followed almost similar trend as that of grain yields al all locations. Tiller and panicle number (Table 5.8.3) in general followed the grain yield trend in most of the locations with maximum number in N3 followed by N2 and N1. Among the varieties, ARRH7576, CNN1, CNN5, Varadhan and MTU 1010 recorded maximum number in most of the locations.

Nutrients uptake

Total nutrients (NPK) uptake data was presented in Table 5.8.4. N uptake was maximum at N3 level at all locations ranging from 47-115 kg/ha and 31-80 kg/ha at N1 level. Pusa centre with low yields recorded lowest N uptake than other centres. Among the varieties, ARRH7576, CNN5, Varadhan and MTU 1010 recorded maximum uptake values at most of the locations.

Soil Properties

From the Table 5.8.5, the soil properties pH and EC were not influenced by N levels as well as varieties. In case of available N, N levels did not influence at PNT and PSA while at MTU, KRK and MND, N values were significantly less at N1 compared to N2 and N3.

Among the varieties, there was no significant difference at PNT, MND and PSA and no specific trend was noticed at KNP, MTU and KRK.

Summary

In the first year of study on "Screening of rice germplasm for NUE, ten genotypes were evaluated at three nitrogen levels (0, 50 and 100% of recommended N) at nine locations. At all locations, grain yield was significantly higher at 100% RDN and the increase was in the range of 5-36% over 50% RDN and 21-110% over no N application. Among the varieties, out of nine locations, ARRH7576, CNN5, CNN4 and Varadhan recorded higher yields of around 5.0 t/ha. Yield parameters and nutrients uptake almost followed similar trend as that of grain yield trend and no spectacular differences were noticed in soil properties after harvest.

Table 5.8.1: Screening of rice germplasm for Nitrogen use efficiency (NUE), *Kharif* 2019 Soil and crop characteristics

Parameter	TTB [1]	MND [2]	KNP [3]	PUR [4]	RPR [5]	KRK [6]	MTU [7]	PNT [8]	PSA [9]
Cropping system	Rice-Rice	Rice-Rice	Rice-Rice	Rice-Rice	Rice-Rice	Rice-Rice	Rice-Rice	Rice-Wheat	Rice-Wheat
RFD (Kg NPK/ha)	60:20:40	125:50:50:40	120:60:60:25	70:35:35	100:60:40	150:50:50	90:60:60:50	120:60:30	120:60:40:25
Crop growth	Good	Very	-	Good	Good	Good	Good	Good	Good
Soil data									
% clay	42-48	48.32	20.5		45	17.4	38	25.9	17.5
% silt	20-35	30.45	23.7		35	2.0	28	61.4	31
% sand	25-30	21.23	55.8		20	82.76	34	13.0	51.5
Soil Texture	Clay	Clay	Sandy loam	Sandy loam loam	Clay	Sandy loam	Clay loam	Silty clay loam	Sandy loam
pH (1:1)	5.3 -5.8	8.97	7.93	6.5	7.3	6.91	6.10	7.5	8.49
Org. carbon	0.65-	0.38	0.45	0.85	0.49	0.51	1.24	0.68	0.65
CEC [c mol	15-18		25.5	-		8.2	48.6	23.7	-
EC (ds/m)	-	0.53	0.47	0.13	0.42	0.07	0.64	0.42	0.14
Avail.N	215-	269	225	360	144	250	234	165	197
Avail. P_2O_5	20-34	25.7	18.7	26	13.2	35.1	61.2	9.08	38
Avail. K_2O	125-	186	174	309	472	161	294	210	211
DTPA –Zn	0.65-0.9	-	0.43	-	1.01	-	-	0.68	0.48
DTPA –Fe	18.5-	-	38.7	-	6.0	-	-	128	-
DTPA –Mn	12-15.5	-	22.6	-	8.42	-	-	22.7	-
DTPA –Cu	0.65-0.9	-	0.15	-	3.08	-	-	6.4	-

Table 5.8.2: Screening of rice germplasm for Nitrogen use efficiency (NUE), *Kharif* 2019 , Grain and Straw yields of rice

Variety / N levels	Titabar								Mandya								Kanpur							
	Grain yield (t/ha)				Straw Yield (t/ha)				Grain yield (t/ha)				Straw Yield (t/ha))				Grain yield (t/ha)				Straw Yield (t/ha)			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	2.15	2.60	4.43	3.06	3.85	4.65	7.93	5.48	5.49	6.69	7.63	6.61	5.66	6.01	8.51	6.73	3.04	4.25	4.88	4.06	3.22	5.07	5.86	4.71
CNN -2	2.77	2.85	3.47	3.03	4.80	4.88	6.20	5.29	3.61	6.09	6.66	5.46	4.31	6.38	8.63	6.44	2.82	4.04	4.80	3.89	3.34	4.88	5.87	4.70
CNN -3	2.77	3.08	3.80	3.22	5.05	6.00	6.80	5.95	4.58	5.47	5.88	5.31	6.62	6.95	7.84	7.14	2.62	3.82	4.59	3.68	3.15	4.72	5.69	4.52
CNN -4	2.53	3.02	3.83	3.13	4.53	5.40	6.90	5.61	4.29	6.70	7.31	6.10	5.90	8.02	9.01	7.64	2.94	4.18	4.95	4.02	3.47	5.04	5.97	4.82
CNN -5	2.80	3.13	3.72	3.22	5.05	5.63	6.68	5.79	3.95	6.06	7.81	5.94	4.76	7.18	8.74	6.89	2.93	4.17	4.90	4.00	3.42	4.94	5.87	4.74
ARRH7576	2.93	4.28	4.73	3.98	5.40	7.27	8.61	7.09	5.84	6.13	6.69	6.22	7.57	8.26	9.13	8.32	2.50	3.65	4.38	3.51	2.93	4.35	5.37	4.21
Rasi	2.25	2.63	2.70	2.53	4.03	4.72	4.91	4.55	3.01	3.88	4.48	3.79	4.02	5.04	6.80	5.29	2.71	3.93	4.71	3.78	3.16	4.69	5.73	4.53
Varadhan	2.53	2.73	2.93	2.73	4.57	4.93	5.34	4.95	4.20	6.30	7.77	6.09	5.09	6.64	7.98	6.57	2.76	3.81	4.80	3.79	3.22	4.54	5.79	4.52
MTU- 1010	3.03	3.43	4.50	3.66	5.70	6.17	8.19	6.69	2.70	3.20	4.13	3.35	4.63	5.70	6.64	5.66	2.89	4.04	4.66	3.86	3.37	4.79	5.55	4.57
TI-93	2.47	2.50	4.48	3.15	4.00	4.38	8.16	5.51	2.48	4.11	5.12	3.90	4.70	6.66	7.95	6.43	2.77	3.69	4.66	3.71	3.24	4.40	5.64	4.42
Mean	**2.62**	**3.02**	**3.86**	**3.17**	**4.69**	**5.40**	**6.97**	**5.69**	**4.01**	**5.46**	**6.35**	**5.27**	**5.33**	**6.68**	**8.12**	**6.71**	**2.80**	**3.96**	**4.73**	**3.83**	**3.25**	**4.74**	**5.73**	**4.58**
CD M	0.09				0.13				0.26				0.33				0.03				0.07			
CD S	0.27				0.53				0.40				0.41				0.21				0.24			
M X S	0.47				0.93				0.69				0.72				NS				NS			
S XM	0.45				0.88				0.68				0.71				NS				NS			
CV (%) M	5.86				4.83				10.76				10.67				1.6				3.5			
CV (%) S	9.02				9.96				8.05				6.55				5.7				5.5			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.2: Screening of rice germplasm for Nitrogen use efficiency (NUE), *Kharif* 2019 , Grain and Straw yields of rice

Variety / N levels	Purulia								Raipur								Karaikal							
	Grain yield (t/ha)				Straw Yield (t/ha)				Grain yield (t/ha)				Straw Yield (t/ha))				Grain yield (t/ha)				Straw Yield (t/ha)			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	3.59	3.99	4.21	3.93	4.31	4.80	5.16	4.72	3.20	4.86	5.61	4.55	4.06	5.82	6.11	5.33	3.70	4.44	5.19	4.44	10.3	11.8	14.1	12.0
CNN -2	4.06	4.14	4.30	4.16	4.78	4.89	4.96	5.01	2.72	4.81	5.48	4.34	3.98	5.65	6.11	5.25	4.26	4.96	5.37	4.86	11.0	11.7	14.1	12.3
CNN -3	2.89	3.68	4.00	3.52	3.51	4.44	4.49	4.26	2.12	4.41	5.22	3.92	3.44	5.29	5.75	4.83	4.48	5.00	5.19	4.89	13.9	11.1	11.8	12.2
CNN -4	3.58	3.61	3.68	3.62	4.32	4.35	5.20	4.37	2.85	4.81	5.15	4.27	3.64	5.59	5.68	4.97	5.19	5.39	5.49	5.36	10.9	12.3	15.1	12.8
CNN -5	3.66	3.86	4.31	3.94	4.40	4.65	6.08	4.75	3.05	4.97	5.52	4.51	4.01	5.78	6.14	5.31	4.48	4.81	5.19	4.88	10.4	12.4	14.5	12.4
ARRH7576	4.93	5.12	5.59	5.21	4.32	5.91	6.23	6.07	4.27	5.84	6.26	5.46	5.52	7.25	7.26	6.68	5.48	5.93	6.52	5.98	12.9	14.8	15.7	14.5
Rasi	3.18	3.29	3.61	3.36	3.81	3.96	6.17	4.03	2.38	4.08	4.86	3.77	3.22	4.91	5.34	4.49	3.33	3.70	4.81	3.95	6.0	6.6	7.8	6.8
Varadhan	4.05	5.12	5.25	4.81	4.92	6.13	6.51	5.74	3.53	5.56	5.96	5.02	4.37	6.52	6.72	5.87	4.44	5.93	7.04	5.80	9.7	11.0	11.0	10.6
MTU- 1010	3.22	4.89	5.49	4.53	3.83	5.91	6.00	5.41	3.38	4.85	5.82	4.68	4.25	5.81	6.41	5.49	3.40	3.70	4.26	3.89	9.1	9.6	9.9	9.5
TI-93	3.96	4.58	4.99	4.51	4.79	5.16	5.47	5.42	2.49	3.94	4.19	3.54	3.84	4.78	5.82	4.81	3.26	3.52	4.44	3.74	6.2	9.8	10.3	8.8
Mean	**3.71**	**4.23**	**4.54**	**4.16**	**4.29**	**5.02**	**5.62**	**4.98**	**3.00**	**4.81**	**5.41**	**4.41**	**4.03**	**5.74**	**6.13**	**5.30**	**4.20**	**4.73**	**5.35**	**4.81**	**10.0**	**11.1**	**12.4**	**11.2**
CD (0.05)-M	0.08				0.11				0.08				0.04				NS				NS			
CD(0.05)-S	0.39				0.47				0.13				0.07				1.01				2.3			
M X S	NS				NS				0.23				0.13				NS				NS			
S XM	NS				NS				0.22				0.13				NS				NS			
CV (%) M	4.38				4.9				3.8				1.62				15.2				48.8			
CV (%) S	9.9				9.92				3.2				1.5				20.4				21.7			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.2: Screening of rice germplasm for Nitrogen use efficiency (NUE), *Kharif* 2019 , Grain and Straw yields of rice

Variety / N levels	Maruteru								Pantnagar								Pusa							
	Grain yield (t/ha)				Straw Yield (t/ha)				Grain yield (t/ha)				Straw Yield (t/ha))				Grain yield (t/ha)				Straw Yield (t/ha)			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	3.68	4.10	3.78	3.85	4.30	4.72	4.83	4.62	2.50	4.55	5.60	4.21	2.81	5.20	5.95	4.65	2.05	2.20	3.61	2.62	2.59	2.62	4.51	3.24
CNN -2	5.22	5.42	5.62	5.42	4.90	6.49	7.03	6.14	2.70	4.68	5.81	4.40	2.99	5.22	5.92	4.71	2.72	2.87	3.48	3.02	3.13	3.44	4.19	3.59
CNN -3	3.97	4.49	4.60	4.35	4.79	5.05	5.76	5.20	2.71	4.73	5.96	4.47	3.18	5.28	5.88	4.78	1.51	2.09	3.77	2.46	2.48	2.80	3.93	3.07
CNN -4	5.82	6.62	6.81	6.42	6.07	6.89	8.51	7.16	2.75	4.82	5.95	4.51	2.92	5.28	6.16	4.79	1.81	2.49	2.50	2.27	3.11	3.29	3.44	3.28
CNN -5	5.17	6.46	6.52	6.05	5.56	6.62	8.16	6.78	2.91	4.95	5.81	4.56	2.77	5.28	5.88	4.64	1.79	2.04	2.45	2.09	2.31	2.94	3.13	2.80
ARRH7576	4.17	5.01	5.23	4.80	5.47	6.02	7.20	6.23	2.79	4.97	5.83	4.53	2.99	5.27	6.02	4.76	2.64	2.72	2.98	2.78	2.90	3.23	3.53	3.22
Rasi	2.24	2.38	3.33	2.65	3.39	3.83	4.47	3.90	2.54	4.62	5.92	4.36	3.12	5.35	6.01	4.83	1.17	2.13	2.23	1.84	1.71	2.70	3.19	2.54
Varadhan	3.09	4.06	4.22	3.79	3.86	4.86	6.35	5.02	2.99	5.00	5.85	4.61	2.98	5.27	6.01	4.76	2.26	3.06	3.73	3.02	3.65	3.70	4.18	3.84
MTU- 1010	4.60	5.39	5.72	5.24	5.31	6.58	7.41	6.43	2.81	4.86	5.73	4.47	2.95	5.27	6.08	4.77	1.31	1.97	2.74	2.00	1.70	2.58	3.36	2.54
TI-93	3.97	5.37	5.54	4.96	4.51	6.37	6.38	5.75	2.90	4.84	5.54	4.43	2.86	5.23	5.93	4.68	1.93	1.98	2.79	2.23	2.57	2.63	3.21	2.80
Mean	**4.19**	**4.93**	**5.14**	**4.75**	**4.82**	**5.74**	**6.61**	**5.72**	**2.76**	**4.80**	**5.80**	**4.45**	**2.96**	**5.26**	**5.99**	**4.74**	**1.90**	**2.36**	**3.03**	**2.43**	**2.62**	**2.99**	**3.67**	**3.09**
CD (0.05)-M	0.11				0.44				0.03				0.16				NS				NS			
CD (0.05)-S	0.65				0.66				0.1				NS				0.50				0.52			
M X S	NS				1.14				0.17				NS				0.87				0.91			
S XM	NS				1.12				0.16				NS				1.06				1.15			
CV (%) M	4.9				16.6				1.43				7.38				87				79			
CV (%) S	14.5				12.2				2.35				3.15				21.9				17.9			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.3: Screening of rice germplasm for nitrogen use efficiency (NUE) , *Kharif* 2019 yield parameters of rice

Variety / N levels	Titabar								RAIPUR								Purulia							
	Tillers/m^2				Panicles/m^2				Tillers/m^2				Panicles/m^2				Tillers/m^2				Panicles/m^2			
	N1	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**
CNN -1	300	283	208	264	223	258	192	225	345	385	388	373	235	260	282	259	372	413	438	408	288	327	350	322
CNN -2	225	267	325	272	181	216	226	208	345	398	426	389	248	255	270	258	421	429	447	432	329	333	362	341
CNN -3	208	283	317	269	156	240	263	220	344	372	381	366	240	250	269	253	313	381	415	370	240	290	334	288
CNN -4	292	308	325	308	254	261	252	256	365	378	389	377	250	260	258	256	370	390	381	380	289	301	299	296
CNN -5	308	375	308	331	200	258	215	224	369	412	391	390	200	280	305	262	379	399	449	409	299	309	365	324
ARRH7576	292	367	250	303	219	250	229	233	394	405	410	403	250	290	325	288	497	518	535	517	401	386	395	394
Rasi	275	283	300	286	212	233	231	225	379	413	401	398	235	248	270	251	328	339	373	347	245	247	300	264
Varadhan	200	283	308	264	153	230	227	203	380	400	415	398	260	275	310	282	421	518	513	484	335	360	388	361
MTU- 1010	267	342	358	322	242	277	233	251	370	403	397	390	245	266	298	270	332	494	527	451	259	379	399	345
TI-93	367	367	300	344	282	267	236	261	365	392	400	385	210	200	236	216	410	477	520	469	326	360	394	360
Mean	**273**	**316**	**300**	**296**	**212**	**249**	**230**	**231**	**366**	**396**	**400**	**387**	**237**	**258**	**282**	**259**	**384**	**436**	**460**	**427**	**301**	**329**	**359**	**330**
CD (0.05)- M	NS				NS				2.31				1.26				8.22				11.3			
CD(0.05)- S	NS				36				6.59				2.55				36.2				32.8			
M X S	NS				NS				11.4				4.41				NS				NS			
S XM	NS				NS				10.9				4.26				NS				NS			
CV (%) M	25				31				1.3				1.06				4.2				7.5			
CV (%) S	23				17				1.81				1.04				9.01				11.6			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.3: Screening of rice germplasm for nitrogen use efficiency (NUE) , *Kharif* 2019 yield parameters of rice

Variety / N levels	Karaikal								Kanpur								Maruteru							
	Tillers/m^2				Panicles/m^2				Tillers/m^2				Panicles/m^2				Tillers/m^2				Panicles/m^2			
	N1	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**
CNN -1	364	369	287	340	321	337	271	310	333	424	447	401	329	420	444	398	294	377	316	329	175	203	183	187
CNN -2	349	385	308	348	325	347	283	318	326	410	443	393	320	406	440	388	309	363	343	338	173	226	214	204
CNN -3	335	400	324	353	316	372	303	330	313	397	435	381	305	393	430	376	301	329	311	314	178	215	209	201
CNN -4	387	364	319	356	359	324	293	325	335	436	465	412	329	431	461	407	290	329	327	315	167	197	193	186
CNN -5	371	451	265	362	351	420	242	338	329	446	462	412	322	441	459	407	295	349	331	325	183	217	228	209
ARRH7576	301	291	245	279	275	256	223	251	300	378	403	360	294	372	398	355	301	328	315	315	192	202	194	196
Rasi	337	411	317	355	320	389	292	334	326	422	409	385	318	416	406	380	311	316	294	307	213	193	178	195
Varadhan	259	360	375	331	233	323	351	302	322	437	462	407	315	431	458	401	260	319	311	297	163	188	199	183
MTU- 1010	371	365	364	367	343	335	349	342	317	401	417	378	311	395	415	373	294	322	330	315	179	207	200	195
TI-93	293	349	279	307	277	325	258	287	315	402	422	380	306	395	419	374	297	364	320	327	185	237	180	201
Mean	**337**	**375**	**308**	**340**	**312**	**343**	**286**	**314**	**322**	**415**	**436**	**391**	**315**	**410**	**433**	**386**	**295**	**340**	**320**	**318**	**181**	**209**	**198**	**196**
CD(0.05)-M	NS				NS				4.39				4.43				17.6				NS			
CD(0.05)-S	NS				NS				18.2				18.7				22.1				NS			
M X S	NS				NS				NS				NS				NS				NS			
S XM	NS				NS				NS				NS				NS				NS			
CV (%) M	61				58				2.45				2.50				12.0				26			
CV (%) S	20				21				4.96				5.13				7.4				10			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.3: Screening of rice germplasm for nitrogen use efficiency (NUE) , *Kharif* 2019 yield parameters of rice

Variety / N levels	Pantnagar								Kanpur								Mandya			
	Tillers/m^2				Panicles/m^2				Tillers/m^2				Panicles/m^2				Panicles/m^2			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	175	162	167	168	127	118	132	126	333	424	447	401	329	420	444	398	338	427	476	414
CNN -2	180	165	162	169	137	118	123	126	326	410	443	393	320	406	440	388	246	349	446	347
CNN -3	180	160	158	166	127	127	128	127	313	397	435	381	305	393	430	376	297	413	486	399
CNN -4	173	177	150	167	130	115	120	122	335	436	465	412	329	431	461	407	304	395	479	393
CNN -5	173	163	135	157	135	120	123	126	329	446	462	412	322	441	459	407	253	421	452	375
ARRH7576	163	170	142	158	127	118	125	123	300	378	403	360	294	372	398	355	335	436	474	415
Rasi	170	160	130	153	133	115	118	122	326	422	409	385	318	416	406	380	249	344	456	350
Varadhan	170	152	137	153	133	133	118	128	322	437	462	407	315	431	458	401	197	362	409	323
MTU-1010	160	160	155	158	125	128	125	126	317	401	417	378	311	395	415	373	237	379	419	345
TI-93	163	147	157	156	133	130	142	135	315	402	422	380	306	395	419	374	289	408	452	383
Mean	**171**	**162**	**149**	**160**	**131**	**122**	**126**	**126**	**322**	**415**	**436**	**391**	**315**	**410**	**433**	**386**	**275**	**393**	**455**	**374**
CD(0.05)-M	NS				NS				4.39				4.43				20.2			
CD (0.05)-S	11				NS				18.2				18.7				13.4			
M X S	NS				NS				NS				NS				23.3			
S XM	NS				NS				NS				NS				25.8			
CV (%) M	17				14				2.45				2.50				11.7			
CV (%) S	7				11				4.96				5.13				3.82			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.4: Screening of rice germplasm for Nitrogen use efficiency (NUE) , *Kharif* 2019 Total nutrient uptake (kg/ha)

Variety / N levels	Kanpur												Maruteru											
	Nitrogen				Phosphorus				Potassium				Nitrogen				Phosphorus				Potassium			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	64	103	121	96	15.7	24.8	30.5	23.7	61	101	119	94	50	66	78	65	14.1	17.4	16.5	16.0	66	81	83	76
CNN -2	62	98	118	93	14.9	23.6	29.9	22.8	62	96	119	92	89	100	106	98	19.1	24.5	27.7	23.8	74	126	129	110
CNN -3	58	93	110	87	14.3	22.4	28.7	21.8	58	93	114	88	79	84	96	86	17.4	18.4	22.0	19.3	73	93	98	88
CNN -4	65	101	121	96	15.8	24.5	31.1	23.8	64	100	122	95	109	118	127	118	23.7	28.9	32.2	28.3	101	120	148	123
CNN -5	64	100	121	95	15.6	24.5	30.6	23.6	63	98	120	94	105	112	131	116	20.7	24.9	28.3	24.6	100	133	157	130
ARRH7576	54	87	104	82	13.0	21.0	27.0	20.3	54	86	108	82	80	100	111	97	19.0	26.8	23.9	23.2	91	125	107	107
Rasi	59	95	114	89	14.3	22.9	29.4	22.2	58	93	116	89	51	56	70	59	9.8	11.9	14.8	12.1	60	71	67	66
Varadhan	60	92	114	89	14.6	22.3	30.0	22.3	59	90	118	89	66	83	86	79	12.4	20.6	18.6	17.2	69	116	84	90
MTU- 1010	63	97	115	92	15.2	23.5	28.8	22.5	62	95	113	90	90	96	114	100	19.9	25.6	22.6	22.7	96	135	127	119
TI-93	60	88	113	87	14.5	21.4	28.9	21.6	60	87	114	87	79	105	110	100	18.2	24.2	26.3	22.9	91	123	101	105
Mean	**61**	**95**	**115**	**90**	**14.8**	**23.1**	**29.5**	**22.5**	**60**	**94**	**116**	**90**	**80**	**92**	**103**	**92**	**17.4**	**22.3**	**23.3**	**21.0**	**82**	**112**	**110**	**101**
CD(0.05)-M	0.99				0.27				1.24				4.8				0.69				7.5			
CD(0.05)-S	5.30				1.26				4.81				12.6				3.1				12.3			
M X S	NS				NS				NS				NS				NS				21.3			
S XM	NS				NS				NS				NS				NS				20.7			
CV (%) M	2.38				2.65				3.01				11.4				7.18				16.2			
CV (%) S	6.21				5.97				5.67				14.5				15.5				12.9			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.4: Screening of rice germplasm for Nitrogen use efficiency (NUE) , *Kharif* 2019 Total nutrient uptake (kg/ha)

Variety / N levels	Raipur												Karaikal											
	Nitrogen				Phosphorus				Potassium				Nitrogen				Phosphorus				Potassium			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	78	98	110	96	6.77	12.3	13.6	10.9	107	147	156	137	199	234	267	233	87	123	100	233	213	323	320	286
CNN -2	75	103	116	98	6.08	10.8	13.1	10.0	106	148	159	138	189	210	268	222	85	93	111	215	254	271	346	290
CNN -3	40	88	119	82	5.67	9.1	13.5	9.4	90	140	151	127	181	186	292	220	100	93	104	220	292	291	420	335
CNN -4	49	97	105	84	7.22	13.1	13.5	11.3	98	151	155	134	171	238	244	218	93	103	127	218	328	367	545	413
CNN -5	59	101	113	91	8.78	12.0	14.7	11.8	106	156	163	142	203	229	233	222	88	102	112	222	267	353	468	363
ARRH7576	73	125	137	112	13.50	12.7	16.4	14.2	145	185	194	175	237	241	247	242	121	107	123	242	284	361	340	328
Rasi	36	80	93	70	6.44	12.1	13.1	10.5	85	133	140	119	139	143	149	144	62	60	65	143	186	162	215	188
Varadhan	72	115	134	107	9.86	13.2	13.9	12.3	117	176	174	156	180	199	229	203	85	109	107	203	227	350	320	299
MTU- 1010	61	110	119	96	9.78	9.8	15.4	11.7	111	149	168	142	170	181	328	226	85	78	87	226	238	315	289	281
TI-93	47	100	103	83	6.98	9.9	9.8	8.9	102	127	151	126	106	156	182	148	54	84	88	148	148	262	274	228
Mean	**59**	**102**	**115**	**92**	**8.11**	**11.5**	**13.6**	**11.1**	**107**	**151**	**161**	**140**	**178**	**202**	**244**	**208**	**86**	**95**	**102**	**95**	**244**	**306**	**354**	**301**
CD(0.05)-M	1.46				0.32				0.88				NS				NS				NS			
CD(0.05)-S	2.48				0.81				2.14				38				18				61			
M X S	4.30				1.41				3.70				67				NS				NS			
S XM	4.18				1.35				3.55				69				NS				NS			
CV (%) M	3.46				6.20				1.37				45				39				47			
CV (%) S	2.87				7.76				1.62				20				20				22			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.4: Screening of rice germplasm for Nitrogen use efficiency (NUE) , *Kharif* 2019 Total nutrient uptake (kg/ha)

Variety / N levels	Pantnagar												Mandya											
	Nitrogen				Phosphorus				Potassium				Nitrogen				Phosphorus				Potassium			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	40	70	100	70	10.4	18.1	22.4	16.9	36	69	100	68	102	123	157	128	16.3	20.4	27.0	21.2	117	130	181	143
CNN -2	44	73	90	69	12.1	19.6	27.8	19.8	40	71	99	70	70	120	147	112	11.9	20.0	25.1	19.0	88	133	179	133
CNN -3	42	75	93	70	10.9	19.8	25.8	18.8	40	67	90	66	99	116	131	115	15.7	19.1	22.8	19.2	132	143	164	146
CNN -4	44	80	103	76	12.3	20.6	25.9	19.6	39	69	90	66	88	137	157	127	14.7	23.8	27.7	22.1	119	167	189	158
CNN -5	44	83	96	74	11.8	19.7	25.1	18.9	35	64	93	64	79	124	161	121	12.3	20.4	27.1	19.9	96	149	185	144
ARRH7576	43	79	96	75	12.1	34.8	25.9	24.3	39	81	98	73	120	133	152	135	19.3	22.3	26.1	22.5	153	169	189	170
Rasi	41	77	102	73	11.1	19.4	26.2	18.9	43	72	93	69	62	83	106	84	10.1	14.1	18.3	14.1	81	103	138	107
Varadhan	46	81	100	73	12.6	21.3	27.2	20.4	38	71	96	68	82	124	156	120	13.4	20.5	27.8	20.5	103	139	171	138
MTU- 1010	43	74	101	76	12.7	20.3	24.0	19.0	39	63	102	68	63	79	100	81	9.6	12.3	16.7	12.9	91	114	135	113
TI-93	45	82	99	73	11.8	20.5	24.4	18.9	34	71	94	66	61	97	123	93	9.7	16.5	22.1	16.1	91	133	161	129
Mean	**43**	**77**	**98**	**73**	**11.8**	**21.4**	**25.5**	**19.5**	**38**	**70**	**96**	**68**	**82**	**114**	**139**	**112**	**13.3**	**18.9**	**24.1**	**18.8**	**107**	**138**	**169**	**138**
CD(0.05)-M	2.66				5.4				2.27				5.08				0.33				6.5			
CD (0.05)-S	3.30				NS				NS				5.15				1.22				7.18			
M X S	5.72				NS				NS				8.92				2.12				12.4			
S XM	5.67				NS				NS				9.05				2.02				12.5			
CV (%) M	7.98				60.8				7.28				9.91				3.84				10.3			
CV (%) S	4.81				24.2				11				4.89				6.92				5.51			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.4: Screening of rice germplasm for Nitrogen use efficiency (NUE) , *Kharif* 2019 Total nutrient uptake (kg/ha)

Variety / N levels	Purulia				Titabar				Pusa			
	Nitrogen				Nitrogen				Nitrogen			
	N1	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Mean
CNN -1	53	57	73	61	32	46	80	53	18	31	34	28
CNN -2	61	62	67	63	44	49	67	53	23	42	64	43
CNN -3	40	50	69	53	44	49	75	56	31	34	37	34
CNN -4	59	65	68	64	42	54	80	59	33	39	62	45
CNN -5	67	71	75	71	44	53	74	57	18	35	39	31
ARRH7576	79	86	89	85	55	80	94	76	30	43	58	44
Rasi	54	56	67	59	37	50	56	47	29	44	48	40
Varadhan	72	90	98	87	45	48	61	51	39	42	43	41
MTU- 1010	53	87	107	82	58	55	95	70	33	35	45	38
TI-93	74	87	96	86	40	42	80	58	38	45	64	49
Mean	**61**	**71**	**81**	**71**	**44**	**52**	**77**	**57**	**29**	**39**	**49**	**39**
CD (0.05)-M	0.91				1.12				NS			
CD (0.05)-S	7.03				5.17				7.6			
M X S	12				8.95				13.2			
S XM	12				8.52				17.4			
CV (%) M	2.79				4.26				99.5			
CV (%) S	10.5				9.57				20.8			

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.5: Screening of rice germplasm for Nitrogen use efficiency (NUE) , *Kharif* 2019 Soil fertility status at harvest

Variety / N levels	Kanpur						Maruteru						Karaikal						
	pH	EC (ds/m)	OC (%)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)	pH	EC (ds/m)	OC (%)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)	pH	EC (ds/m)	OC (%)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)	S (Kg/ha)
N levels																			
N1	7.91	0.48	0.49	136	23.1	181	6.65	0.42	0.88	248	39.6	359	5.57	0.11	0.29	99	16.8	97	84
N2	7.90	0.53	0.54	173	20.6	177	6.52	0.48	0.93	299	59.1	348	5.62	0.06	0.26	89	22.4	80	89
N3	7.88	0.55	0.61	207	18.7	172	6.65	0.57	0.91	302	54.4	347	5.6	0.04	0.36	121	37.5	80	154
CD(0.05)	0.00	0.00	0.01	0.21	0.09	0.27	ns	0.01	ns	5.61	0.8	ns	ns	0.02	0.03	1.49	5.18	7.4	9.47
CV(%)	0.06	1.85	2.59	0.27	0.98	0.34	3.62	2.8	7.33	4.33	3.5	6.31	3.52	63.0	22.9	3.15	44.2	18.8	19.0
Variety																			
CNN -1	7.89	0.52	0.54	170	17.9	177	6.53	0.45	0.89	292	52.3	352	5.62	0.09	0.32	87	15.1	111	70
CNN -2	7.89	0.52	0.54	172	20.9	177	6.68	0.49	0.87	284	52.5	367	5.73	0.08	0.31	97	19.6	96	91
CNN -3	7.89	0.52	0.55	173	22.7	176	6.65	0.46	0.94	283	48.6	361	5.49	0.06	0.26	101	16.5	77	103
CNN -4	7.89	0.52	0.56	171	18.7	175	6.86	0.47	0.95	271	48.3	350	5.52	0.12	0.25	97	20.8	69	93
CNN -5	7.90	0.52	0.56	171	18.9	175	6.69	0.41	0.84	287	54.8	345	5.65	0.05	0.29	103	23.2	75	110
ARRH7576	7.90	0.52	0.55	174	24.6	178	6.48	0.52	0.87	296	50.1	356	5.6	0.06	0.35	106	32.2	88	76
Rasi	7.90	0.53	0.56	172	21.2	176	6.7	0.5	0.93	276	51.6	339	5.51	0.06	0.24	91	29.1	86	124
Varadhan	7.90	0.52	0.56	172	20.7	175	6.61	0.49	0.98	280	47.5	354	5.67	0.06	0.3	125	45.0	82	161
MTU- 1010	7.89	0.52	0.53	171	20.0	178	6.5	0.56	0.9	279	52.5	354	5.51	0.06	0.35	91	29.1	86	124
TI-93	7.90	0.53	0.54	173	22.2	178	6.38	0.57	0.9	278	52.0	335	5.59	0.07	0.34	114	29.9	90	133
CD(0.05)	ns	ns	0.02	1.69	1.79	1.36	0.27	0.04	0.06	12.6	3.89	19.2	0.12	0.03	0.05	8.52	5.00	11.0	36.9
CV(%)	0.12	2.97	3.02	1.04	9.13	0.82	4.32	9.54	7.5	4.7	8.08	5.8	2.35	53.0	18.91	8.76	20.8	13.7	36.0
Interaction																			
MXT	0.02	ns	Ns	ns	ns	2.36	0.47	0.08	0.11	21.9	6.7	ns	0.22	0.06	ns	14.8	8.66	19.1	64
TXM	0.01	ns	Ns	ns	ns	2.25	0.45	0.07	0.11	21.0	6.4	ns	0.21	0.06	ns	14.0	8.85	18.7	61
Mean	**7.89**	**0.52**	**0.55**	**172**	**20.7**	**177**	**6.61**	**0.49**	**0.91**	**283**	**51.0**	**351**	**5.6**	**0.07**	**0.3**	**103**	**25.6**	**86**	**109**

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

Table 5.8.5: Screening of rice germplasm for Nitrogen use efficiency (NUE) , *Kharif* 2019 Soil fertility status at harvest

Variety / N levels	Pantnagar						MANDYA	Pusa
	pH	EC (ds/m)	OC (%)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)	Available N (Kg/ha)	Available N (Kg/ha)
N levels								
N1	7.35	0.36	0.54	177	10.6	193	217	192
N2	7.32	0.36	0.56	192	9.5	204	295	198
N3	7.41	0.4	0.60	255	13.4	206	324	202
CD(0.05)	ns	ns	ns	ns	0.9	ns	4.05	ns
CV(%)	2.08	44.3	25.2	76.8	17.1	16	3.17	5.45
Variety								
CNN -1	7.24	0.4	0.58	180	11.4	206	276	199
CNN -2	7.33	0.36	0.56	187	11.7	201	278	198
CNN -3	7.38	0.38	0.59	186	11.4	197	277	198
CNN -4	7.3	0.43	0.58	194	11.2	203	280	197
CNN -5	7.46	0.39	0.58	189	10.9	202	280	198
ARRH7576	7.4	0.4	0.56	193	10.9	201	276	197
Rasi	7.49	0.33	0.55	383	11.1	200	277	198
Varadhan	7.51	0.36	0.55	191	10.7	196	280	195
MTU- 1010	7.22	0.34	0.54	193	11.1	200	283	197
TI-93	7.27	0.34	0.57	187	11.3	203	279	197
CD(0.05)	ns	ns	ns	ns	ns	ns	ns	ns
CV (%)	3.19	23.3	14.5	86.9	7.0	5.69	3.68	1.61
Interaction								
MXT	ns	ns	ns	ns	ns	ns	ns	ns
TXM	ns	ns	ns	ns	ns	ns	ns	ns
Mean	**7.36**	**0.37**	**0.57**	**208**	**11.2**	**201**	**279**	**197**

CNN1- RP6252-BV/RIL/1689; CNN2- RP6252-BV/RIL/1690; CNN3- RP6252-BV/RIL/1692; CNN4- RP6252-BV/RIL/1700; CNN5- RP6252-BV/RIL/1705

PLANT PHYSIOLOGY

6. PLANT PHYSIOLOGY

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6. Plant Physiology

Summary

Physiological studies under All India Co-ordinated Rice Improvement Program were conducted at eight funded centres, (Coimbatore, Maruteru, Pantnagar, Pattambi, Rewa, Raipur, Karjat and Titabar), two ICAR institutions (IIRR Hyderabad and NRRI Cuttack) and six voluntary centres (RARS Chinsurah, NDUAT Faizabad, PJNAR Karaikal, RARS Karjat, IGKV RAIPUR and BAU Ranchi). The trials conducted during 2019 are given as below.

Star Chart of Plant Physiology Coordinated Studies for the Year Kharif 2019

Locations	Trials						Allotted	Conducted	Conducted (%)	Not conducted	Grand Total
	Silicon	Heat Tolerance	RFU	MAS	SUB	LLS					
CHN	√	√	-	-	-	-	2	2	100	-	2
CBT	√	-	√	√	√	-	4	4	100	-	4
NRRI	√	√	√	√	√	√	6	6	100	-	6
IIRR	√	√	-	-		√	3	3	100	-	3
FZB	-	-	-	√	√	-	2	2	100	-	2
KJT	√	-	-	√	-	√	3	3	100	-	3
KRK	√	-	-	√	-	-	2	2	100	-	2
MTU	√	√	-	√	-	√	4	4	100	-	4
PNR	√	√	-	√	-	√	4	4	100	-	4
PTB	√	√	√	√	√	-	5	5	100	-	5
REWA	√	√	√	√	-	-	4	4	100	-	4
TTB	√	√	√	√	√	√	6	6	100	-	6
RPUR	-	-	√	-	-	√	2	2	100	-	2
RANCHI	√	-	√	√	-	-	3	2	75	1	2
Total	**12**	**8**	**7**	**11**	**5**	**7**	**50**	**49**		**1**	**49**

The salient findings of the experimental research are presented below:

6.1. Influence of silicon on induced stress tolerance in rice genotypes

In view of the importance of silica in rice nutrition, a trial was conducted at different AICRIP locations spread across the country. The experimental lay-out was split-plot with three replications. The treatments include T1 = Control (water spray), T2 =0.8% Silicon, T3 = Water stress T4 =. Silicon + water stress, Water stress was imposed after PI stage by withholding irrigation. The results revealed that application of silicon (T2) resulted in >11% increase in mean grain yield(mean of all varieties & locations) . The increase in grain yield is maximum at REWA (>17% in crease over control) followed by KJT and NRRI (<12% increase). Similarly, imposition of WS (T3) caused significant reduction in yield and the extent of reduction varied from location to location. Maximum reduction in GY was observed at PTB followed by TTB and REWA. Imposition of water stress (T3) resulted in >10%

reduction in mean grain yield. Maximum reduction in GY was observed at PTB followed by TTB and REWA The mean GY (mean of all locations) varied between 566 g/m^2 (IRRH-132) to 480 g/m^2 (Sahabhagidhan). Application of Silicon showed maximum effect in JKRH-3333 followed by IIRRH-122. Imposition of water stress show maximum effect on HRI-174 followed by IRRH-132 and KRH-4. Application Silicon on water stressed plants resulted in maximum mitigation of yield reduction caused by water stress in Sahabhagidhan followed by IIRRH-131.

6.2 Screening of elite rice cultures for drought tolerance:

A trial was conducted 30 rice genotypes taken from *IVT-E-DS* trial and 5 released varieties during Kharif-2019 at 5 locations and during Rabi-2018-19 season at TTB where in 22 AVT entries and 8 released varieties were tested for drought tolerance. Treatments consists of total rainfed condition without any supplementary irrigation and another with recommended irrigation. Based on the reduction in grain yield under rainfed condition IET 28250, IET 28262, IET 28262, IET 28660 and US 314 could be identified as relatively drought tolerant and these entries are suitable for rainfed cultivation. Based on drought indices computed, IET 28252, IET 28256, IET 28245, Sahabhagidhan and US-314 have high Mean Rank with low SEm and they may be considered as relatively drought tolerant and are suitable for rain fed cultivation. Stability analysis indicated Based on stability analysis IET 28243, Sahabhagidhan, IET 28246, IET 28247, IET 28249, IET 282 51, IET 280 52, IET 28254, Tulsi, IET 28255, 28256, US314, IET 28260 and IET 28262 can be selected as stable genotypes which performed well across the locations. At TTB the trial was conducted during Rabi season. Based on the reduction in yield under rainfed condition IET 27519, Vandana and Govind can be identified as drought tolerant varieties. Various drought tolerance indices were computed and based on high mean rank and low SEm the genotypes IET 27514, IET27522, Govind, IET 27520, 27525, 27519 and Sammaleswari could be identified as relatively drought tolerant and suitable for rain fed conditions.

6.3 Screening for high temperature tolerance in rice genotypes.

Covering the field grown crop with polythene supported by metal frame immediately after PI stage had resulted in an increase in temperature inside the tunnel. The increase in temperature is <4.0 C at most of the centres with an exception at IIRR, PTB and PNR where the temperature difference is >8.0 C. The results show all the tested genotypes suffered substantial yield loss under high temperature condition. None of the tested entries performed better than the tolerant check N-22 (>17% reduction over control) in terms of grain yield. Only IET26780 with 19.5% reduction and IET28403 (>25% reduction over control) showed any tolerance to high temperature. These entries may be considered as moderately tolerant. The grain yield recorded under elevated temperature showed strong association with GMP, YI, MP, K2STI and HIS and these indices are useful in screening for high temperature tolerance. The genotypes were ranked for each index and rank-sum and mean rank for each genotype was calculated. The genotype with high mean rank and low SEm± was considered as heat tolerant genotype. Based on the mean rank IET28387, IET28390, IET28393, IET28397, IET28403, Gontra bidhan-3 and IET28432 performed better than the tolerant check N-22. These entries may be considered as relatively heat tolerant. Stability analysis was performed to identify genotypes which produced high yield and high stability. Based on stability variance and stability rating IET 28386, 28387,28390, 27668, 28393, 28397, 28400, 28403, Gontra bidhan-3, IET28408, 28409, 28511, 28422, 28425, 27908 and IET25713 performed well and are selected as genotypes with high yield . However, in IET 28407 and IET27876 show non-significant stability variance (σ_i^2) .

6.4 Physiological characterization of selected rice genotypes for multiple abiotic stress Tolerance

Screening for multiple abiotic stress tolerance was conducted at 11 AICRIP centres for salinity, water stress (1% and 2%) and anaerobic stress. Germination % under saline conditions is one of the important criteria for screening for salinity tolerance. Based on their performance under salinity stress, IET 27762, IET 26861, Mahulata, IET 27768, Rashpanjor and IET 27768 performed well and may be considered as relatively tolerant genotypes. The entries IET 27750 , IET 27762, Parijat, IET 27768, IET 26861 and IET 27356 performed well under moderate water stress (1% mannitol) where as under 2% mannitol induced stress, Mahulata, IET 27768, BVD 109, IET 27762 IET 27750, Brahman-Nakhi), IET 27758 and IET 27757 can be identified as relatively tolerant. Under anaerobic stress, all the tested entries suffered reduction in important physiological trait. However, IET 27768, Rashpanjor, Mahulata, and IET 27356 could be identified as relatively suitable for anaerobic conditions. Entries like IET 27762 show tolerance to salinity and water stress, IET 27768 and Mahulata performed well under salinity, water stress and anaerobic stress, IET 27356 show relative tolerance to water stress and anaerobic stress. These entries could be identified as possessing tolerance to multiple abiotic stresses.

6.5. Screening for submergence tolerance in Rice

During Kharif 2019, a trial was formulated to evaluate promising rice genotypes for submergence tolerance. Seventeen different rice genotypes were included in the trial which was conducted at four AICRIP centres (NRRI, PTB, FZ B and TTB). Submergence tolerance was estimated by survival percentage of the seedlings subjected to complete submergence. The survival percentage was relatively higher in AC42088 Sabita followed by AC38575, AC42088 and Madhulata, these show better survival percentage than the Swarna sub1 at TTB centre. Similarly, at NRRI AC42088 show maximum survival percentage (98%) followed by Sabita (61%) Swarna Sub-1 (61%) andIC516009 (<58%). As many as 7 genotypes did not survived the submergence treatment. Significant differences were noticed in starch content among the genotypes. A significant positive association was observed between the leaf starch content and % survival indicating that leaf starch content is very important in seedling survival during submergence.

6.6 Screening of elite rice germplasm for low light stress tolerance

A trial was conducted at 7 AICRIP centres with 18 genotypes including 16 taken from IVT-SDW trial. Swarnaprabha was included as tolerant check and IR-8 was taken as susceptible check. Low light treatments were imposed immediately after transplanting by enclosing the plots in shade-net (50% transmittance). The shade net was supported by metal/bamboo poles. Low-light stress did not significantly influence the days to flowering and days to maturity. Significant increase in leaf chlorophyll content was observed in all genotypes under low-light. Low-light treatment significantly influenced many yield contributing traits and reduced grain yield substantially. The reduction in grain yield was highest in IET27590 followed by IET27597 and IET27592. The reduction is >40% in all the remaining entries with the exception of IET27595, IET275995 and IET27596 in which the reduction is <40%. These entries may be considered as relatively tolerant to low-light as the yield loss in these entries is less than the tolerant check swarnaprabha.

6.1 Influence of silicon on induced stress tolerance in rice genotypes

Locations: *CBT, CTK, IIRR, KJT, KRK, MTU, PNR, PTB, REWA, CHN, NRRI and TTB*

Silicon (Si) is next to oxygen (O) in quantity on earth's crust. Silicon in combination with oxygen forms silicon dioxide (SiO_2) which is also known as silica. Rice exhibits the greatest uptake of silicic acid in the grass family. With the application of large quantity of silicon fertilizers, rice can accumulate silicon in the stem and leaves up to 10- 15% of its dry weight. Research findings from China reveal that rice yield of 7.5 ton/ha require 750-500 kg of silica. On an average, 1,125 kg of silica is required to achieve that yield. In view of the importance of silica in rice nutrition, a trial was conducted at different AICRIP locations spread across the country to investigate the role of silicon in increasing productivity of rice and study it's effects on imparting abiotic stress tolerance. The trial is conducted in split-plot design with following treatments with the objective to study the effect of silicon (Silixol @400ml in 200 litres/acre (as spray) were used at active tillering, panicle initiation, 50% flowering and milky grain stages. The experimental lay-out was split-plot with three replications. The treatments include T1=Control (water spray), T2=0.8% Silicon, T3=water stress, T4=Water stress+ Silicon. Water stress was imposed after PI stage by withholding irrigation. The mean days to flowering (mean of all locations and genotypes) was not significantly affected by silicon application and water stress (*Table 6.1.1*). The mean days to flowering (DF) is 96, 96, 94, and 94 days, respectively at Control, T1, T2, T3 and T4. (Fig. 1) The interaction between Location x treatment was found to be significant ($p<0.01$). The mean DF (mean of all treatments and genotypes) varied between 91 days (PNR) to 116 (IIRR) followed by 112 (Ranchi). Significant interaction was observed between Location x Variety. However, the interaction between Variety x Treatment was non-significant. However, the three way interaction between Treatment x Variety x Location was found to be significant.

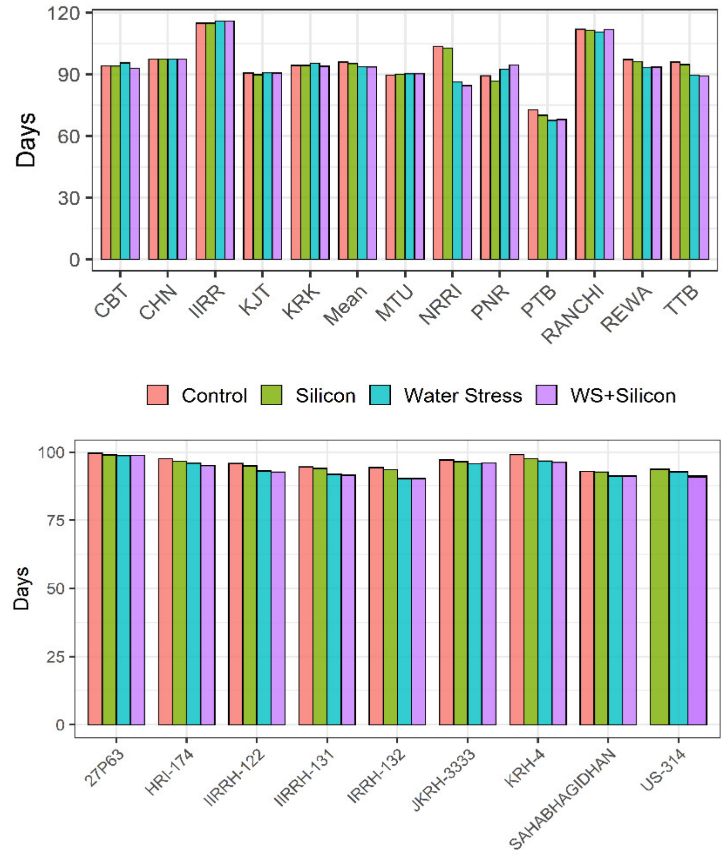


Fig. 6.1.1: Influence of silicon (T2), Water Stress (T3) and WS+Si (T4) on days to flowering of selected rice varieties. Each value represents the mean of 3 replications.

The days to maturity (DM) was significantly (p<0.01) influenced by the treatments. The mean (average of all locations) was increased from 110 days under control to 114 days with silicon application (T1). However, imposition of water stress reduced the DM to 106 days and application of silicon on water stressed crop resulted in marginal improvement in DM to 108 days (*Table* 6.2.2). The interaction between Treatment x Location was found to be significant implying that the treatment effect varied among the locations.

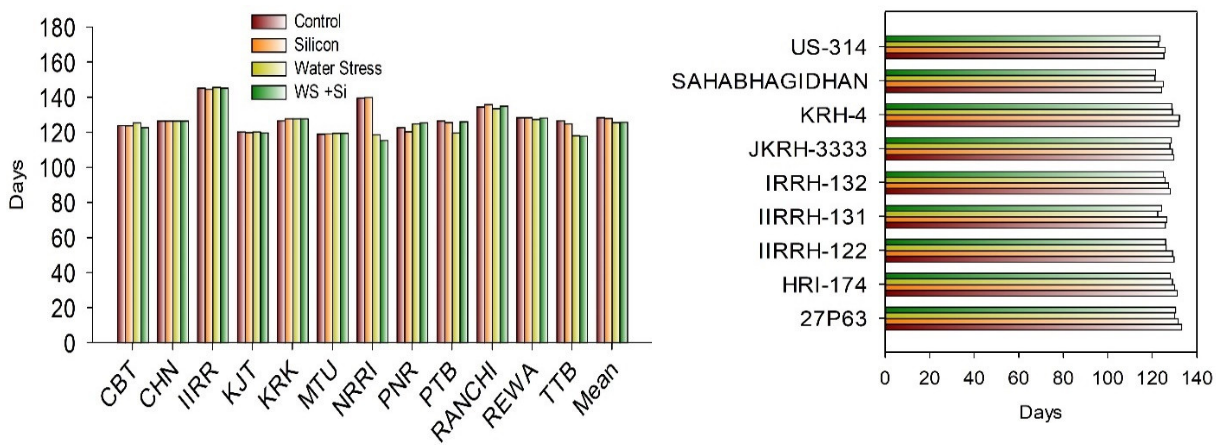


Fig. 6.1.2: Influence of silicon (T2), Water Stress (T3) and WS+Si (T4) on days to maturity of selected rice varieties. Each value represents the mean of 3 replications.

The mean DM (mean of varieties and treatments) varied between a maximum of 146 days (IIRR) to 123 days(TTB) with a mean of 127 days. Significant differences were observed amongst the genotypes for DM and the interaction between location x variety was also found to be significant ($p<0.01$). However, the interaction between Variety x Treatment was non-significant. However, the three way interaction between Treatment x Variety x Location was found to be highly significant (*Table 6.1.2*).

Plant height was significantly (p<0-.01) affected by the treatments (*Table 6.1.3*). The mean plant height under control treatment is 110.4 cm where as under silicon application, the mean plant height was 114.0 cm, whereas under water stress treatment (T3) the mean plant height was reduced to 105.9 cm. When water stress and silicon were applied together the mean plant height was partially improved to 107.6 cm. The interaction between Location x Treatment was found to be highly significant ($p<0.01$) implying that the applied treatment effect varied amongst the locations. The mean plant height (mean of all genotypes) varied between 89.5 cm (CBT) to 136 cm (KRK) followed by MTU (131.4 cm). Significant ($p<0.01$) differences were observed amongst the genotypes included in this study. The mean plant height (mean of all locations and treatments) varied between 91.7 cm (Sahabhagidhan) to 105.5 cm (KRH-4). However, the interaction effect between Treatment x Variety was statistically non-significant *(Table)*. The interaction between Treatment x Variety and three way interaction between Treatment x Variety x Location was found to be non-significant.

Total shoot weight recorded at flowering stage was not significantly influenced by the treatments *(Table 6.1.7)*. However, the interaction between Treatment x Location was found to be highly significant ($p<0.01$) indicating that the response to the treatment was not uniform across the locations. Application of silicon had resulted in >10% increase in mean (mean of all varieties and locations) shoot weight recorded at flowering stage in comparison with control treatment. The mean shoot weight was not influenced significantly by water stress (T3) alone at flowering stage. However, application of silicon along with water stress (T4) had resulted in marginal increase (>4% over control) in shoot weight (*Table 6.1.7)*. Significant differences were observed amongst the varieties ($p<0.01$). The mean shoot weight (mean of all treatments and locations) was highest in KRH-4 and minimum shoot weight was recorded in Sahabhagidhan. The mean shoot weight (mean of all treatments and varieties) was highest at CHN centre followed by KJT and PNR centres and minimum shoot weight was recorded at MTU followed by TTB and NRRI. The interaction between Variety x Treatment was non-significant and the three way interaction between Treatment x Variety x Location was also found to be non-significant *(Table 6.1.7).*

The number of panicle m^{-2} (NP) is an important yield trait which was recorded at harvest. The mean NP was not significantly influenced by the treatments (*Table 6.1.9).* Application of silicon had resulted in >6% increase in NP. The mean NP was not significantly influenced by imposition of water stress (T3) or when WS and Silicon were applied together(T4). The interaction between Variety x Treatment was significant *(p<0.01)* implying that the treatments effect is not uniform across the locations. The differences amongst the varieties was found to be highly significant (p<0.05). The mean NP was highest in HRI-174 followed by 27P63 and JKRH-3333. The interaction between variety x location is highly significant (p<0.01) indicating that the performance of the varieties varied amongst the locations *(Table 6.1.9).* The interaction between Treatment x Variety was non-significant. The three way interaction between Treatment x Variety x Location was found to be highly significant *(p<0.01).*

Number of filled grains per panicle (GNP) is very important yield related trait which show significant change. Application of silicon had resulted in marginal improvement in mean GNP (mean of all locations and varieties). Imposition of water stress (T3) significantly reduced the GNP (>15% reduction in comparison with control). Application of silicon to water stressed crop (T4) significantly reversed negative effects of water stress. The interaction between Treatment x Location is significant (p<0.01) indicating that the treatment effect is not uniform across the locations. Maximum number of GNP were recorded at PNR, CHN and Ranchi followed by MTU.

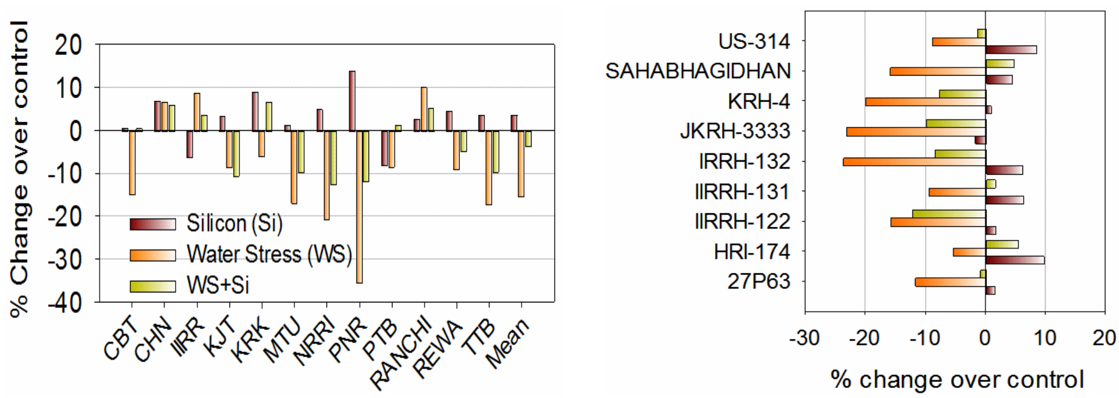


Fig. 6.1.3 influence of silicon (T2), water stress (T3) and WS+Si (T4) on number of filled grains per panicle in different rice varieties at different locations during kharif-2019

Significant differences in mean GNP were found to be significant *(p<0.01)* amongst the varieties. HRI-174 show maximum increase in GNP when silicon was applied followed by US-314. The percent change in GNP in comparison with control was minimum in JKRH-3333, KRH-4, IIRRH-122 (*Fig.6.1.3).* The interaction between Location x Variety was significant *(p<0.01)* indicating that the varieties performed different at different locations. However, the interaction between Treatment x Variety was non-significant. Nevertheless, the three way interaction between Treatment x Variety x Location was found to be significant *(p<0.01).*

The mean 1000 grain weight/Test weight (TW) was not significantly affected by the treatments. Application of silicon had not resulted in any significant change in TW. However, imposing water stress (T3) after flowering stage reduced mean TW by >9% in comparison with control treatment (Table). Application of silicon on water stressed crop (T4) resulted in significantly reversed the deleterious effect of water stress.

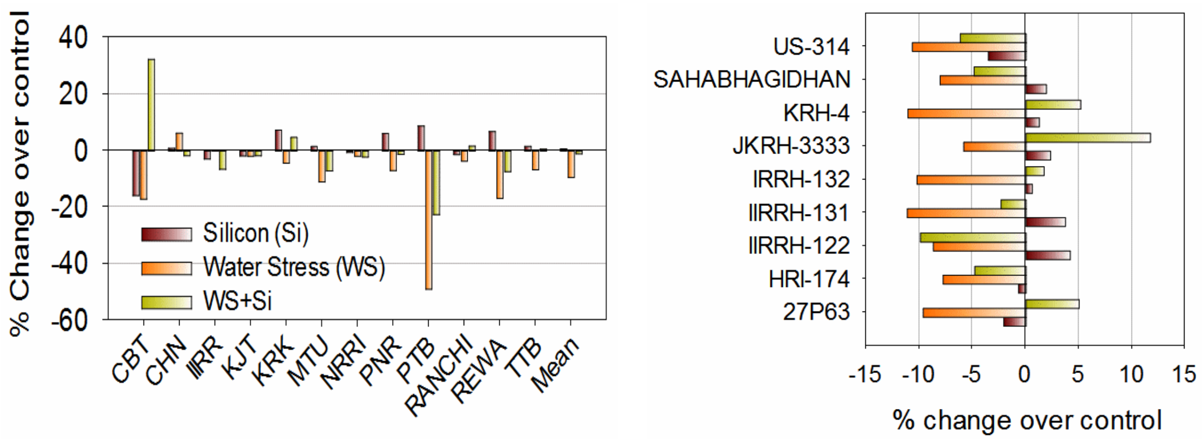
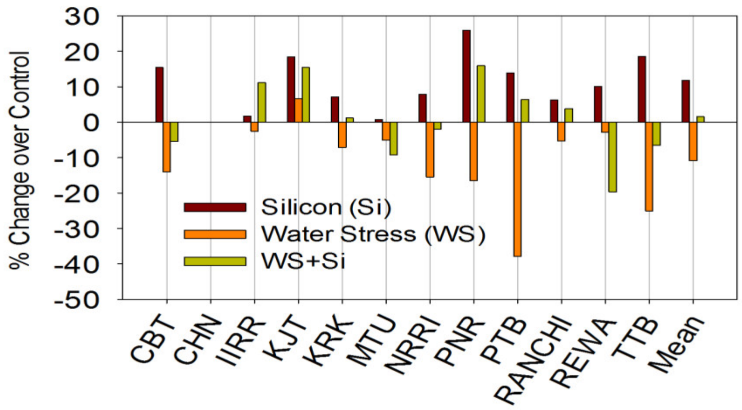


Fig. 6.1.4 influence of silicon (T2), water stress (T3) and WS+Si (T4) on number of 1000 grain weight in different rice varieties at different locations during kharif-2019. Each bar represents the percent reduction in comparison with control.

The interaction between Treatment x location was significant *(p<0.01)* implying that the effect of treatment differed amongst the locations. The mean TW (mean of all treatments and varieties) varied from a minimum of 16.5% (KRK) to a maximum of 23.4 g (KJT) followed by CHN (22.4 g). Significant differences were observed in mean TW amongst the varieties. The mean TW varied between 21.8 (IIRRH-122) to 18.3 (27P63). The interaction between Location x Variety was also found to be significant (p<0.01). However, the interaction between Treatment x Variety was non-significant indicating that the varieties did not responded differently to applied treatments. However, the three way interaction between Treatment x Variety x Location was found to be statistically significant *(p<0.01).*

Total above ground dry matter (TDM) was recorded after physiological maturity and harvest. The data presented in (*Table 6.1.14)*. Indicated that treatments had significant ($p<0.01$) influence on the accumulation of dry matter. Application of silicon (T2) had resulted in >11% increase in mean (mean of all varieties and locations) TDM in comparison with control treatment. Imposing water stress (T3) during reproductive stage resulted in >10% reduction in mean TDM . Application of silicon on water stressed crop (T4) mitigated the negative effect of water stress. In fact it restored the mean TDM value at par with the control treatment. The interaction between Treatment x Location was found to be highly significant ($p<0.01$) implying that the treatment effect varied amongst the locations. Increase in TDM by silicon application (T2) was maximum at PNR followed by TTB *(Fig. 6.1.5)* Minimum improvement was observed at MTU followed by IIRR where in the increase in mean TDM is negligible. Similarly, the interaction between Variety x Location was also found to be significant indicating that the varieties behaved differently at different locations. However, the interaction between Treatment x Varieties was non-significant. Nevertheless, maximum improvement in mean



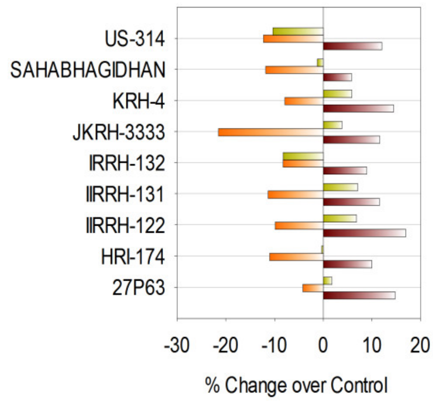


Fig. 6.1.5 influence of silicon (T2), water stress (T3) and WS+Si (T4) on TDM in different rice varieties at different locations during kharif-2019. Each bar represents the percent reduction in comparison with control.

TDM (mean of all locations) was observed in case of IRRH-122 followed by27P63 and KRH-4. Similarly water stress (T3) caused maximum reduction in mean TDM in JKRH-3333 where as 27P63 followed by KRH-4 and IRRH-131 recorded minimum reduction in mean TDM. Furthermore, applicaton of silicon on water stressed plants (T4) reversed the negative effect of WS in all tested varieties except US-314, Sahabhagidhan and 27P63 (*Fig .6.1.5).* The three way interaction between Treatment x Variety x Location was found to be highly significant *($p<0.01$).*

Grain yield (g/m^2) was significantly (p<0.01) by the treatments (*Table* 6.1.15). Application of silicon (T2) resulted in >11% increase in mean grain yield (mean of all varieties and treatments) in comparison with control (T1). Similarly, imposition of water stress (T3) by suspending irrigation during reproductive stage had resulted in <10% increase in mean GY. Application of silicon on water stressed plants (T4) significantly reduced the yield loss caused by water stress. A marginal non-significant improvement in yield was noticed in comparison with control treatment *(Fig.6.1.6).*

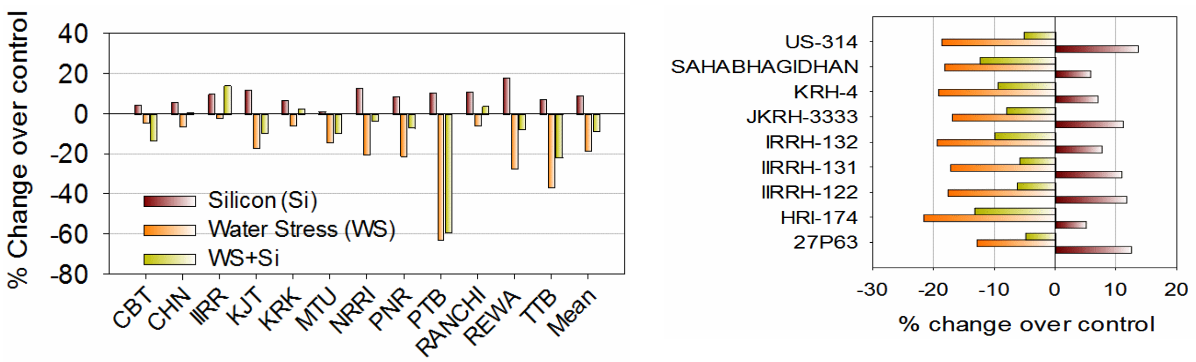


Fig. 6.1.6 influence of silicon (T2), water stress (T3) and WS+Si (T4) on grain yield in different rice varieties at different locations during kharif-2019. Each bar represents the percent reduction in comparison with control.

The interaction between Treatment x Location was highly significant (o<0.01) implying that the treatments effect is not uniform across the locations. Silicon application (T1) resulted in an improvement in GY in comparison with control (T1). The increase in grain yield is maximum at REWA (>17% in crease over control) followed by KJT and NRRI (<12% increase). Similarly, imposition of WS (T3) caused significant reduction in yield and the extent of reduction varied from location to location. Maximum reduction in GY was observed at PTB followed by TTB and REWA (*Fig.6.1.6).* Application of Si on water stressed crop (T4) resulted in reduction in yield loss caused by WS. The effect of more pronounced at IIRR and RANCHI centres *(Table 6.1.15).* The interaction between Treatment x Location and Variety x Location are found to be significant indicating that the treatment effect varied from location to location and varieties differed in their response to treatments. Significant differences were observed amongst the varieties. The mean GY (mean of all locations) varied between 566 g/m^2 (IRRH-132) to 480 g/m^2 (Sahabhagidhan). Application of Si showed maximum effect in JKRH-3333 followed by IIRRH-122 (Fig.). Imposition of water stress show maximum effect on HRI-174 followed by IRRH-132 and KRH-4.

Application Silicon on water stressed plants resulted in maximum mitigation of yield reduction caused by water stress in Sahabhagidhan followed by IIRRH-131 *(Fig.6.1.6)*.

Harvest index is one of the most important yield trait which was measured after harvest. The effect of treatments was non-significant (*Table 6.1.17).* However, the interaction between Treatment x Location was found to be significant ($p<0.01$) the effect of treatment was not uniform across locations. Similarly, the interaction between Treatment x Variety was non-significant. The mean HI was highest at IIRR centre followed by MTU (Table 6.1.17).

Summary & conclusions

In view of the importance of silica in rice nutrition, a trial was conducted at different AICRIP locations spread across the country. The experimental lay-out was split-plot with three replications. The treatments include T1 = Control (water spray), T2 =0.8% Silicon, T3 = Water stress T4 =. Silicon + water stress, Water stress was imposed after PI stage by withholding irrigation. The results revealed that application of silicon (T2) resulted in >11% increase in mean grain yield(mean of all varieties & locations) . The increase in grain yield is maximum at REWA (>17% in crease over control) followed by KJT and NRRI (<12% increase). Similarly, imposition of WS (T3) caused significant reduction in yield and the extent of reduction varied from location to location. Maximum reduction in GY was observed at PTB followed by TTB and REWA. Imposition of water stress (T3) resulted in >10% reduction in mean grain yield. Maximum reduction in GY was observed at PTB followed by TTB and REWA The mean GY (mean of all locations) varied between 566 g/m^2 (IRRH-132) to 480 g/m^2 (Sahabhagidhan). Application of Silicon showed maximum effect in JKRH-3333 followed by IIRRH-122. Imposition of water stress show maximum effect on HRI-174 followed by IRRH-132 and KRH-4. Application Silicon on water stressed plants resulted in maximum mitigation of yield reduction caused by water stress in Sahabhagidhan followed by IIRRH-131.

Table 6.1.1 Influence of Silica application on Days to flowering at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	110	104	117	98	91	96	107	104	70	108	95	96	100
	2	HRI-174	101	103	119	87	90	97	107	96	72	100	100	98	98
	3	IIRRH-122	94	93	117	92	79	86	107	80	78	121	102	100	96
	4	IIRRH-131	93	94	109	87	112	82	99	81	75	113	98	92	95
	5	IRRH-132	88	93	118	89	78	88	104	82	73	120	104	96	94
	6	JKRH-3333	91	103	120	93	86	96	107	103	75	105	92	92	97
	7	KRH-4	100	102	117	89	87	97	107	104	70	119	100	96	99
	8	SB.DHAN	89	92	109	88	112	84	99	76	67	113	90	96	93
	9	US-314	82	93	109	93	114	82	96	78	76	109	94	98	94
		T1 Mean	**94**	**97**	**115**	**91**	**94**	**90**	**104**	**89**	**73**	**112**	**97**	**96**	**96**
T2 (0.6% Silicon)	1	27P63	108	104	117	94	91	95	107	103	77	108	91	92	99
	2	HRI-174	98	103	119	85	92	98	107	92	65	99	104	97	97
	3	IIRRH-122	95	93	117	91	78	85	105	77	75	119	104	100	95
	4	IIRRH-131	94	94	109	85	113	83	101	78	73	114	92	92	94
	5	IRRH-132	87	93	118	89	79	87	102	78	71	118	107	92	93
	6	JKRH-3333	92	103	120	94	86	96	104	101	73	105	92	92	97
	7	KRH-4	100	102	117	89	86	97	105	103	67	117	94	95	98
	8	SB.DHAN	89	92	109	88	113	85	99	73	64	113	91	96	93
	9	US-314	84	93	109	93	112	83	96	77	66	111	92	97	93
		T2 Mean	**94**	**97**	**115**	**90**	**94**	**90**	**103**	**87**	**70**	**111**	**96**	**95**	**95**
T3 (water stress)	1	27P63	110	104	118	98	90	96	95	107	77	106	97	86	99
	2	HRI-174	112	103	120	87	90	98	95	99	61	99	95	92	96
	3	IIRRH-122	91	93	118	93	81	86	86	82	74	119	100	94	93
	4	IIRRH-131	87	94	110	86	119	82	81	85	67	113	91	86	92
	5	IRRH-132	91	93	119	90	78	87	84	86	63	117	88	88	90
	6	JKRH-3333	100	103	121	94	86	96	88	107	74	104	88	87	96
	7	KRH-4	93	102	118	88	85	98	95	106	67	117	100	91	97
	8	SB.DHAN	91	92	110	88	115	85	75	80	63	112	92	91	91
	9	US-314	86	93	110	93	114	85	79	81	63	109	91	92	91
		T3 Mean	**96**	**97**	**116**	**91**	**95**	**90**	**86**	**93**	**68**	**111**	**93**	**90**	**94**
T4 (water stress+silicon)	1	27P63	108	104	118	98	90	96	94	110	77	111	92	86	99
	2	HRI-174	106	103	120	87	90	98	83	101	64	99	98	92	95
	3	IIRRH-122	87	93	118	94	78	87	82	86	74	117	103	94	93
	4	IIRRH-131	90	94	110	85	114	84	82	85	67	113	88	85	91
	5	IRRH-132	86	93	119	90	78	86	82	87	64	117	94	88	90
	6	JKRH-3333	98	103	121	93	87	97	92	110	74	107	85	87	96
	7	KRH-4	96	102	118	89	84	97	87	109	67	115	101	90	96
	8	SB.DHAN	86	92	110	88	112	85	78	82	63	115	93	90	91
	9	US-314	80	93	110	93	113	83	81	82	63	112	89	91	91
		T4 Mean	**93**	**97**	**116**	**91**	**94**	**90**	**85**	**95**	**68**	**112**	**94**	**89**	**94**
		Grand Mean	**94**	**97**	**115**	**91**	**95**	**90**	**94**	**91**	**70**	**112**	**95**	**92**	**95**
		LSD (Silicon)							NS						
		LSD (Center x Silicon)							0.89**						
		LSD (Variety)							ns						
		LSD (Center x Variety)							1.23**						
		LSD (Silicon x Variety)							ns						
		LSD (Center x Silicon x Variety)							2.5**						
		CV (%) Silicon							1.3						
		CV (%) Residual							1.22						

SB.Dhan= Sahabhagidhan

Table 6.1.2 Influence of Silica application on Days to maturity at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	140	133	148	128	128	125	143	132	125	134	133	127	133
	2	HRI-174	131	133	150	117	128	126	143	130	132	121	132	130	131
	3	IIRRH-122	124	122	148	121	128	118	143	121	124	142	134	130	130
	4	IIRRH-131	123	124	140	119	128	111	135	120	123	133	130	123	126
	5	IRRH-132	118	123	150	121	128	118	140	117	123	142	129	127	128
	6	JKRH-3333	121	131	151	123	128	127	143	132	123	128	124	123	130
	7	KRH-4	130	131	148	115	128	126	143	131	132	139	128	128	132
	8	SB.DHAN	119	121	136	118	123	114	135	108	130	139	120	125	124
	9	US-314	112	123	138	123	124	111	133	116	130	134	128	130	125
		T1 Mean	**124**	**127**	**146**	**121**	**127**	**119**	**140**	**123**	**127**	**135**	**129**	**127**	**129**
T2 (0.6% Silicon)	1	27P63	138	133	149	127	128	124	143	130	120	131	134	121	131
	2	HRI-174	128	133	149	115	128	128	143	126	132	121	129	125	130
	3	IIRRH-122	125	122	148	120	128	114	143	119	120	145	131	132	129
	4	IIRRH-131	124	124	137	117	128	113	138	118	123	138	132	125	126
	5	IRRH-132	117	123	149	120	128	116	138	117	123	142	130	122	127
	6	JKRH-3333	122	131	150	123	128	125	143	128	123	131	120	122	129
	7	KRH-4	130	131	147	116	128	125	143	127	132	145	133	127	132
	8	SB.DHAN	119	121	137	118	128	115	138	108	130	136	122	126	125
	9	US-314	114	123	137	123	128	115	133	113	130	138	128	126	126
		T2 Mean	**124**	**127**	**145**	**120**	**128**	**120**	**140**	**121**	**126**	**136**	**129**	**125**	**128**
T3 (water stress)	1	27P63	138	133	149	127	128	126	125	132	126	134	130	116	130
	2	HRI-174	136	133	152	116	128	127	115	132	126	124	128	119	128
	3	IIRRH-122	117	122	150	122	128	117	113	125	126	139	129	122	126
	4	IIRRH-131	120	124	137	118	128	114	113	123	126	142	129	115	124
	5	IRRH-132	116	123	149	119	128	116	113	122	126	139	130	117	125
	6	JKRH-3333	128	131	149	122	128	126	123	132	126	130	129	116	128
	7	KRH-4	126	131	148	118	128	126	118	132	128	139	131	119	129
	8	SB.DHAN	116	121	137	117	128	115	109	111	128	136	120	119	121
	9	US-314	110	123	138	122	128	113	113	122	126	134	131	120	123
		T3 Mean	**123**	**127**	**145**	**120**	**128**	**120**	**116**	**126**	**126**	**135**	**128**	**118**	**126**
T4 (water stress)	1	27P63	140	133	150	128	128	124	128	132	120	130	129	116	130
	2	HRI-174	142	133	150	117	128	127	128	132	120	121	128	120	129
	3	IIRRH-122	121	122	149	122	128	116	118	124	120	141	131	121	126
	4	IIRRH-131	117	124	138	118	128	111	113	123	120	133	126	115	122
	5	IRRH-132	121	123	150	122	128	116	118	121	120	140	132	117	126
	6	JKRH-3333	130	131	153	123	128	126	120	132	120	127	127	117	128
	7	KRH-4	123	131	149	114	128	128	128	132	120	144	129	120	129
	8	SB.DHAN	121	121	138	118	128	115	108	109	120	136	118	120	121
	9	US-314	116	123	137	123	128	114	110	121	120	132	127	120	123
		T4 Mean	**126**	**127**	**146**	**121**	**128**	**120**	**119**	**125**	**120**	**134**	**128**	**118**	**126**
		Grand Mean	**124**	**127**	**145**	**120**	**128**	**120**	**129**	**124**	**125**	**135**	**128**	**122**	**127**
		LSD (Silicon)							NS						
		LSD (Center x Silicon)							0.95**						
		LSD (Variety)							0.397**						
		LSD (Center x Variety)							1.36**						
		LSD (Silicon x Variety)							NS						
		LSD (Center x Silicon x Variety)							2.71**						
		CV (%) Silicon							1.05						
		CV (%) Residual							1.01						

SB.Dhan= Sahabhagidhan

Table 6.1.3 Influence of Silica application on Plant Height (cm) flowering at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	89	0	118	108	141	142	97	126	93	98	0	104	112
	2	HRI-174	89	0	100	116	187	122	103	105	101	98	0	109	113
	3	IIRRH-122	94	0	104	108	126	125	113	119	110	83	0	111	109
	4	IIRRH-131	88	0	99	116	124	145	110	115	105	97	0	111	111
	5	IRRH-132	86	0	109	113	149	126	101	119	85	89	0	106	108
	6	JKRH-3333	97	0	101	109	128	119	100	123	98	89	0	104	107
	7	KRH-4	103	0	117	126	172	147	111	135	97	91	0	125	122
	8	SB.DHAN	97	0	108	107	107	135	101	103	112	93	0	100	106
	9	US-314	86	0	95	122	117	127	99	110	105	93	0	100	106
		T1 Mean	**92**	**0**	**106**	**114**	**139**	**132**	**104**	**118**	**101**	**92**	**0**	**108**	**110**
T2 (0.6% Silicon)	1	27P63	93	0	111	112	136	141	97	132	98	102	0	105	113
	2	HRI-174	94	0	96	121	182	126	101	125	103	102	0	108	116
	3	IIRRH-122	99	0	111	113	131	130	117	139	108	89	0	115	115
	4	IIRRH-131	93	0	96	118	130	143	111	140	110	101	0	111	115
	5	IRRH-132	90	0	114	111	160	125	101	145	88	87	0	104	113
	6	JKRH-3333	102	0	100	109	149	119	100	132	101	95	0	104	111
	7	KRH-4	108	0	128	126	183	148	109	147	100	95	0	130	127
	8	SB.DHAN	102	0	105	108	111	133	99	110	113	95	0	97	107
	9	US-314	90	0	97	125	119	130	100	122	105	91	0	107	109
		T2 Mean	**97**	**0**	**106**	**116**	**145**	**133**	**104**	**132**	**103**	**95**	**0**	**109**	**114**
T3 (water stress)	1	27P63	80	0	107	108	146	143	90	115	100	101	0	99	109
	2	HRI-174	80	0	104	114	128	121	95	121	95	103	0	115	107
	3	IIRRH-122	84	0	113	112	135	125	101	124	107	91	0	98	109
	4	IIRRH-131	79	0	101	117	137	145	102	112	96	102	0	102	109
	5	IRRH-132	77	0	109	109	124	122	101	126	84	89	0	107	105
	6	JKRH-3333	87	0	107	106	141	118	85	118	96	98	0	104	106
	7	KRH-4	93	0	126	124	149	144	106	124	92	92	0	121	117
	8	SB.DHAN	87	0	111	108	115	132	103	101	107	95	0	93	105
	9	US-314	77	0	99	124	113	124	85	102	99	91	0	92	101
		T3 Mean	**83**	**0**	**108**	**114**	**132**	**131**	**96**	**116**	**97**	**96**	**0**	**104**	**108**
T4 (water stress+silicon)	1	27P63	84	0	127	107	149	143	86	114	92	101	0	106	111
	2	HRI-174	84	0	105	115	129	123	91	104	87	105	0	113	106
	3	IIRRH-122	89	0	116	111	125	125	95	110	97	88	0	83	104
	4	IIRRH-131	83	0	108	114	128	144	97	106	88	99	0	105	107
	5	IRRH-132	81	0	120	108	131	122	99	116	77	92	0	105	105
	6	JKRH-3333	92	0	104	105	119	115	85	118	85	91	0	107	102
	7	KRH-4	98	0	131	126	138	143	105	115	82	94	0	121	115
	8	SB.DHAN	91	0	106	111	106	133	90	107	99	97	0	92	103
	9	US-314	81	0	96	121	116	124	84	101	92	93	0	91	100
		T4 Mean	**87**	**0**	**112**	**113**	**127**	**130**	**92**	**110**	**89**	**96**	**0**	**103**	**106**
		Grand Mean	**90**	**0**	**108**	**114**	**136**	**131**	**99**	**119**	**98**	**95**	**0**	**106**	**110**
		LSD (Silicon)							2.96**						
		LSD (Center x Silicon)							10.28**						
		LSD (Variety)							2.68**						
		LSD (Center x Variety)							9.10**						
		LSD (Silicon x Variety)							NS						
		LSD (Center x Silicon x Variety)							NS						
		CV (%) Silicon							15.7						
		CV (%) Residual							9.47						

SB.Dhan= Sahabhagidhan

Table 6.1.4 Influence of Silica application on Leaf Area Index at Tillering different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	IIRR	KRK	NRRI	PNR	PTB	TTB	Grand Mean
T1 (Control)	1	27P63	3.92	4.03	1.00	2.18	2.15	3.99	0.00	2.47
	2	HRI-174	6.80	4.81	1.13	2.39	1.84	5.90	0.00	3.27
	3	IIRRH-122	4.24	3.59	1.14	2.77	2.13	4.62	0.00	2.64
	4	IIRRH-131	2.35	2.96	0.62	2.43	2.16	4.71	0.00	2.18
	5	IRRH-132	3.39	3.02	0.93	2.21	2.21	4.27	0.00	2.29
	6	JKRH-3333	4.64	4.55	0.91	2.56	2.02	4.06	0.00	2.68
	7	KRH-4	6.22	4.46	1.19	2.69	1.93	4.11	0.00	2.94
	8	SB.DHAN	2.66	3.02	0.81	2.45	1.61	4.01	0.00	2.08
	9	US-314	4.55	4.11	0.93	2.33	2.43	4.39	0.00	2.68
		T1 Mean	**4.31**	**3.84**	**0.96**	**2.44**	**2.05**	**4.45**	**0.00**	**2.58**
T2 (0.6% Silicon)	1	27P63	4.18	3.56	1.14	3.45	2.71	4.29	0.00	2.76
	2	HRI-174	7.25	2.66	1.21	2.94	2.50	3.71	0.00	2.90
	3	IIRRH-122	4.52	4.17	1.25	3.06	2.45	5.04	0.00	2.93
	4	IIRRH-131	2.50	3.68	0.93	3.71	2.43	4.25	0.00	2.50
	5	IRRH-132	3.62	4.54	1.06	2.54	2.91	3.41	0.00	2.58
	6	JKRH-3333	4.95	3.64	1.69	3.40	2.51	3.01	0.00	2.74
	7	KRH-4	6.64	3.92	0.91	3.07	2.48	3.57	0.00	2.94
	8	SB.DHAN	2.84	2.09	1.14	2.99	2.75	3.43	0.00	2.18
	9	US-314	4.86	3.44	0.91	3.31	3.13	4.97	0.00	2.94
		T2 Mean	**4.59**	**3.52**	**1.14**	**3.16**	**2.65**	**3.96**	**0.00**	**2.72**
T3 (water stress)	1	27P63	3.82	3.13	1.02	2.22	2.15	1.89	0.00	2.03
	2	HRI-174	6.63	2.70	0.87	2.92	2.42	1.66	0.00	2.46
	3	IIRRH-122	4.03	4.37	1.17	2.47	2.22	1.00	0.00	2.18
	4	IIRRH-131	2.29	2.09	1.36	2.99	2.24	1.38	0.00	1.76
	5	IRRH-132	3.31	2.87	0.74	2.18	2.62	0.99	0.00	1.81
	6	JKRH-3333	4.53	3.22	1.26	3.20	1.78	1.98	0.00	2.28
	7	KRH-4	6.07	2.82	1.35	2.95	1.62	1.26	0.00	2.30
	8	SB.DHAN	2.59	3.75	1.04	2.63	2.19	1.17	0.00	1.91
	9	US-314	4.44	3.66	1.33	2.75	2.66	3.59	0.00	2.63
		T3 Mean	**4.19**	**3.18**	**1.13**	**2.70**	**2.21**	**1.66**	**0.00**	**2.15**
T4 (water stress+silicon)	1	27P63	3.33	4.05	1.03	2.31	1.84	1.14	0.00	1.96
	2	HRI-174	5.79	3.35	1.12	2.36	1.61	0.89	0.00	2.16
	3	IIRRH-122	3.52	2.71	1.12	2.22	1.80	0.75	0.00	1.73
	4	IIRRH-131	2.00	2.98	0.84	2.73	1.89	0.96	0.00	1.63
	5	IRRH-132	2.89	3.66	0.67	2.36	1.95	1.19	0.00	1.82
	6	JKRH-3333	3.95	4.70	0.79	2.32	1.59	1.66	0.00	2.14
	7	KRH-4	5.30	3.24	1.04	2.67	1.55	1.75	0.00	2.22
	8	SB.DHAN	2.26	3.08	0.82	2.32	1.44	0.56	0.00	1.50
	9	US-314	3.88	3.40	0.80	2.21	1.67	2.26	0.00	2.03
		T4 Mean	**3.66**	**3.46**	**0.91**	**2.39**	**1.70**	**1.24**	**0.00**	**1.91**
		Grand Mean	**4.19**	**3.50**	**1.04**	**2.67**	**2.16**	**2.83**	**0.00**	**2.34**
		LSD (Silicon)				NS				
		LSD (Center x Silicon)				0.407**				
		LSD (Variety)				ns				
		LSD (Center x Variety)				0.584**				
		LSD (Silicon x Variety)				NS				
		LSD (Center x Silicon x Variety)				1.16**				
		CV (%) Silicon				24				
		CV (%) Residual				24				

SB.Dhan= Sahabhagidhan

Table 6.1.5 Influence of Silica application on Leaf Area Index at Panicle Initiation different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	IIRR	KRK	NRRI	PNR	PTB	TTB	Grand Mean
T1 (Control)	1	27P63	4.53	8.06	3.37	0.00	4.33	3.03	0.00	4.67
	2	HRI-174	7.84	4.53	3.45	0.00	3.64	5.13	0.00	4.92
	3	IIRRH-122	4.90	5.66	3.04	0.00	3.89	3.73	0.00	4.24
	4	IIRRH-131	2.72	5.01	1.26	0.00	4.09	4.90	0.00	3.60
	5	IRRH-132	3.93	4.86	1.60	0.00	3.84	7.23	0.00	4.29
	6	JKRH-3333	5.36	6.54	2.60	0.00	3.53	4.90	0.00	4.59
	7	KRH-4	7.18	6.94	2.88	0.00	4.16	6.53	0.00	5.54
	8	SB.DHAN	3.08	6.06	1.61	0.00	2.57	4.90	0.00	3.64
	9	US-314	5.26	6.04	2.13	0.00	3.60	3.97	0.00	4.20
		T1 Mean	**4.98**	**5.97**	**2.44**	**0.00**	**3.74**	**4.93**	**0.00**	**4.41**
T2 (0.6% Silicon)	1	27P63	4.83	6.03	3.15	0.00	4.90	5.60	0.00	4.90
	2	HRI-174	8.35	6.25	2.37	0.00	4.81	4.43	0.00	5.24
	3	IIRRH-122	5.22	5.99	2.41	0.00	4.49	3.73	0.00	4.37
	4	IIRRH-131	2.90	4.72	1.49	0.00	4.44	4.90	0.00	3.69
	5	IRRH-132	4.19	5.63	1.82	0.00	4.19	7.00	0.00	4.56
	6	JKRH-3333	5.71	6.09	3.49	0.00	4.46	6.53	0.00	5.26
	7	KRH-4	7.65	7.34	2.87	0.00	4.48	8.17	0.00	6.10
	8	SB.DHAN	3.28	4.40	1.32	0.00	4.20	6.30	0.00	3.90
	9	US-314	5.60	6.31	2.07	0.00	4.28	5.13	0.00	4.68
		T2 Mean	**5.30**	**5.86**	**2.33**	**0.00**	**4.47**	**5.76**	**0.00**	**4.75**
T3 (water stress)	1	27P63	4.41	4.38	2.24	0.00	3.62	1.56	0.00	3.24
	2	HRI-174	7.64	4.80	2.58	0.00	3.92	2.31	0.00	4.25
	3	IIRRH-122	4.66	4.02	2.92	0.00	4.40	1.49	0.00	3.50
	4	IIRRH-131	2.65	3.71	1.88	0.00	3.42	2.22	0.00	2.78
	5	IRRH-132	3.82	4.59	1.20	0.00	3.45	1.03	0.00	2.82
	6	JKRH-3333	5.22	5.60	2.33	0.00	3.33	2.54	0.00	3.80
	7	KRH-4	6.99	6.35	2.58	0.00	3.68	1.56	0.00	4.23
	8	SB.DHAN	3.00	5.15	1.13	0.00	3.12	1.21	0.00	2.72
	9	US-314	5.12	4.19	2.20	0.00	3.45	5.39	0.00	4.07
		T3 Mean	**4.83**	**4.75**	**2.12**	**0.00**	**3.60**	**2.15**	**0.00**	**3.49**
T4 (water stress+silicon)	1	27P63	3.85	5.13	2.47	0.00	3.15	2.47	0.00	3.41
	2	HRI-174	6.67	6.86	1.62	0.00	2.67	1.98	0.00	3.96
	3	IIRRH-122	4.06	7.08	2.89	0.00	3.29	1.24	0.00	3.71
	4	IIRRH-131	2.31	4.55	1.23	0.00	2.90	1.63	0.00	2.53
	5	IRRH-132	3.34	5.88	1.45	0.00	2.84	2.26	0.00	3.16
	6	JKRH-3333	4.56	5.90	1.79	0.00	3.07	1.98	0.00	3.46
	7	KRH-4	6.11	6.66	1.91	0.00	3.64	1.63	0.00	3.99
	8	SB.DHAN	2.62	5.15	0.93	0.00	2.32	1.05	0.00	2.41
	9	US-314	4.47	3.72	1.94	0.00	3.46	2.71	0.00	3.26
		T4 Mean	**4.22**	**5.66**	**1.80**	**0.00**	**3.04**	**1.88**	**0.00**	**3.32**
		Grand Mean	**4.83**	**5.56**	**2.17**	**0.00**	**3.71**	**3.68**	**0.00**	**3.99**
		LSD (Silicon)				0.289*				
		LSD (Center x Silicon)				1.02**				
		LSD (Variety)				0.354*				
		LSD (Center x Variety)				0.937**				
		LSD (Silicon x Variety)				NS				
		LSD (Center x Silicon x Variety)				1.4*				
		CV (%) Silicon				29				
		CV (%) Residual				31				

SB.Dhan= Sahabhagidhan

Table 6.1.6 Influence of Silica application on Leaf Area Index at flowering different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	IIRR	KRK	NRRI	PNR	PTB	TTB	Grand Mean
T1 (Control)	1	27P63	4.78	5.57	3.66	2.77	5.49	5.00	4.64	4.56
	2	HRI-174	8.27	4.69	4.58	2.92	5.19	3.67	5.27	4.94
	3	IIRRH-122	5.18	3.65	2.96	3.31	5.58	4.67	3.46	4.11
	4	IIRRH-131	2.88	3.36	2.13	3.32	5.12	3.33	3.90	3.44
	5	IRRH-132	4.15	3.34	3.11	2.65	5.67	5.67	3.93	4.07
	6	JKRH-3333	5.66	5.50	2.28	3.22	5.22	7.67	3.85	4.77
	7	KRH-4	7.57	5.71	3.57	3.33	5.37	4.67	5.66	5.13
	8	SB.DHAN	3.25	4.76	1.85	2.81	4.53	4.00	4.67	3.70
	9	US-314	5.55	5.70	1.57	3.74	5.47	3.33	4.53	4.27
		T1 Mean	**5.25**	**4.70**	**2.86**	**3.12**	**5.29**	**4.67**	**4.43**	**4.33**
T2 (0.6% Silicon)	1	27P63	5.10	4.27	2.68	4.42	5.89	5.33	5.47	4.74
	2	HRI-174	8.82	4.95	4.67	4.32	5.93	6.00	5.36	5.72
	3	IIRRH-122	5.52	4.09	2.40	3.50	5.90	4.67	3.45	4.22
	4	IIRRH-131	3.07	3.66	2.20	3.79	5.52	5.00	3.97	3.89
	5	IRRH-132	4.42	4.18	2.89	3.32	5.87	11.67	4.05	5.20
	6	JKRH-3333	6.03	5.89	3.23	3.98	5.46	5.33	3.31	4.75
	7	KRH-4	8.07	5.64	4.25	5.79	5.54	6.00	5.61	5.84
	8	SB.DHAN	3.47	3.50	2.37	3.29	5.59	7.33	4.82	4.34
	9	US-314	5.92	4.30	1.86	3.92	5.66	4.67	5.33	4.52
		T2 Mean	**5.60**	**4.50**	**2.95**	**4.04**	**5.71**	**6.22**	**4.60**	**4.80**
T3 (water stress)	1	27P63	4.66	6.13	3.38	3.88	5.33	2.33	3.95	4.24
	2	HRI-174	8.06	6.98	1.74	3.61	5.71	3.67	4.40	4.88
	3	IIRRH-122	4.92	4.67	2.14	2.85	5.51	2.00	2.93	3.57
	4	IIRRH-131	2.80	3.87	2.66	3.23	5.04	1.00	3.60	3.17
	5	IRRH-132	4.04	4.05	1.98	3.12	4.62	2.00	2.91	3.25
	6	JKRH-3333	5.51	5.85	2.59	3.42	4.92	3.33	3.00	4.09
	7	KRH-4	7.38	5.97	2.86	4.37	4.48	2.33	3.97	4.48
	8	SB.DHAN	3.17	4.26	2.59	3.10	4.91	1.67	3.88	3.37
	9	US-314	5.41	3.68	1.11	3.70	5.54	3.00	3.80	3.75
		T3 Mean	**5.11**	**5.05**	**2.34**	**3.48**	**5.12**	**2.37**	**3.60**	**3.87**
T4 (water stress+silicon)	1	27P63	4.07	5.46	4.27	3.10	4.18	3.00	3.44	3.93
	2	HRI-174	7.05	6.99	2.65	2.84	4.78	3.33	3.95	4.51
	3	IIRRH-122	4.29	5.78	2.33	2.56	4.94	2.33	2.65	3.56
	4	IIRRH-131	2.44	5.34	1.94	2.71	4.18	2.67	3.87	3.31
	5	IRRH-132	3.52	3.61	2.56	2.60	3.91	3.33	2.45	3.14
	6	JKRH-3333	4.81	7.30	1.92	2.74	4.12	3.33	3.06	3.90
	7	KRH-4	6.45	6.46	2.14	3.15	5.08	5.67	3.35	4.61
	8	SB.DHAN	2.76	3.91	1.78	2.71	3.52	2.00	3.60	2.90
	9	US-314	4.72	4.11	3.21	2.82	5.05	3.33	3.38	3.80
		T4 Mean	**4.46**	**5.44**	**2.53**	**2.80**	**4.42**	**3.22**	**3.30**	**3.74**
		Grand Mean	**5.10**	**4.92**	**2.67**	**3.36**	**5.13**	**4.12**	**3.98**	**4.18**
		LSD (Silicon)				0.02*				
		LSD (Center x Silicon)				0.44**				
		LSD (Variety)				0.27**				
		LSD (Center x Variety)				0.71**				
		LSD (Silicon x Variety)				NS				
		LSD (Center x Silicon x Variety)				1.42**				
		CV (%) Silicon				19.1				
		CV (%) Residual				21.14				

SB.Dhan= Sahabhagidhan

Table 6.1.7 Influence of Silica application on Shoot Weight (g/m2) maturity at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	1052	2045	665	1062	198	485	536	1523	668	481	553	559	819
	2	HRI-174	1063	3137	580	783	253	415	517	1430	743	482	593	551	879
	3	IIRRH-122	1055	2156	614	1080	164	551	612	975	925	432	603	575	812
	4	IIRRH-131	1046	2201	480	1116	121	550	542	1422	864	474	584	551	829
	5	IRRH-132	1076	2197	533	948	174	537	553	1115	715	457	575	492	781
	6	JKRH-3333	894	2442	563	819	126	514	563	1491	610	470	552	648	808
	7	KRH-4	1049	2768	650	960	200	544	622	1349	440	467	513	560	844
	8	SB.DHAN	942	1495	548	606	102	582	410	917	808	476	541	448	656
	9	US-314	893	2599	621	993	92	559	562	1287	815	445	575	586	835
		T1 Mean	**1008**	**2338**	**584**	**930**	**159**	**526**	**546**	**1279**	**732**	**465**	**565**	**552**	**807**
T2 (0.6% Silicon)	1	27P63	1199	2681	650	1107	148	464	600	1705	823	426	566	769	928
	2	HRI-174	1212	2856	603	1278	261	437	524	1848	694	446	666	706	961
	3	IIRRH-122	1203	2581	536	1149	134	540	677	1160	1158	437	631	641	904
	4	IIRRH-131	1193	2411	505	1467	125	547	638	1274	1057	467	585	620	907
	5	IRRH-132	1227	2358	547	900	164	551	529	1226	760	461	629	609	830
	6	JKRH-3333	1020	3320	580	1170	179	515	575	1682	733	467	562	723	960
	7	KRH-4	1196	3083	736	1227	237	544	659	1645	742	483	544	609	975
	8	SB.DHAN	1074	1443	575	933	130	588	506	815	670	431	532	506	684
	9	US-314	1019	2629	716	1233	106	563	491	1071	1292	449	562	709	903
		T2 Mean	**1149**	**2596**	**605**	**1163**	**165**	**528**	**578**	**1381**	**881**	**452**	**586**	**655**	**895**
T3 (water stress)	1	27P63	904	2133	613	1020	184	526	543	1416	811	435	491	570	804
	2	HRI-174	914	2030	615	1581	97	414	661	1197	1055	442	529	511	837
	3	IIRRH-122	908	2451	554	1374	120	486	768	824	1239	456	604	507	858
	4	IIRRH-131	900	1896	493	1551	147	537	629	1057	1190	467	469	500	820
	5	IRRH-132	926	2562	523	1094	111	548	579	779	1274	473	504	502	823
	6	JKRH-3333	769	3001	585	987	144	515	633	1287	1517	484	653	548	927
	7	KRH-4	902	3362	633	1137	160	537	756	847	1196	467	688	456	928
	8	SB.DHAN	810	1548	539	1113	141	589	389	1086	1250	452	601	471	749
	9	US-314	768	2367	601	981	64	550	537	1036	1152	494	486	580	801
		T3 Mean	**867**	**2372**	**573**	**1204**	**130**	**522**	**610**	**1059**	**1187**	**463**	**559**	**516**	**839**
T4 (water stress+silicon)	1	27P63	995	2610	639	1455	232	540	452	1244	549	474	467	432	841
	2	HRI-174	1006	2879	664	1821	145	396	494	899	539	458	518	439	855
	3	IIRRH-122	998	2105	658	1155	128	482	503	616	737	446	558	422	734
	4	IIRRH-131	990	2399	611	1428	110	514	497	664	666	447	472	420	768
	5	IRRH-132	1018	3089	628	1602	142	548	437	747	595	455	443	395	842
	6	JKRH-3333	846	2711	658	1305	107	484	463	1101	667	464	565	447	818
	7	KRH-4	992	2855	783	1287	118	480	522	749	971	453	621	382	851
	8	SB.DHAN	891	1387	596	1206	99	549	384	759	652	486	577	344	661
	9	US-314	842	2885	638	1224	174	549	398	914	842	466	476	441	821
		T4 Mean	**953**	**2547**	**653**	**1387**	**139**	**505**	**461**	**855**	**691**	**461**	**522**	**414**	**799**
		Grand Mean	**994**	**2463**	**604**	**1171**	**148**	**520**	**549**	**1143**	**873**	**460**	**558**	**534**	**835**
		LSD (Silicon)							NS						
		LSD (Center x Silicon)							333*						
		LSD (Variety)							NS						
		LSD (Center x Variety)							272						
		LSD (Silicon x Variety)							NS						
		LSD (Center x Silicon x Variety)							NS						
		CV (%) Silicon							35.5						
		CV (%) Residual							31						

SB.Dhan= Sahabhagidhan

Table 6.1.8 Influence of Silica application on Panicle Weight (g/m2) maturity at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	1133	1039	885	774	321	579	605	611	432	0	963	494	712
	2	HRI-174	1317	1003	839	675	623	573	698	637	652	0	937	495	768
	3	IIRRH-122	809	1130	888	867	290	551	646	609	689	0	720	498	700
	4	IIRRH-131	781	987	771	978	227	637	601	585	596	0	802	495	678
	5	IRRH-132	807	1254	845	873	461	600	655	652	757	0	809	443	741
	6	JKRH-3333	955	1071	864	942	402	585	612	569	539	0	723	545	710
	7	KRH-4	952	995	1049	879	592	542	733	621	489	0	894	503	750
	8	SB.DHAN	1013	782	849	660	132	699	614	516	574	0	670	403	628
	9	US-314	1485	946	1041	861	262	680	657	647	670	0	975	527	795
		T1 Mean	**1028**	**1023**	**892**	**834**	**368**	**605**	**647**	**605**	**600**	**0**	**832**	**489**	**720**
T2 (0.6% Silicon)	1	27P63	1083	1560	812	1026	352	564	589	695	510	0	1039	674	809
	2	HRI-174	1156	1107	875	780	624	552	749	686	432	0	1033	635	785
	3	IIRRH-122	598	1360	750	882	297	547	653	674	637	0	807	576	707
	4	IIRRH-131	734	1461	733	951	397	627	725	593	746	0	913	558	767
	5	IRRH-132	542	1730	859	843	640	612	731	708	603	0	900	548	792
	6	JKRH-3333	860	1908	831	915	451	613	685	651	715	0	824	651	827
	7	KRH-4	382	1386	976	795	623	579	780	688	549	0	982	547	753
	8	SB.DHAN	1012	1316	802	858	164	752	667	585	683	0	775	455	734
	9	US-314	1278	1590	984	765	283	728	808	695	850	0	1060	638	880
		T2 Mean	**849**	**1491**	**847**	**868**	**426**	**619**	**710**	**664**	**636**	**0**	**926**	**587**	**784**
T3 (water stress)	1	27P63	1396	1665	989	813	325	536	599	584	215	0	888	513	775
	2	HRI-174	971	1793	1034	813	469	525	642	536	230	0	845	459	756
	3	IIRRH-122	612	1521	891	846	192	493	532	576	257	0	758	456	649
	4	IIRRH-131	772	1187	846	828	250	501	653	543	250	0	815	450	645
	5	IRRH-132	978	1349	897	882	313	483	695	621	366	0	765	451	709
	6	JKRH-3333	1411	1770	904	747	298	496	592	529	113	0	658	494	728
	7	KRH-4	1178	1429	801	843	356	482	716	586	49	0	794	411	695
	8	SB.DHAN	677	982	860	3255	145	639	616	514	269	0	535	423	811
	9	US-314	889	1795	1102	870	207	617	734	597	299	0	920	522	778
		T3 Mean	**987**	**1499**	**925**	**1100**	**284**	**530**	**642**	**565**	**228**	**0**	**775**	**464**	**727**
T4 (water stress+silicon)	1	27P63	921	1181	1014	780	275	444	470	556	171	0	697	389	627
	2	HRI-174	905	1164	908	705	425	444	507	501	218	0	663	395	621
	3	IIRRH-122	477	987	1073	759	171	457	454	384	109	0	572	380	529
	4	IIRRH-131	732	944	828	870	211	457	579	502	153	0	565	378	565
	5	IRRH-132	473	1038	1010	678	339	444	571	549	122	0	590	355	561
	6	JKRH-3333	1739	1442	955	771	193	441	591	499	165	0	549	402	704
	7	KRH-4	914	1336	1034	801	478	429	591	517	120	0	654	344	656
	8	SB.DHAN	589	999	872	750	299	614	553	441	99	0	369	310	536
	9	US-314	1073	1001	960	909	245	537	611	569	70	0	694	397	642
		T4 Mean	**869**	**1121**	**962**	**780**	**293**	**474**	**547**	**502**	**136**	**0**	**595**	**372**	**605**
		Grand Mean	**933**	**1284**	**906**	**896**	**343**	**557**	**636**	**584**	**400**	**0**	**782**	**478**	**709**
		LSD (Silicon)							42.3**						
		LSD (Center x Silicon)							194**						
		LSD (Variety)							NS						
		LSD (Center x Variety)							240**						
		LSD (Silicon x Variety)							ns						
		LSD (Center x Silicon x Variety)							480**						
		CV (%) Silicon							31.5						
		CV (%) Residual							35.03						

SB.Dhan= Sahabhagidhan

Table 6.1.9 Influence of Silica application on Panicle Number/m2 maturity at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	339	187	343	258	250	418	283	225	207	201	175	126	251
	2	HRI-174	403	176	350	274	125	429	242	192	250	183	200	194	251
	3	IIRRH-122	342	242	367	222	217	429	263	258	290	227	233	179	272
	4	IIRRH-131	323	220	287	218	167	407	253	208	229	186	217	161	240
	5	IRRH-132	320	231	263	206	213	440	277	225	215	163	242	165	247
	6	JKRH-3333	322	176	260	260	208	484	233	175	220	178	217	131	239
	7	KRH-4	330	209	400	227	188	462	253	225	200	202	167	151	251
	8	SB.DHAN	332	165	393	244	200	451	225	225	251	217	217	138	255
	9	US-314	335	154	327	232	150	473	230	242	261	215	292	134	254
		T1 Mean	**339**	**196**	**332**	**238**	**191**	**444**	**251**	**219**	**236**	**197**	**218**	**153**	**251**
T2 (0.6% Silicon)	1	27P63	330	253	353	231	125	418	268	292	235	205	175	188	256
	2	HRI-174	342	242	310	229	175	451	263	242	262	246	225	209	266
	3	IIRRH-122	417	264	353	223	225	440	247	308	263	254	225	183	284
	4	IIRRH-131	345	264	283	272	188	429	267	242	244	265	217	178	266
	5	IRRH-132	309	275	317	263	263	462	270	325	207	222	208	186	276
	6	JKRH-3333	322	253	317	226	175	473	253	225	252	244	192	145	256
	7	KRH-4	322	253	377	224	213	451	292	292	246	255	275	200	283
	8	SB.DHAN	356	286	273	236	100	462	227	258	235	276	217	159	257
	9	US-314	408	209	427	253	183	473	218	242	295	256	300	151	285
		T2 Mean	**350**	**255**	**334**	**240**	**183**	**451**	**256**	**269**	**249**	**247**	**226**	**178**	**270**
T3 (water stress)	1	27P63	341	242	333	266	100	396	268	225	181	319	233	129	253
	2	HRI-174	422	253	343	297	300	451	262	175	230	263	200	187	282
	3	IIRRH-122	348	275	377	281	250	440	260	225	214	291	167	187	276
	4	IIRRH-131	339	198	367	264	175	429	272	208	246	307	183	170	263
	5	IRRH-132	335	242	343	268	263	440	262	192	203	284	217	172	268
	6	JKRH-3333	305	209	320	248	188	473	278	175	182	205	175	148	242
	7	KRH-4	345	220	280	275	275	440	328	208	222	278	208	189	273
	8	SB.DHAN	337	198	317	260	138	462	217	208	214	325	208	133	251
	9	US-314	359	220	387	278	138	484	262	225	219	244	200	129	262
		T3 Mean	**348**	**229**	**341**	**271**	**203**	**446**	**268**	**205**	**212**	**280**	**199**	**160**	**263**
T4 (water stress+silicon)	1	27P63	363	209	350	298	125	407	265	125	350	267	175	111	254
	2	HRI-174	353	209	340	243	200	440	240	142	460	243	158	156	265
	3	IIRRH-122	425	231	377	283	142	429	267	142	350	309	193	135	273
	4	IIRRH-131	347	220	250	277	192	407	268	108	341	291	258	132	258
	5	IRRH-132	338	231	337	302	188	440	238	92	382	226	217	138	261
	6	JKRH-3333	349	220	313	255	188	451	260	158	344	224	117	134	251
	7	KRH-4	357	231	390	303	138	451	275	125	348	261	175	145	267
	8	SB.DHAN	325	231	367	286	138	462	237	142	253	333	208	124	259
	9	US-314	439	187	307	316	142	495	222	142	273	235	192	132	257
		T4 Mean	**366**	**219**	**337**	**285**	**161**	**442**	**252**	**131**	**344**	**265**	**188**	**134**	**260**
		Grand Mean	**351**	**225**	**336**	**258**	**184**	**446**	**257**	**206**	**260**	**247**	**208**	**156**	**261**
		LSD (Silicon)						NS							
		LSD (Center x Silicon)						29.8**							
		LSD (Variety)						9.1*							
		LSD (Center x Variety)						41.5**							
		LSD (Silicon x Variety)						NS							
		LSD (Center x Silicon x Variety)						83.0**							
		CV (%) Silicon						15.9							
		CV (%) Residual						15.1							

SB.Dhan= Sahabhagidhan

Table 6.1.10 Influence of Silica application on Grain Number/Panicle at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	146	143	139	147	119	216	174	247	157	163	133	128	159
	2	HRI-174	67	140	87	150	137	200	130	248	136	159	136	205	150
	3	IIRRH-122	120	124	89	128	132	138	130	196	117	143	122	117	130
	4	IIRRH-131	130	130	120	134	120	155	148	258	108	144	128	148	144
	5	IRRH-132	92	143	122	156	147	153	126	204	256	145	123	115	148
	6	JKRH-3333	221	226	176	165	136	154	247	370	243	147	137	213	203
	7	KRH-4	146	157	112	154	179	174	168	317	136	159	126	174	167
	8	SB.DHAN	105	127	83	139	155	149	128	133	133	159	118	93	127
	9	US-314	119	177	131	145	91	161	178	239	89	161	143	118	146
		T1 Mean	**127**	**152**	**118**	**147**	**135**	**167**	**159**	**246**	**153**	**153**	**130**	**146**	**153**
T2 (0.6% Silicon)	1	27P63	168	164	123	131	111	211	185	337	87	130	149	142	162
	2	HRI-174	112	173	103	147	176	190	174	266	105	171	140	211	164
	3	IIRRH-122	90	117	78	131	136	135	118	240	130	153	129	123	132
	4	IIRRH-131	123	150	96	149	132	153	150	303	120	169	131	153	152
	5	IRRH-132	126	192	105	177	202	155	128	194	208	162	129	111	157
	6	JKRH-3333	186	211	137	177	154	159	278	397	170	177	132	211	199
	7	KRH-4	160	178	120	151	118	177	182	295	161	151	141	184	168
	8	SB.DHAN	83	114	109	146	162	162	130	219	117	131	121	95	132
	9	US-314	104	164	123	155	135	176	157	270	165	175	147	130	158
		T2 Mean	**128**	**163**	**111**	**152**	**147**	**169**	**167**	**280**	**141**	**158**	**135**	**151**	**158**
T3 (water stress)	1	27P63	175	142	159	122	120	177	151	241	188	163	131	128	158
	2	HRI-174	115	151	135	146	171	176	138	218	189	149	132	172	158
	3	IIRRH-122	96	119	111	121	115	128	98	134	59	171	112	99	114
	4	IIRRH-131	129	150	99	148	144	140	144	212	167	161	121	134	146
	5	IRRH-132	128	175	100	152	183	135	117	164	87	174	115	99	136
	6	JKRH-3333	198	247	147	127	164	140	173	347	178	154	131	187	183
	7	KRH-4	140	189	129	132	116	159	120	287	139	152	120	162	154
	8	SB.DHAN	36	119	105	117	158	146	149	107	282	164	113	96	133
	9	US-314	136	157	114	118	128	154	165	243	103	165	136	110	144
		T3 Mean	**128**	**161**	**122**	**131**	**144**	**151**	**139**	**217**	**155**	**161**	**123**	**132**	**147**
T4 (water stress+silicon)	1	27P63	98	181	156	124	104	158	148	235	82	151	127	124	141
	2	HRI-174	109	150	96	137	144	150	114	236	100	177	128	156	141
	3	IIRRH-122	64	117	102	130	134	115	82	167	42	158	110	87	109
	4	IIRRH-131	108	156	191	146	123	137	110	101	78	170	118	120	130
	5	IRRH-132	54	145	110	135	141	131	127	100	42	165	109	98	113
	6	JKRH-3333	206	234	164	132	120	122	164	193	61	179	124	170	156
	7	KRH-4	169	172	120	147	114	148	119	117	63	178	117	136	133
	8	SB.DHAN	69	109	90	136	140	138	112	81	41	166	100	97	107
	9	US-314	99	194	125	122	123	148	159	200	21	175	130	100	133
		T4 Mean	**108**	**162**	**128**	**134**	**127**	**139**	**126**	**159**	**59**	**169**	**118**	**121**	**129**
		Grand Mean	**123**	**159**	**120**	**141**	**138**	**156**	**148**	**225**	**127**	**160**	**127**	**137**	**147**
		LSD (Silicon)							4.4**						
		LSD (Center x Silicon)							15.1**						
		LSD (Variety)							7.72**						
		LSD (Center x Variety)							26.8**						
		LSD (Silicon x Variety)							Ns						
		LSD (Center x Silicon x Variety)							53.5**						
		CV (%) Silicon							14.3						
		CV (%) Residual							17.3						

SB.Dhan= Sahabhagidhan

Table 6.1.11 Influence of Silica application on Spikelet Number/panicle at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	164	155	187	0	150	232	249	270	199	104	146	143	182
	2	HRI-174	75	153	123	0	152	219	177	266	143	90	149	236	162
	3	IIRRH-122	134	135	120	0	146	155	186	228	159	93	135	138	148
	4	IIRRH-131	145	141	165	0	144	168	190	238	185	86	141	174	161
	5	IRRH-132	103	155	149	0	212	173	162	215	295	92	137	140	167
	6	JKRH-3333	248	241	224	0	181	172	305	403	262	96	153	237	229
	7	KRH-4	164	169	151	0	226	189	213	349	136	94	139	214	186
	8	SB.DHAN	117	138	107	0	177	163	140	145	190	100	129	108	138
	9	US-314	134	188	171	0	122	177	196	273	114	107	163	144	163
		T1 Mean	**143**	**164**	**155**	**0**	**167**	**183**	**202**	**265**	**187**	**96**	**144**	**171**	**171**
T2 (0.6% Silicon)	1	27P63	188	176	163	0	153	232	245	358	106	88	161	160	185
	2	HRI-174	125	185	144	0	231	215	214	282	112	106	152	246	183
	3	IIRRH-122	101	129	106	0	152	154	157	271	205	105	141	140	151
	4	IIRRH-131	138	161	131	0	193	167	196	329	149	98	142	168	170
	5	IRRH-132	141	206	147	0	263	175	163	213	233	99	142	130	174
	6	JKRH-3333	209	227	183	0	188	174	341	419	197	111	147	247	222
	7	KRH-4	179	191	159	0	136	193	237	361	152	102	158	217	190
	8	SB.DHAN	93	125	142	0	170	176	142	230	146	96	132	115	142
	9	US-314	117	175	186	0	159	195	177	295	196	103	168	156	175
		T2 Mean	**143**	**175**	**151**	**0**	**183**	**187**	**208**	**306**	**166**	**101**	**149**	**175**	**177**
T3 (water stress)	1	27P63	196	153	200	0	160	211	216	283	252	110	144	144	188
	2	HRI-174	128	164	192	0	201	206	195	269	233	102	143	216	186
	3	IIRRH-122	108	131	151	0	152	152	165	241	96	111	123	127	142
	4	IIRRH-131	145	162	139	0	218	156	199	264	280	115	131	169	180
	5	IRRH-132	143	187	139	0	254	161	175	218	167	100	127	124	163
	6	JKRH-3333	221	262	190	0	208	166	262	393	224	87	144	231	217
	7	KRH-4	157	202	189	0	170	179	182	316	225	101	135	199	187
	8	SB.DHAN	40	130	126	0	186	167	177	116	348	108	124	113	148
	9	US-314	152	168	168	0	143	176	197	265	140	109	151	131	164
		T3 Mean	**143**	**173**	**166**	**0**	**188**	**175**	**197**	**263**	**218**	**105**	**136**	**162**	**175**
T4 (water stress+silicon)	1	27P63	110	193	203	0	160	214	212	251	107	99	142	137	166
	2	HRI-174	123	163	164	0	217	188	170	256	115	110	142	191	167
	3	IIRRH-122	72	129	129	0	180	149	143	265	75	94	124	118	134
	4	IIRRH-131	121	168	260	0	209	154	169	153	119	111	136	145	159
	5	IRRH-132	60	156	134	0	172	160	181	112	83	107	127	121	128
	6	JKRH-3333	230	251	229	0	182	152	233	209	118	112	134	209	187
	7	KRH-4	189	185	172	0	177	170	187	149	81	117	132	191	159
	8	SB.DHAN	77	119	123	0	168	163	138	105	61	115	118	115	118
	9	US-314	111	206	157	0	158	177	193	222	57	97	145	126	150
		T4 Mean	**121**	**174**	**175**	**0**	**180**	**170**	**181**	**191**	**91**	**107**	**133**	**150**	**152**
		Grand Mean	**138**	**172**	**162**	**0**	**179**	**179**	**197**	**256**	**166**	**102**	**140**	**164**	**169**
		LSD (Silicon)							4.3*						
		LSD (Center x Silicon)							15.1**						
		LSD (Variety)							9.09**						
		LSD (Center x Variety)							31.4**						
		LSD (Silicon x Variety)							ns						
		LSD (Center x Silicon x Variety)							62.8**						
		CV (%) Silicon							13.6						
		CV (%) Residual							19.3						

SB.Dhan= Sahabhagidhan

Table 6.1.12 Influence of Silica application on Grain Number/m2 at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	49436	26829	47800	0	29750	90200	49332	55500	30747	32712	23350	16025	41062
	2	HRI-174	26852	24860	30507	0	17063	85393	31331	47533	36529	29631	27267	39823	36072
	3	IIRRH-122	40898	29524	32144	0	28167	58971	33925	50417	33514	33043	28400	20992	35454
	4	IIRRH-131	41903	28468	33169	0	20200	62656	37594	53725	24612	27484	27700	23791	34664
	5	IRRH-132	29365	33033	32200	0	30513	67177	34936	45825	52157	23471	29842	18916	36130
	6	JKRH-3333	71197	39523	45667	0	28633	74283	57724	64808	45101	26153	29733	27800	46420
	7	KRH-4	48167	33264	45021	0	33342	80366	42916	71250	29209	31473	20867	26416	42026
	8	SB.DHAN	34827	20900	32656	0	30933	66946	28955	29925	37408	34775	25575	12821	32338
	9	US-314	39988	27522	42570	0	14475	76318	41320	57967	23422	34908	41692	15739	37811
		T1 Mean	**42515**	**29325**	**37970**	**0**	**25897**	**73590**	**39781**	**52994**	**34744**	**30406**	**28269**	**22480**	**37998**
T2 (0.6% Silicon)	1	27P63	55450	40579	43580	0	13875	88198	49660	98233	22810	27072	26117	27039	44783
	2	HRI-174	38225	41800	31976	0	30442	85602	45784	64092	28201	42661	31533	44222	44049
	3	IIRRH-122	37576	30888	27322	0	29333	59620	29063	73933	34295	39385	28867	22526	37528
	4	IIRRH-131	42408	39732	27254	0	24758	65560	40072	73250	29735	45023	28500	27328	40329
	5	IRRH-132	38894	52459	33249	0	52571	71874	34389	63158	43249	36173	26783	20548	43032
	6	JKRH-3333	59933	52723	43642	0	26450	75702	70326	89400	42487	43179	25267	30661	50888
	7	KRH-4	51626	44550	45267	0	24073	79684	53312	85925	34556	38513	38717	36671	48445
	8	SB.DHAN	29618	32560	29031	0	16150	74767	29362	56492	35387	36667	26217	15185	34676
	9	US-314	42463	33935	52371	0	28092	83248	34461	65233	50458	44774	44608	19529	45379
		T2 Mean	**44022**	**41025**	**37077**	**0**	**27305**	**76028**	**42937**	**74413**	**35686**	**39272**	**30734**	**27079**	**43234**
T3 (water stress)	1	27P63	59506	34078	52833	0	11792	70235	40240	54425	32444	52234	30542	16429	41342
	2	HRI-174	48346	37983	46258	0	51050	79816	35987	38092	42660	38947	26442	32083	43424
	3	IIRRH-122	33496	32802	41763	0	28925	56540	25724	30150	12162	48932	18533	18498	31593
	4	IIRRH-131	43734	29766	36298	0	25504	60313	38352	44283	41691	48672	22108	22867	37599
	5	IRRH-132	42865	42537	34371	0	47927	59510	30526	31375	17974	49316	24908	17001	36210
	6	JKRH-3333	60309	51964	46954	0	29775	65934	47979	60783	31237	31850	22917	27476	43380
	7	KRH-4	48514	41558	36449	0	31446	69971	39412	59600	31055	42045	24992	30460	41409
	8	SB.DHAN	12096	23562	33563	0	21635	67452	32387	22358	60753	53371	23333	12684	33018
	9	US-314	48646	34958	43720	0	17969	74624	42910	54950	23589	40274	27300	14157	38463
		T3 Mean	**44168**	**36579**	**41356**	**0**	**29558**	**67155**	**37057**	**44002**	**32618**	**45071**	**24564**	**21295**	**38493**
T4 (water stress+silicon)	1	27P63	35544	37895	53923	0	13133	64482	39048	29417	29781	40221	22067	13683	34472
	2	HRI-174	38639	31031	32346	0	28775	66550	27192	33475	44950	42858	20317	24343	35498
	3	IIRRH-122	27159	27005	38299	0	18733	49412	21929	23592	13557	50528	21247	11657	27556
	4	IIRRH-131	37364	34804	34209	0	23517	55605	29609	10967	28331	51420	30350	15756	31994
	5	IRRH-132	18237	33418	37114	0	26396	57805	30477	9342	16871	37641	23617	13543	27678
	6	JKRH-3333	71796	51403	51425	0	22238	55154	42514	30767	26709	39619	14350	22703	38971
	7	KRH-4	60051	39853	46782	0	15675	66726	32800	14667	23435	46657	20400	19604	35150
	8	SB.DHAN	22297	25179	32851	0	19100	63811	26368	11442	10508	55315	21000	12002	27261
	9	US-314	43387	36124	38152	0	17342	73260	35216	28492	5938	41176	24808	13145	32458
		T4 Mean	**39386**	**35190**	**40567**	**0**	**20545**	**61423**	**31684**	**21351**	**22231**	**45048**	**22017**	**16271**	**32338**
		Grand Mean	**42523**	**35530**	**39243**	**0**	**25826**	**69549**	**37865**	**48190**	**31320**	**39949**	**26396**	**21781**	**38016**
		LSD (Silicon)							1103*						
		LSD (Center x Silicon)							5072**						
		LSD (Variety)							2182**						
		LSD (Center x Variety)							7559**						
		LSD (Silicon x Variety)							NS						
		LSD (Center x Silicon x Variety)							15118**						
		CV (%) Silicon							20.21						
		CV (%) Residual							20.58						

SB.Dhan= Sahabhagidhan

Table 6.1.13 Influence of Silica application on Spikelet Number/m2 at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	55369	2200	64146	0	3750	97119	70582	60750	39972	20747	25567	17930	41648
	2	HRI-174	30074	2167	43195	0	3788	93676	42539	51083	37964	16493	29800	45929	36064
	3	IIRRH-122	45805	2728	43642	0	3638	66429	49194	59000	45547	21092	31517	24661	35750
	4	IIRRH-131	46343	2420	46234	0	3588	68068	48328	49492	43426	16037	30450	28042	34766
	5	IRRH-132	33312	2772	39273	0	5288	75636	44886	48300	59981	14940	33300	23147	34621
	6	JKRH-3333	79741	2772	58327	0	4513	83171	71329	70525	52000	16976	33267	30938	45778
	7	KRH-4	53947	2662	60567	0	5642	87527	54116	78450	31582	18885	23083	32599	40824
	8	SB.DHAN	39006	1870	42250	0	4425	73194	31514	32550	50005	21869	28025	14911	30874
	9	US-314	44787	1694	55247	0	3042	83897	45494	65900	29965	23134	47583	19274	38183
		T1 Mean	**47598**	**2365**	**50320**	**0**	**4186**	**80969**	**50887**	**57339**	**43382**	**18908**	**31399**	**26381**	**37612**
T2 (0.6% Sidslicon)	1	27P63	62105	3036	57459	0	3825	96965	65784	104417	22613	18361	28250	30463	44843
	2	HRI-174	42812	2827	44355	0	5763	96712	56276	68258	21545	26361	34317	51547	40979
	3	IIRRH-122	42086	3080	36688	0	3788	67980	38924	83583	42189	27529	31633	25709	36654
	4	IIRRH-131	47497	3003	37137	0	4813	71445	52275	79500	36627	25940	30883	30053	38107
	5	IRRH-132	43562	3641	46021	0	6575	81312	43863	69225	46523	25128	29442	24043	38121
	6	JKRH-3333	67124	3993	58049	0	4700	82863	86419	94275	37632	26745	28142	35881	47802
	7	KRH-4	57821	3234	59766	0	3400	87021	69628	105458	44532	25876	43458	43266	49405
	8	SB.DHAN	33172	3047	37767	0	4238	81246	32253	59442	44164	27227	28600	18516	33606
	9	US-314	47558	2376	79039	0	3963	92257	38797	71200	47858	26161	50700	23472	43944
		T2 Mean	**49304**	**3137**	**50698**	**0**	**4563**	**84200**	**53802**	**81706**	**38187**	**25481**	**33936**	**31439**	**41496**
T3 (water stress)	1	27P63	66646	2750	66648	0	3996	83622	57648	63592	43903	35223	33592	18534	43287
	2	HRI-174	54147	3190	65927	0	5013	93291	51174	47075	52720	26728	28717	40340	42575
	3	IIRRH-122	37515	3311	56683	0	3800	66935	43206	54225	20336	32200	20317	23776	32937
	4	IIRRH-131	48982	2376	51279	0	5438	66880	53568	55125	68537	35482	24031	28769	40042
	5	IRRH-132	48009	2827	47513	0	6338	70928	45673	41858	34658	28492	27533	21275	34100
	6	JKRH-3333	67546	3300	60579	0	5200	78496	72958	68717	39760	17682	25181	34005	43039
	7	KRH-4	54335	2860	52946	0	4246	78771	59560	65792	50073	28847	27983	37525	42085
	8	SB.DHAN	13548	2112	39815	0	4638	77154	38416	24258	74773	41127	25653	14945	32404
	9	US-314	54484	2343	63119	0	3563	85096	51484	59717	31927	26626	30350	16913	38693
		T3 Mean	**49468**	**2785**	**56057**	**0**	**4692**	**77908**	**52632**	**53373**	**46299**	**30267**	**27040**	**26231**	**38796**
T4 (water stress+silicon)	1	27P63	39810	2574	70467	0	4000	87527	56128	31417	38491	26273	24783	15236	36064
	2	HRI-174	43275	2728	55676	0	5417	83336	40813	36300	52168	27433	22433	29745	36302
	3	IIRRH-122	30418	2772	48360	0	4488	64262	37965	37600	24825	28922	23959	15914	29044
	4	IIRRH-131	41847	2640	47279	0	5213	62557	45241	16608	42619	33091	35100	19022	31929
	5	IRRH-132	20426	2541	45047	0	4308	70279	43324	10075	33535	24511	27533	16609	27108
	6	JKRH-3333	80412	3674	71737	0	4542	68530	60338	33050	49066	25030	15567	27912	39987
	7	KRH-4	67257	3014	66855	0	4425	76813	51189	18583	29436	30163	22992	27559	36208
	8	SB.DHAN	24973	2464	44770	0	4200	75009	32513	14942	15136	38974	24767	14760	26592
	9	US-314	48593	2244	47855	0	3958	87879	42466	31342	16345	22868	27683	16548	31617
		T4 Mean	**44112**	**2739**	**55338**	**0**	**4506**	**75132**	**45553**	**25546**	**33513**	**28585**	**24980**	**20583**	**32781**
		Grand Mean	**47621**	**2757**	**53103**	**0**	**4486**	**79552**	**50719**	**54491**	**40345**	**25810**	**29339**	**26211**	**37676**
		LSD (Silicon)							NS						
		LSD (Center x Silicon)							5807**						
		LSD (Variety)							2417**						
		LSD (Center x Variety)							8373**						
		LSD (Silicon x Variety)							NS						
		LSD (Center x Silicon x Variety)							16748**						
		CV (%) Silicon							23.3						
		CV (%) Residual							23.01						

SB.Dhan= Sahabhagidhan

Table 6.1.14 Influence of Silica application on Total Dry Matter (g/m2) maturity at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	1331	0	1551	1410	2622	979	1141	2133	1100	683	1588	1063	1418
	2	HRI-174	1346	0	1419	1506	2689	864	1215	2067	1394	664	1641	1047	1441
	3	IIRRH-122	1336	0	1503	1548	2089	1076	1259	1583	1614	659	1600	1092	1396
	4	IIRRH-131	1324	0	1251	1452	2333	1124	1143	2007	1460	661	1457	1046	1387
	5	IRRH-132	1362	0	1378	1746	2244	1122	1208	1767	1472	620	1496	934	1395
	6	JKRH-3333	1132	0	1427	1377	2067	1012	1175	2060	1148	648	1526	1232	1346
	7	KRH-4	1328	0	1699	1197	2222	1067	1355	1970	929	670	1726	1063	1384
	8	SB.DHAN	1193	0	1397	1728	1333	1192	1024	1433	1382	693	1339	850	1233
	9	US-314	1132	0	1662	1683	1622	1153	1218	1933	1485	661	1615	1113	1389
		T1 Mean	**1276**	**0**	**1476**	**1516**	**2136**	**1065**	**1193**	**1884**	**1332**	**662**	**1554**	**1049**	**1377**
T2 (0.6% Silicon)	1	27P63	1518	0	1462	1801	2833	945	1189	2400	1333	631	1798	1461	1579
	2	HRI-174	1534	0	1478	1686	2756	874	1273	2533	1126	692	1906	1342	1564
	3	IIRRH-122	1523	0	1287	2121	2711	1080	1330	1833	1795	691	1665	1217	1569
	4	IIRRH-131	1510	0	1238	1683	2378	1136	1363	1867	1803	732	1685	1178	1507
	5	IRRH-132	1553	0	1405	1809	2333	1144	1259	1933	1363	684	1729	1157	1488
	6	JKRH-3333	1291	0	1410	1638	2133	1017	1260	2333	1448	711	1580	1374	1472
	7	KRH-4	1513	0	1712	1539	2333	1079	1439	2333	1291	738	1766	1157	1536
	8	SB.DHAN	1359	0	1377	1935	1467	1217	1173	1400	1353	708	1480	961	1312
	9	US-314	1291	0	1700	1956	1644	1172	1300	1767	2141	705	1791	1347	1529
		T2 Mean	**1455**	**0**	**1452**	**1797**	**2288**	**1074**	**1287**	**2044**	**1517**	**699**	**1711**	**1244**	**1506**
T3 (water stress)	1	27P63	1145	0	1601	1677	2800	959	1142	2000	1027	753	1552	1084	1431
	2	HRI-174	1157	0	1649	1410	2789	811	1303	1733	1286	705	1553	970	1397
	3	IIRRH-122	1149	0	1445	1614	2622	946	1300	1400	1497	747	1568	963	1386
	4	IIRRH-131	1139	0	1340	1578	2267	1028	1282	1600	1403	774	1443	950	1346
	5	IRRH-132	1172	0	1420	2265	2267	1092	1274	1400	1682	757	1416	953	1427
	6	JKRH-3333	974	0	1489	1476	2422	951	1224	1817	1630	689	1497	1042	1383
	7	KRH-4	1142	0	1434	1260	2178	1041	1472	1433	1245	745	1678	866	1318
	8	SB.DHAN	1026	0	1398	1818	1244	1156	1005	1600	1541	776	1321	895	1253
	9	US-314	974	0	1703	1761	1489	1118	1270	1633	1451	738	1561	1103	1346
		T3 Mean	**1097**	**0**	**1498**	**1651**	**2231**	**1011**	**1253**	**1624**	**1418**	**743**	**1510**	**981**	**1365**
T4 (water stress+silicon)	1	27P63	1259	0	1653	2022	2800	957	922	1800	720	741	1300	822	1363
	2	HRI-174	1273	0	1572	1410	2689	762	1001	1400	757	701	1287	834	1244
	3	IIRRH-122	1264	0	1731	1692	2622	915	957	1000	846	755	1311	802	1263
	4	IIRRH-131	1253	0	1438	1880	2044	985	1076	1167	819	738	1183	798	1216
	5	IRRH-132	1289	0	1638	2366	2000	1078	1009	1297	718	680	1162	750	1271
	6	JKRH-3333	1071	0	1613	1413	2560	876	1054	1600	832	688	1215	849	1252
	7	KRH-4	1256	0	1817	1893	2133	957	1112	1267	1091	713	1411	726	1307
	8	SB.DHAN	1128	0	1468	1539	1156	1089	937	1200	751	819	1057	654	1073
	9	US-314	1071	0	1597	1542	1444	1090	1009	1483	912	701	1309	838	1182
		T4 Mean	**1207**	**0**	**1614**	**1751**	**2161**	**968**	**1009**	**1357**	**827**	**726**	**1248**	**786**	**1241**
		Grand Mean	**1259**	**0**	**1510**	**1679**	**2204**	**1030**	**1185**	**1727**	**1273**	**708**	**1506**	**1015**	**1372**
		LSD (Silicon)						87.9**							
		LSD (Center x Silicon)						304**							
		LSD (Variety)						NS							
		LSD (Center x Variety)						181.9**							
		LSD (Silicon x Variety)						ns							
		LSD (Center x Silicon x Variety)						363**							
		CV (%) Silicon						23.6							
		CV (%) Residual						13.7							

SB.Dhan= Sahabhagidhan

Table 6.1.15 Influence of Silica application on Grain Yield (g/m2) at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	510	4479	763	744	467	495	412	613	362	296	863	470	873
	2	HRI-174	588	5313	723	754	644	449	524	630	511	255	854	473	977
	3	IIRRH-122	548	4896	783	619	644	526	524	536	550	290	623	417	913
	4	IIRRH-131	594	4635	674	794	444	574	488	457	480	265	725	423	880
	5	IRRH-132	815	5104	750	800	578	584	537	641	629	160	713	401	976
	6	JKRH-3333	576	4479	769	712	578	498	446	530	411	243	618	520	865
	7	KRH-4	750	4844	914	663	489	523	543	618	379	213	766	468	931
	8	SB.DHAN	499	4792	751	865	378	610	484	515	445	249	577	349	876
	9	US-314	658	4583	916	840	422	594	575	575	555	231	883	495	944
		T1 Mean	**615**	**4792**	**783**	**754**	**516**	**539**	**504**	**568**	**480**	**245**	**736**	**446**	**915**
T2 (0.6% Silicon)	1	27P63	534	5417	698	791	511	481	490	619	429	279	995	555	983
	2	HRI-174	615	5104	746	863	656	437	572	673	329	237	989	483	975
	3	IIRRH-122	574	5260	652	964	667	540	536	522	521	261	747	439	974
	4	IIRRH-131	621	4167	627	861	489	589	624	535	613	314	858	439	895
	5	IRRH-132	852	5625	765	979	711	592	591	706	506	213	845	431	1068
	6	JKRH-3333	602	4531	724	788	600	502	538	610	561	367	754	561	928
	7	KRH-4	785	4583	861	766	511	535	583	666	595	201	908	497	958
	8	SB.DHAN	522	4792	699	756	356	630	553	558	525	249	703	375	893
	9	US-314	688	6146	810	854	467	609	632	671	706	213	1014	534	1112
		T2 Mean	**644**	**5069**	**731**	**847**	**552**	**546**	**569**	**618**	**532**	**259**	**868**	**479**	**976**
T3 (water stress)	1	27P63	444	5417	865	709	489	433	417	559	187	332	824	350	919
	2	HRI-174	512	4479	883	693	622	396	487	530	150	290	809	338	849
	3	IIRRH-122	477	4271	779	751	644	460	399	461	214	249	571	374	804
	4	IIRRH-131	517	4115	728	775	556	492	496	523	188	320	685	329	810
	5	IRRH-132	709	5208	780	629	556	544	512	592	243	237	671	347	919
	6	JKRH-3333	501	4896	793	650	567	436	455	524	185	332	573	368	857
	7	KRH-4	653	4531	673	591	533	504	547	535	173	237	714	281	831
	8	SB.DHAN	434	4479	779	596	356	567	471	483	204	279	419	366	786
	9	US-314	573	6146	956	756	444	568	594	558	231	279	842	400	1029
		T3 Mean	**535**	**4838**	**804**	**683**	**530**	**489**	**487**	**530**	**197**	**284**	**679**	**350**	**867**
T4 (water stress+silicon)	1	27P63	486	4896	886	593	533	417	385	487	183	338	668	331	850
	2	HRI-174	560	4167	740	662	622	366	362	425	204	279	652	282	777
	3	IIRRH-122	522	4792	956	623	644	433	293	359	141	320	423	264	814
	4	IIRRH-131	565	3646	714	662	411	471	418	400	244	302	539	262	720
	5	IRRH-132	775	4583	905	691	533	530	421	528	166	178	525	247	840
	6	JKRH-3333	548	4531	827	562	489	392	437	479	244	379	441	276	800
	7	KRH-4	714	4792	880	478	467	477	446	433	201	237	566	251	828
	8	SB.DHAN	492	3958	761	747	291	540	410	438	142	267	298	271	718
	9	US-314	627	5104	850	632	389	542	453	492	80	296	704	375	879
		T4 Mean	**588**	**4497**	**836**	**628**	**487**	**463**	**403**	**449**	**178**	**288**	**535**	**284**	**803**
		Grand Mean	**596**	**4799**	**788**	**728**	**521**	**509**	**490**	**541**	**347**	**269**	**704**	**390**	**890**
		LSD (Silicon)						59.0**							
		LSD (Center x Silicon)						204**							
		LSD (Variety)						47.5*							
		LSD (Center x Variety)						216**							
		LSD (Silicon x Variety)						ns							
		LSD (Center x Silicon x Variety)						ns							
		CV (%) Silicon						31.9							
		CV (%) Residual						23.1							

SB.Dhan= Sahabhagidhan

Table 6.1.16 Influence of Silica application on 1000 Grain weight (g) at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	16.8	17.8	16.0	18.8	14.1	17.5	17.0	17.8	25.0	22.2	17.1	22.9	18.6
	2	HRI-174	23.3	26.2	23.7	25.8	15.2	22.1	23.6	25.2	21.3	21.4	18.1	17.8	22.0
	3	IIRRH-122	21.1	25.7	24.4	25.6	14.3	22.3	24.2	24.1	25.0	21.9	21.5	20.9	22.6
	4	IIRRH-131	17.5	20.8	20.3	23.7	13.7	21.0	20.0	20.3	23.3	25.2	18.5	22.4	20.6
	5	IRRH-132	22.1	24.5	23.3	26.0	16.8	21.9	22.0	22.4	19.0	22.8	21.1	18.5	21.7
	6	JKRH-3333	18.2	18.2	16.8	25.1	16.7	16.6	17.0	17.8	17.3	21.1	18.6	22.3	18.8
	7	KRH-4	20.3	19.0	20.5	21.5	17.7	20.2	19.1	19.6	18.7	22.1	22.4	21.2	20.2
	8	SB.DHAN	23.6	25.7	23.0	25.5	19.7	21.2	22.8	23.6	23.3	22.0	21.9	16.0	22.4
	9	US-314	28.0	23.5	21.5	21.5	17.5	21.5	20.9	22.3	21.7	21.8	22.7	21.1	22.0
		T1 Mean	**21.2**	**22.4**	**21.1**	**23.7**	**16.2**	**20.5**	**20.7**	**21.5**	**21.6**	**22.3**	**20.2**	**20.3**	**21.0**
T2 (0.6% Silicon)	1	27P63	11.6	19.7	16.0	19.3	14.5	17.4	16.2	18.6	22.0	22.1	18.0	22.9	18.2
	2	HRI-174	18.8	23.0	23.3	25.7	18.2	22.9	23.1	27.6	22.7	18.5	19.8	18.3	21.8
	3	IIRRH-122	19.2	26.8	23.8	25.9	14.6	22.8	23.4	25.0	32.7	23.7	23.3	21.0	23.5
	4	IIRRH-131	20.2	20.2	23.0	23.4	19.4	21.2	20.8	21.2	25.7	19.5	18.2	23.2	21.3
	5	IRRH-132	20.5	23.8	23.0	26.1	17.2	22.0	22.3	23.0	20.7	21.4	23.1	18.8	21.8
	6	JKRH-3333	13.7	20.5	16.6	25.0	18.0	16.5	16.3	22.3	20.3	19.3	20.2	22.2	19.2
	7	KRH-4	16.0	19.8	19.0	20.8	16.4	20.6	18.7	21.3	20.3	25.9	24.7	21.9	20.4
	8	SB.DHAN	19.2	25.0	24.1	25.5	23.3	22.1	23.2	23.8	22.7	25.4	23.2	16.1	22.8
	9	US-314	21.7	24.5	15.4	18.2	14.9	22.2	21.7	22.8	25.0	22.3	24.2	21.9	21.2
		T2 Mean	**17.9**	**22.6**	**20.5**	**23.3**	**17.4**	**20.8**	**20.6**	**22.8**	**23.6**	**22.0**	**21.6**	**20.7**	**21.2**
T3 (water stress)	1	27P63	40.1	20.3	16.4	19.2	14.4	16.3	16.0	17.6	13.7	20.9	16.3	22.8	19.5
	2	HRI-174	22.5	21.2	19.1	26.3	17.4	21.0	22.5	24.0	20.0	22.4	16.3	18.3	20.9
	3	IIRRH-122	17.2	24.5	18.6	25.0	15.0	21.2	22.8	24.4	14.0	20.4	19.9	21.0	20.3
	4	IIRRH-131	22.2	19.2	20.0	22.9	13.6	19.2	19.9	20.6	22.3	22.4	16.0	22.6	20.1
	5	IRRH-132	28.5	24.0	22.7	26.0	21.0	19.7	22.2	22.2	16.0	23.8	20.1	18.6	22.1
	6	JKRH-3333	45.1	19.0	16.9	24.7	16.1	15.5	16.3	18.1	15.7	25.0	17.4	22.4	21.0
	7	KRH-4	33.3	20.5	18.5	20.5	21.6	19.2	17.8	18.8	16.7	25.2	21.0	21.8	21.2
	8	SB.DHAN	19.7	25.8	23.3	25.7	18.9	19.6	23.0	23.4	19.3	20.7	20.6	15.3	21.3
	9	US-314	24.2	23.7	21.9	19.5	14.8	19.9	22.4	22.0	13.3	23.1	21.1	21.8	20.6
		T3 Mean	**28.1**	**22.0**	**19.7**	**23.3**	**17.0**	**19.1**	**20.3**	**21.2**	**16.8**	**22.7**	**18.7**	**20.5**	**20.8**
T4 (water stress+silicon)	1	27P63	16.0	20.3	16.4	19.2	14.1	15.5	15.2	16.6	12.3	21.0	14.7	19.9	16.8
	2	HRI-174	21.9	26.2	22.9	25.4	15.0	20.1	21.8	22.3	14.0	20.7	15.8	17.0	20.3
	3	IIRRH-122	21.0	27.8	25.0	25.4	13.4	19.6	22.5	23.4	9.3	21.4	18.7	19.8	20.6
	4	IIRRH-131	17.2	23.2	20.9	22.7	11.1	18.7	21.0	19.1	11.7	19.1	14.6	20.0	18.3
	5	IRRH-132	14.4	26.3	24.4	25.9	15.9	18.9	23.7	20.8	8.0	20.9	17.2	17.2	19.5
	6	JKRH-3333	16.1	18.8	16.1	25.7	14.1	15.0	16.4	17.0	13.7	21.7	16.1	21.7	17.7
	7	KRH-4	10.6	20.8	18.8	20.3	17.3	18.7	18.3	16.3	11.0	26.2	17.1	20.0	17.9
	8	SB.DHAN	22.7	26.7	23.2	25.9	19.7	18.6	22.6	23.2	11.0	19.4	18.4	15.5	20.6
	9	US-314	18.5	24.0	22.3	19.2	19.0	19.3	21.8	21.2	8.7	23.0	18.8	20.0	19.7
		T4 Mean	**17.6**	**23.8**	**21.1**	**23.3**	**15.5**	**18.3**	**20.4**	**20.0**	**11.1**	**21.5**	**16.8**	**19.0**	**19.0**
		Grand Mean	**21.2**	**22.7**	**20.6**	**23.4**	**16.5**	**19.7**	**20.5**	**21.4**	**18.3**	**22.1**	**19.4**	**20.1**	**20.5**
		LSD (Silicon)							NS						
		LSD (Center x Silicon)							1.57**						
		LSD (Variety)							0.605**						
		LSD (Center x Variety)							2.118**						
		LSD (Silicon x Variety)							NS						
		LSD (Center x Silicon x Variety)							4.23**						
		CV (%) Silicon							10.6						
		CV (%) Residual							9.78						

SB.Dhan= Sahabhagidhan

Table 6.1.17 Influence of Silica application on Harvest Index (%) at different centres Kharif 2019

Treat.	S.No.	Genotypes	CBT	CHN	IIRR	KJT	KRK	MTU	NRRI	PNR	PTB	RANCHI	REWA	TTB	Grand Mean
T1 (Control)	1	27P63	37.7	45.7	49.1	44.4	17.9	50.6	36.1	28.8	32.9	43.5	54.0	44.4	40.4
	2	HRI-174	43.3	45.0	51.0	46.5	24.0	51.9	43.1	30.6	36.5	38.6	53.7	45.3	42.5
	3	IIRRH-122	40.7	48.7	52.2	45.5	29.4	48.8	41.5	33.9	34.9	44.1	38.8	38.2	41.3
	4	IIRRH-131	44.7	47.1	53.6	44.4	18.7	51.0	42.8	22.8	33.5	40.1	49.4	40.6	40.7
	5	IRRH-132	59.7	45.1	54.3	43.5	25.8	51.9	44.5	36.3	43.3	25.8	49.2	43.1	43.5
	6	JKRH-3333	50.3	43.9	53.7	44.4	28.9	49.2	38.1	25.8	35.6	37.4	40.2	42.3	40.8
	7	KRH-4	56.3	48.1	53.8	45.4	22.4	49.0	40.1	31.4	40.2	31.7	44.4	44.1	42.2
	8	SB.DHAN	41.7	45.1	53.8	45.5	28.5	51.2	47.3	36.0	32.0	35.9	42.4	41.2	41.7
	9	US-314	57.7	42.6	55.1	45.5	26.0	51.5	47.2	29.8	37.7	35.1	55.2	44.7	44.0
		T1 Mean	**48.0**	**45.7**	**53.0**	**45.0**	**24.6**	**50.6**	**42.3**	**30.6**	**36.3**	**36.9**	**47.5**	**42.6**	**41.9**
T2 (0.6% Silicon)	1	27P63	35.0	48.6	47.6	44.4	18.0	51.0	41.2	25.8	33.0	44.7	55.4	38.0	40.2
	2	HRI-174	39.7	47.1	50.5	46.5	23.9	50.0	44.9	26.6	26.6	34.3	51.9	36.0	39.8
	3	IIRRH-122	37.3	47.4	50.3	45.5	24.3	50.0	40.1	28.5	28.6	38.3	44.9	36.1	39.3
	4	IIRRH-131	40.7	46.4	50.7	44.4	20.7	51.8	45.8	28.7	34.0	42.7	50.9	37.4	41.2
	5	IRRH-132	54.3	44.2	54.2	43.5	30.4	51.8	46.9	36.6	34.0	31.0	48.9	37.6	42.8
	6	JKRH-3333	46.3	44.9	51.1	44.4	30.2	49.4	42.6	26.2	36.1	51.8	47.7	40.8	42.6
	7	KRH-4	51.3	46.7	50.3	45.5	22.5	49.6	40.5	28.6	46.2	27.3	51.4	43.1	41.9
	8	SB.DHAN	37.7	48.5	50.3	45.5	24.2	51.7	47.1	39.8	38.9	35.5	47.5	39.0	42.1
	9	US-314	53.0	46.5	47.6	45.5	28.5	51.9	48.6	38.0	33.0	30.3	56.6	39.7	43.3
		T2 Mean	**43.9**	**46.7**	**50.3**	**45.0**	**24.7**	**50.8**	**44.2**	**31.0**	**34.5**	**37.3**	**50.6**	**38.6**	**41.5**
T3 (water stress)	1	27P63	38.7	52.4	54.0	44.3	17.5	45.2	36.5	27.9	25.5	44.3	50.5	32.3	39.1
	2	HRI-174	43.7	46.1	53.6	46.4	22.3	48.9	37.4	30.7	12.1	41.5	49.6	34.8	38.9
	3	IIRRH-122	40.9	46.6	53.8	45.4	24.7	48.7	30.5	32.9	14.9	33.4	34.7	38.9	37.1
	4	IIRRH-131	44.7	45.8	54.3	44.4	24.5	47.8	38.7	32.7	14.9	41.6	45.0	34.9	39.1
	5	IRRH-132	60.3	47.8	55.0	43.1	24.5	49.8	40.2	42.3	15.9	31.6	45.1	36.4	41.0
	6	JKRH-3333	51.3	43.3	53.3	45.2	23.5	46.0	37.2	28.9	11.5	48.4	36.3	35.4	38.3
	7	KRH-4	56.7	46.5	46.7	44.9	24.6	48.4	37.3	37.4	14.1	32.0	40.6	32.7	38.5
	8	SB.DHAN	42.2	48.9	55.6	45.5	28.6	49.0	46.9	30.2	13.6	35.9	29.9	40.9	38.9
	9	US-314	58.3	48.0	56.4	45.2	30.3	50.9	46.6	34.2	31.7	37.9	51.3	36.4	43.9
		T3 Mean	**48.5**	**47.3**	**53.6**	**44.9**	**24.5**	**48.3**	**39.0**	**33.0**	**17.1**	**38.5**	**42.6**	**35.9**	**39.4**
T4 (water stress+silicon)	1	27P63	38.3	49.1	53.6	44.4	19.1	43.6	41.8	27.0	27.3	45.7	51.5	40.4	40.2
	2	HRI-174	43.7	44.0	47.0	46.5	23.4	47.9	36.1	30.4	30.1	40.0	50.7	34.3	39.5
	3	IIRRH-122	40.7	47.7	55.2	45.5	24.7	47.5	30.7	35.9	20.6	42.5	32.5	32.9	38.0
	4	IIRRH-131	45.0	43.7	49.8	44.4	21.0	47.8	38.8	34.3	32.2	41.5	45.5	32.9	39.7
	5	IRRH-132	59.7	47.8	55.3	43.5	26.6	49.0	41.7	40.7	25.4	26.0	45.7	33.6	41.2
	6	JKRH-3333	50.7	45.7	51.0	44.4	19.5	44.6	41.4	30.0	29.5	55.5	36.5	32.5	40.1
	7	KRH-4	56.3	44.9	48.4	45.4	21.9	49.9	40.0	34.4	18.5	33.2	40.1	35.1	39.0
	8	SB.DHAN	43.0	44.0	51.6	45.5	25.2	49.7	43.7	36.5	19.4	32.8	28.3	42.9	38.6
	9	US-314	58.3	48.0	53.1	45.5	27.2	49.7	44.9	33.2	9.3	42.7	53.9	44.9	42.6
		T4 Mean	**48.4**	**46.1**	**51.7**	**45.0**	**23.2**	**47.7**	**39.9**	**33.6**	**23.6**	**40.0**	**42.7**	**36.6**	**39.9**
		Grand Mean	**47.2**	**46.4**	**52.1**	**45.0**	**24.3**	**49.4**	**41.4**	**32.0**	**27.9**	**38.2**	**45.8**	**38.4**	**40.7**
		LSD (Silicon)						NS							
		LSD (Center x Silicon)						4.19**							
		LSD (Variety)						NS							
		LSD (Center x Variety)						4.42**							
		LSD (Silicon x Variety)						NS							
		LSD (Center x Silicon x Variety)						8.85**							
		CV (%) Silicon						14.3							
		CV (%) Residual						10.32							

SB.Dhan= Sahabhagidhan

6.2.1 Screening of elite rice cultures for drought tolerance:

Locations: NRRI, RANCHI, RPR, PTB AND REWA (kharif-2019), TTB (Rabi 2018-19)

Rain-fed rice ecosystems are home to 80 million farmers on 60 million ha. Progress has been slow in improving productivity, and drought is a major constraint affecting rice production, especially in rain-fed areas across Asia and sub-Saharan Africa. Even in traditionally irrigated areas, which account for almost 75% of total rice production, drought is becoming an increasing problem because of water scarcity resulting from rising demand for water for competing uses. Drought imposes a serious economic burden on society and has been historically associated with food shortages of varying intensities, including those that have resulted in major famines in different parts of Asia and Africa. For example, Pandey et al. (2007[1]) estimate production losses of 36% of the average value of production in eastern India in drought years. This represents a massive loss of US$856 million and, on a yearly basis, a loss of 6.8% of the average value of output in India. In addition to the direct effects on production, there are indirect effects of drought which may be felt over several years. Its impact can even span generations as, e.g., when children fail to recoup lost educational opportunities (Pandey et al., 2007[1]). Identification of suitable rice cultures for rainfed conditions is one of the research area of Plant Physiology group under AICRIP. A trial to study the drought tolerance traits of rice cultures with respect to yield and other attributes under dry spells was conducted with 30 rice genotypes taken from *IVT-E-DS* trial and 5 released varieties during Kharif-2019 at 5 locations and during Rabi-2018-19 season at TTB where in 22 AVT entries and 8 released varieties were tested for drought tolerance. The treatments consisted of two irrigation regimes a. Irrigated as per the recommended schedule and one totally rain fed condition without any supplementary irrigation.

Analysis of rainfall data indicated that at CBT centre the crop received total of 531.6 mm rainfall from sowing to physiological maturity with 50 rainy days. During vegetative period the crop received 292.1 mm rain with 33 rainy days (Fig.1) and during the period from flowering to maturity the crop received 239.5 mm rain with 17 rainy days.

[1] *Pandey S., Bhandari H., Hardy B. (eds). (2007). Economic Costs of Drought and Rice Farmers' Coping Mechanisms: A Cross-Country Comparative Analysis. Los Baños: IRRI, 203*

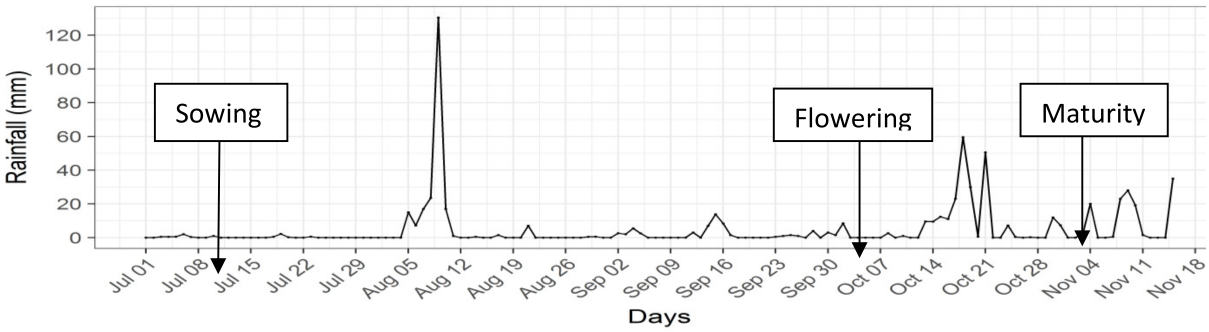


Fig. 6.2.1.1 Distribution of rain during crop season (sowing to maturity) at C BT centre during kharif-2019

At REWA centre the crop received 1241 mm rain between sowing and maturity stages with 54 rainy days. During vegetative phase from sowing to flowering stage the crop received 1101 mm rain with 46 rainy days and from flowering to maturity period it received only 140 mm rain with 8 rainy days (Fig. 2).

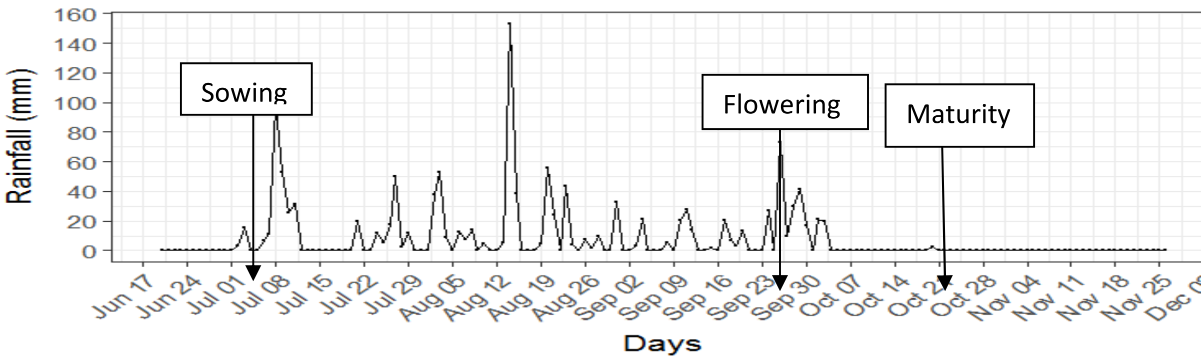


Fig. 6.2.1.2 Distribution of rain during crop season (sowing to maturity) at REWA centre during kharif-2019

During the crop season from sowing to maturity the crop received 955 mm rain with 49 rainy days at PTB centre. However, the crop received 924 mm rain with 45 rainy days during vegetative phase and after flowering up to maturity the crop received only 32 mm rain with 6 rainy days (Fig.3)

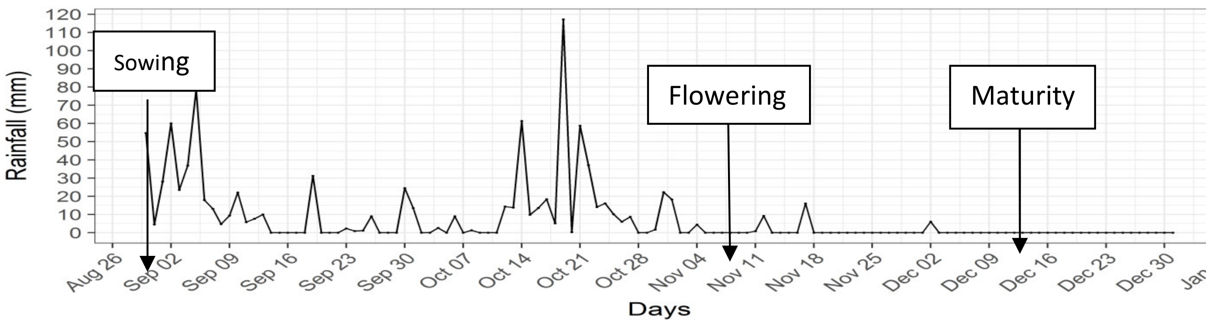


Fig. 6.2.1.3 Distribution of rain during crop season (sowing to maturity) at PTB centre during kharif-2019

At RPR centre the crop received a total of 978 mm rain with 57 rainy days out of which 862 mm with 51 rainy days was received during vegetative phase of crop growth and after flowering to maturity the crop received 116 mm rain with 6 rainy days (Fig. 4)

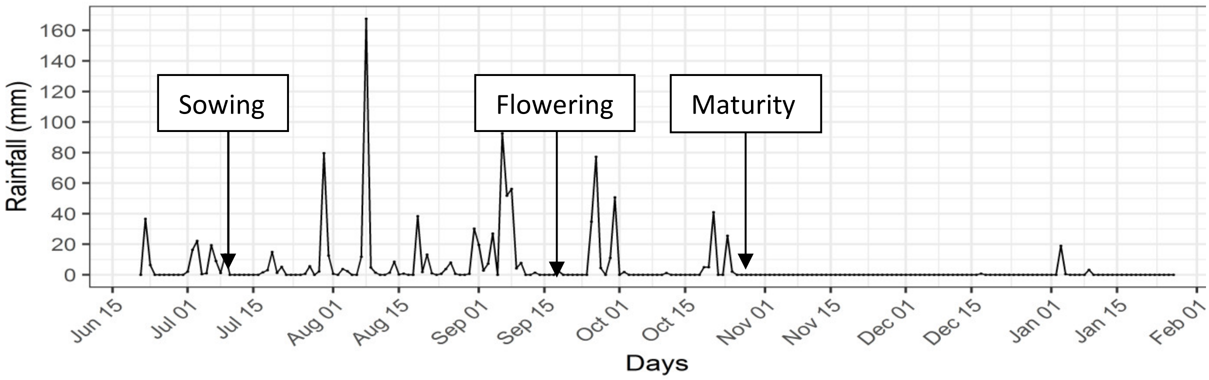


Fig. 6.2.1.4 Distribution of rain during crop season (sowing to maturity) at RPR centre during kharif-2019

Days to flowering and Days to maturity were not significantly influenced by the irrigation regimes (Table 6.2.1). The interaction between Location x Treatment and Treatment x Genotype and Location x Genotype are found to be non-significant. Significant differences(p<0.05) were noticed amongst the tested genotypes for both mean days to flowering and days to maturity (Table 6.2.1).

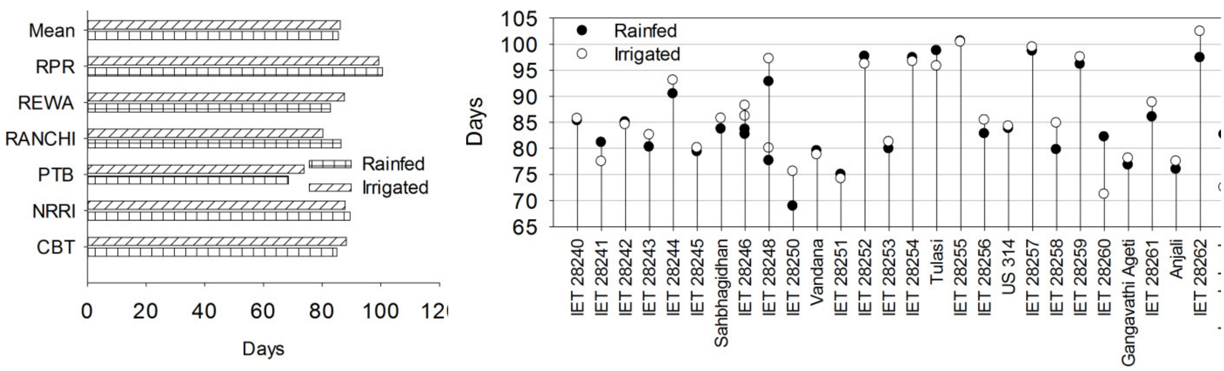


Fig.6.2.1.5 : Influence of irrigation regimes on mean days to flowering of different rice genotypes grown at different locations during kharif-2019

The shoot **weight/plant (g)** is an important parameter as the stems store carbon and nitrogen during vegetative stage and remobilize the same during grain filling period and supplement the carbon from flag leaf photosynthesis. Irrigation regimes show no significant influence on mean (mean of all locations and genotypes) (Table 6.2.3). However, the interaction between Location x Treatment was found to be statistically significant (p<0.01) implying that the effect of treatment is not uniform across the locations. However, the mean shoot weight (mean of all genotypes) was reduced by >38% under rainfed treatment.

Maximum reduction in was observed at PTB followed by RPR centre. Minimum reduction in mean shoot weight was observed at RANCHI followed by REWA centre (Fig.6.2.5).

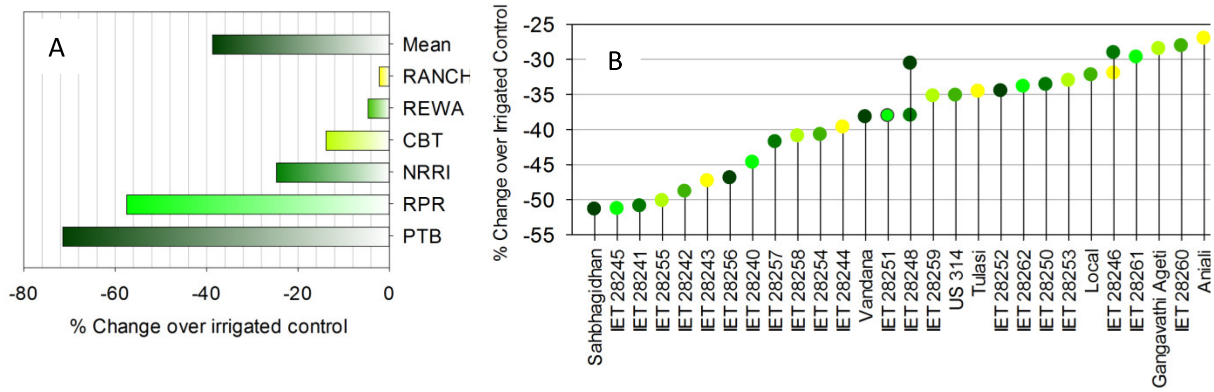


Fig.6.2.1.5: Influence of irrigation regimes on shoot weight recorded at flowering stage in different rice genotypes at different AICRIP centres during kharif-2019 season. [A] Mean of all genotypes [B] Mean of all locations.

Maximum reduction in mean shoot weight was observed in Sahabhagidhan, IET28245 and IET 26241 in which the reduction in shoot weight in relation to irrigated control was >50%. Anjali, IET 28260 and Gangavati Agent performed well with minimum reducing in shoot weight (<30% reduction under rainfed condition). The interaction between Location x Genotype was found to be significant (Table 6.2.3).

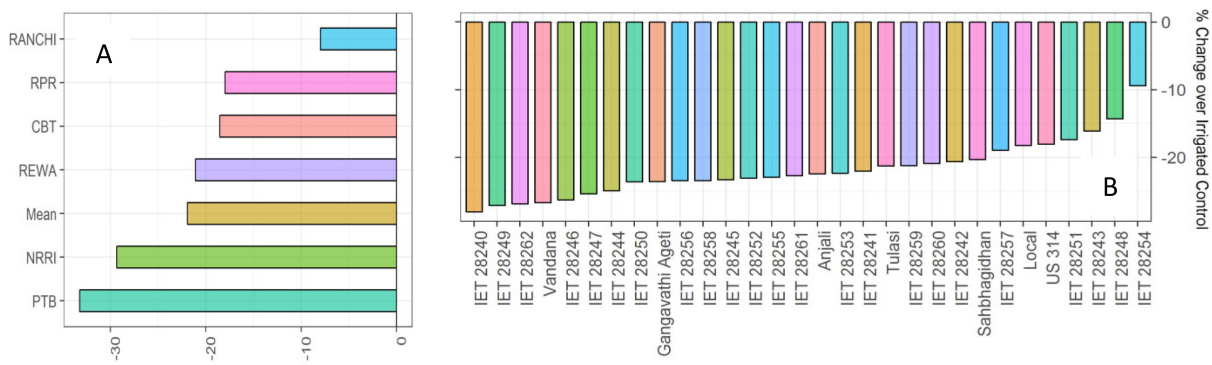


Fig.6.2.1.5: Influence of irrigation regimes on Number of Panicles m^{-2} different rice genotypes at different AICRIP centres during kharif-2019 season. [A] Mean of all genotypes [B] Mean of all locations.

Number of panicles m^{-2} is an important yield trait which was affected by the water regimes. Analysis of variance suggest that the irrigation regime had non-significant influence on mean (mean of all genotypes and locations) panicle number (Table 6.2.4). However, the interaction between Treatment x Location was found to be significant ($p<0.01$). The mean panicle number was reduced by 18% under rainfed treatment in comparison with irrigated treatment. Maximum reduction in number of panicles was observed at PTB followed by NRRI centre. The effect was relatively lower at RANCHI centre (Fig.6.2.5A). When mean of all locations and treatments was considered, the differences amongst the genotypes was non-significant. However, number of panicles were reduced under rainfed conditions. Maximum reduction was observed in IET 28240, IET 20249, IET 28262 and vandana where in the reduction in panicle number was 20% under rainfed condition in comparison with irrigated control. Minimum reduction was observed in IET 28264 and IET28248 (Fig.6.2.5B). The interaction between Genotype x Location was found to be significant implying that the genotypes behaved differently at different locations. However, the interaction between Genotype x Treatment was found to be non-significant indicating that there was no difference between genotypes in their response to irrigation conditions.

Grain number per panicle is one of the most important yield trait which was significantly ($p<0.01$) affected by the irrigation regimes (Table 6.2.6) Under rainfed condition, the mean (mean of all genotypes and locations) was reduced by >22% in comparison with irrigated treatment. The interaction between Location x Treatment was highly significant ($p<0.01$). At RANCHI centre no change in number

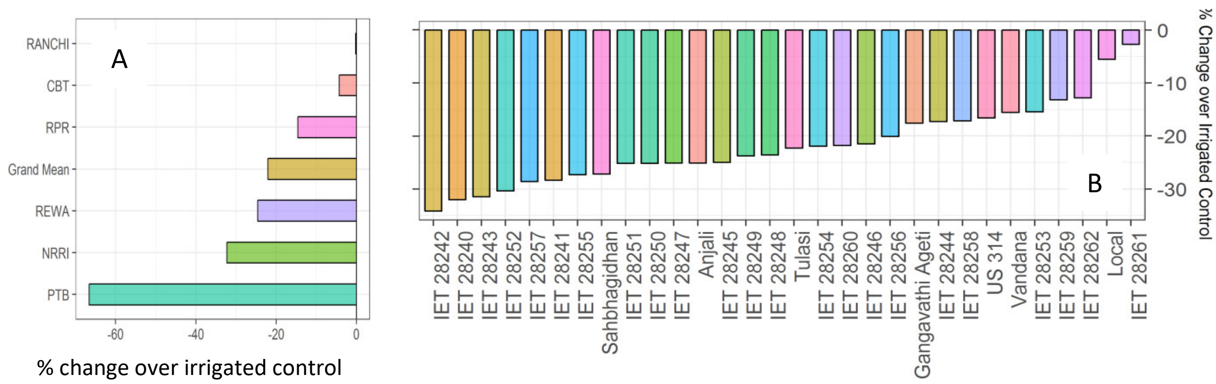


Fig.6.2.1.6: Influence of irrigation regimes on Number of Grains Panicles^{-1} in different rice genotypes at different AICRIP centres during kharif-2019 season. [A] Mean of all genotypes [B] Mean of all locations.

of grains was observed. Maximum reduction in number of grains was noticed at PTB centre followed by NRRI. At the remaining centres the reduction in grain number is less than the mean of all locations (Fig.6.2.6). Analysis of variance results indicate that the mean (mean of all locations & treatments) grain number did not varied amongst the genotypes. However, the interaction between Location x Genotype was found to be significant, which indicated that the genotypes behaved differently at different locations (Table 6.2.6). The interaction between Genotype x treatment was non-significant. The reduction in grain number was lower in case of IET 28261 followed by local check and IET28262. Maximum reduction was observed in IET28242 followed by IET28240, IET28242 and IET28252 (*Fig.6.2.6B).*

Total number of spikelets per panicle is another important yield trait which was significantly affect by the water regime (Table 6.2.7). The mean (mean of all genotypes and locations) spikelet number was reduced by >7% in rainfed condition in comparison with irrigated control (Fig.6.2.7A). Results of ANOVA indicated that a significant ($p<0.01$) interaction exists between Treatment x Location implying that the effect of treatment varied between locations. The reduction in No.spikelets panicle^{-1} was lowest at RANCHI centre followed by CBT and RPR which is lower than the mean reduction.

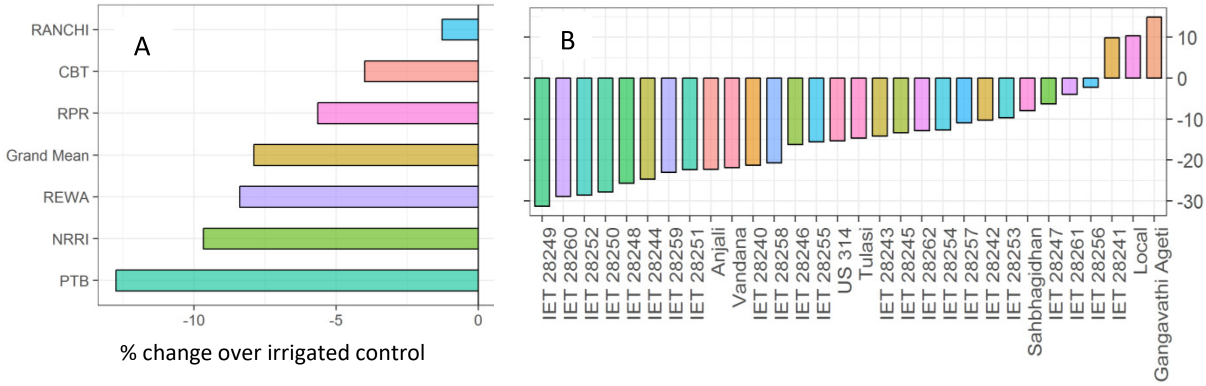


Fig.6.2.1.7: Influence of irrigation regimes on Number of Grains Panicles^{-1} in different rice genotypes at different AICRIP centres during kharif-2019 season. [A] Mean of all genotypes [B] Mean of all locations

Maximum reduction in No.spikelets panicle^{-1} was observed at PTB centre followed by NRRI. The mean number of spikelets (mean of all locations & treatments) did not varied significantly amongst the genotypes (Table 6.2.7). In genotypes like Gangavathi Agent, Local chek and IET 28241 the No. Of spikelets recorded marginal increase under rainfed treatment. IET 28249, IET28260, IET 28250 and IET28248 recorded maximum reduction in spikelet number (Fig.6.2.7B). A significant interaction was observed between Genotype x Location.

Test weight (1000 grain weight) is one of the important yield trait which was recorded. The mean test weight (mean of all genotypes and locations) was not significantly affected by the water regime (Table 6.2.11). The mean test weight was reduced by >17% under rainfed treatment (Fig 6.2.8A). The interaction between Location x Treatment was found to be highly significant ($p<0.01$) indicating that the treatment effect varied between locations. Maximum reduction in mean test weight was recorded at PTB centre followed by CBT and REWA in the remaining locations the reduction is only marginal (Fig.6.2.8A). The differences amongst the genotypes was significant ($p<0.05$) for mean test weight (mean of treatments and locations). The interaction between Location x Genotype was also found to be significant (p<0.01) indicating that the response of genotypes varied between locations (Table 6.2.11).

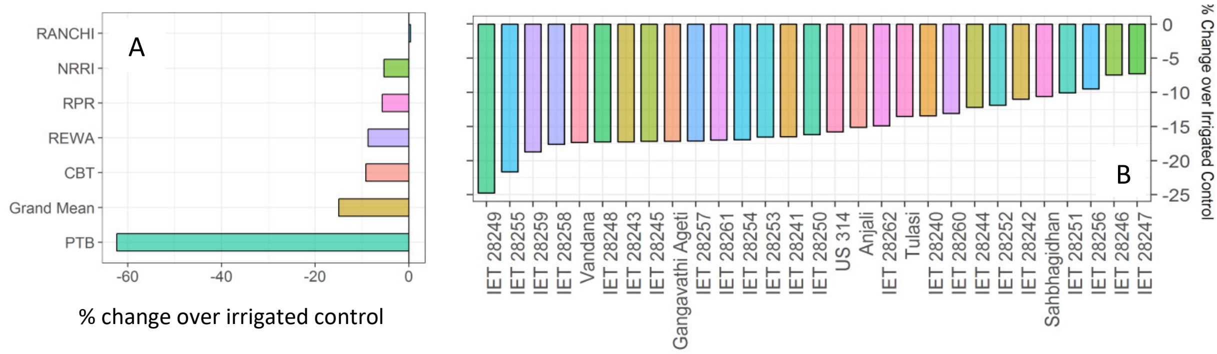


Fig.6.2.1.8: Influence of irrigation regimes on 1000 grain weight in different rice genotypes at different AICRIP centres during kharif-2019 season. [A] Mean of all genotypes [B] Mean of all locations

The reduction in test weight is highest in IET 28249 followed by IET28255. Minimum reduction in test weight under rainfed condition was observed IET 28247, IET28248, IET 28256 and Sahabhagidhan *(Fig.6.2.1.8B).*

Mean grain yield (mean of all genotypes and locations)was significantly (p<0.06) affected by the water regimes. Grain yield was reduced by >28% under rainfed condition in comparison with irrigated control *(Fig.6.2.1.9A).* The interaction effect between Treatment x Location is highly significant (p<0.01) implying that the treatment effect is not uniform across locations. With the exception of PTB centre at

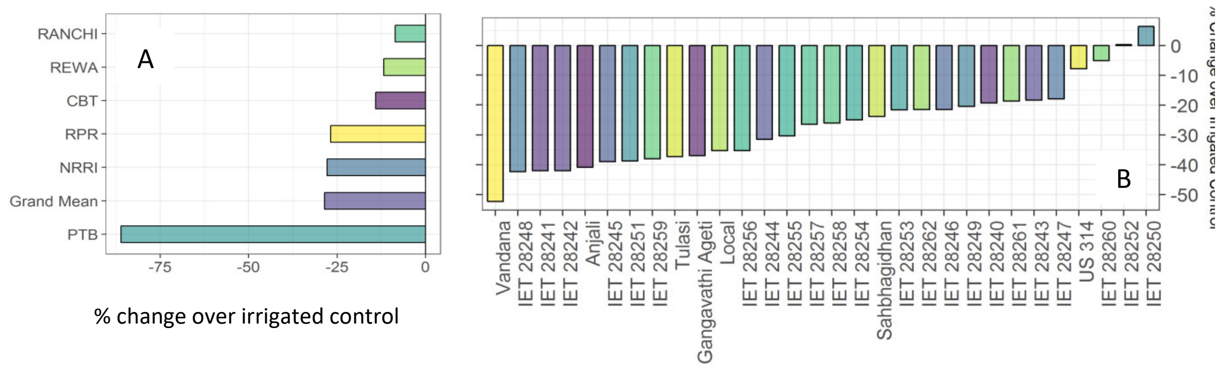


Fig.6.2.1.9: Influence of irrigation regimes on grain yield in different rice genotypes at different AICRIP centres during kharif-2019 season. [A] Mean of all genotypes [B] Mean of all locations

all other centres the reduction in grain yield under rainfed condition is equal to or less than the mean of all location. At PTB centre the reduction is very high (>80% over control).

Significant differences were observed among the genotypes in their response to water stress condition. The reduction in grain yield is lowest in IET 28250, IET 28262, IET 28262, IET 28660 and US 314 which less than the mean value for all the genotypes. These entries are suitable for rainfed cultivation (Table 6.2.10).

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

The results of Drought tolerance indices were presented on Table 6.2.15 The data revealed that significant variation was observed amongst the genotypes for different drought indices. Based on different drought indices individual entries were ranked. The rank sum and mean rank was calculated for each entry and standard error was computed. The genotype having high Mean Rank ±low SEm was considered as most suitable for rain fed conditions as they have relative tolerance to water stressed conditions. The data pertaining to the drought indices and their ranks were presented in Table. 10. The data revealed that IET 28252, IET 28256, IET 28245, Sahabhagidhan and US-314 have high Mean Rank with low SEm and they may be considered as relatively drought tolerant and are suitable for rain fed cultivation.

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

Correlation between grain yield and other important drought tolerance traits. Mean grain yield from all the centres were used to perform Pearson's correlation.

	Yp	*Ys*	*DSI*	*RDI*	*DTI*	*GMP*	*TOL*	*MP*	*YI*	*YSI*	*DI*	*SDI*	*HM*	*K1STI*	*K2ST*
Yp	1.00														
Ys	0.89	1.00													
DSI	0.51	0.06	1.00												
RDI	-0.50	-0.06	-1.00	1.00											
DTI	0.96	0.97	0.28	-0.27	1.00										
GMP	0.97	0.97	0.31	-0.30	0.99	1.00									
TOL	0.84	0.49	0.89	-0.89	0.67	0.69	1.00								
MP	0.98	0.96	0.35	-0.34	0.99	1.00	0.72	1.00							
YI	0.89	1.00	0.06	-0.05	0.97	0.97	0.48	0.96	1.00						
YSI	-0.50	-0.05	-1.00	1.00	-0.27	-0.30	-0.89	-0.34	-0.05	1.00					
DI	0.57	0.88	-0.41	0.41	0.75	0.74	0.02	0.71	0.89	0.42	1.00				
SDI	0.50	0.05	1.00	-1.00	0.27	0.30	0.89	0.34	0.05	-1.00	-0.42	1.00			
HM	0.96	0.98	0.27	-0.26	1.00	1.00	0.66	1.00	0.98	-0.26	0.77	0.26	1.00		
K1STI	1.00	0.89	0.48	-0.47	0.97	0.98	0.82	0.98	0.89	-0.47	0.59	0.47	0.97	1.00	
K2STI	0.88	1.00	0.05	-0.05	0.97	0.96	0.48	0.95	1.00	-0.04	0.88	0.04	0.97	0.89	1.(

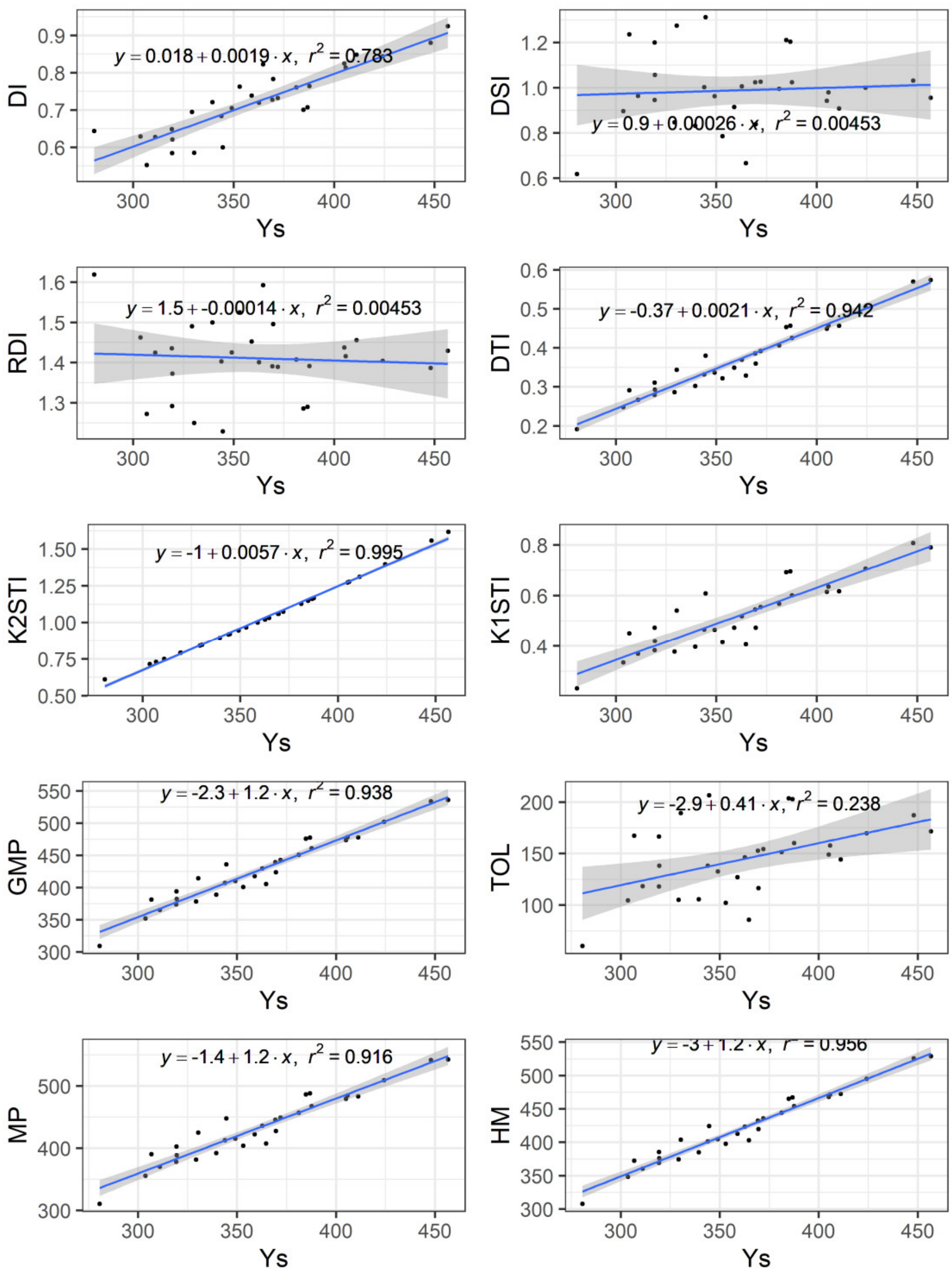


Fig: 6.2.1.10: Relationship between grain yield under rainfed condition and different drought indices. Drought indices were computed using mean grain yield recorded at different centres under rainfed and irrigated conditions.

In order to simultaneously select genotypes with higher yield and stability of performance across locations under elevated temperature conditions, a parametric model for simultaneous selection in yield and stability "shukla's stability variance and kang's" statistic was performed and the results were presented in (Tables (6.1.12 and 6.2.1.3). Based on the YS_i values genotypes can be selected as they produced relatively higher yield under rainfed condition (drought) and also they show non-significant stability variance (σ_i^2). These genotypes have a higher yield and a lower variation. According to the ANOVA, the interaction is significant. Based on stability analysis IET 28243, Sahabhagidhan, IET 28246, IET 28247, IET 28249, IET 282 51, IET 280 52, IET 28254, Tulsi, IET 28255, 28256, US314, IET 28260 and IET 28262 can be selected as stable genotypes which performed well across the locations.

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

At TTB centre this trial was conducted during Rabi season with Rabi-2018-19 season at TTB where in 22 AVT entries and 8 released varieties were tested for drought tolerance. The treatments consisted of rainfed (drought) and recommended irrigation. One of the important trait which was recorded at flowering stage is No of Panicles/plant which was significantly (p<0.01) affected by water regime. The mean(mean of all genotypes) was reduced by >18% under rainfed treatment in comparison with irrigated control (Fig.6.2.2.1A). Significant differences were observed amongst the genotypes. The reduction in number of tillers/plant was lowest in IET27527 followed by IET 27526, IET 27518 (Table 6.2.2.1). The interaction between Treatment x Genotype was also found to be highly significant.

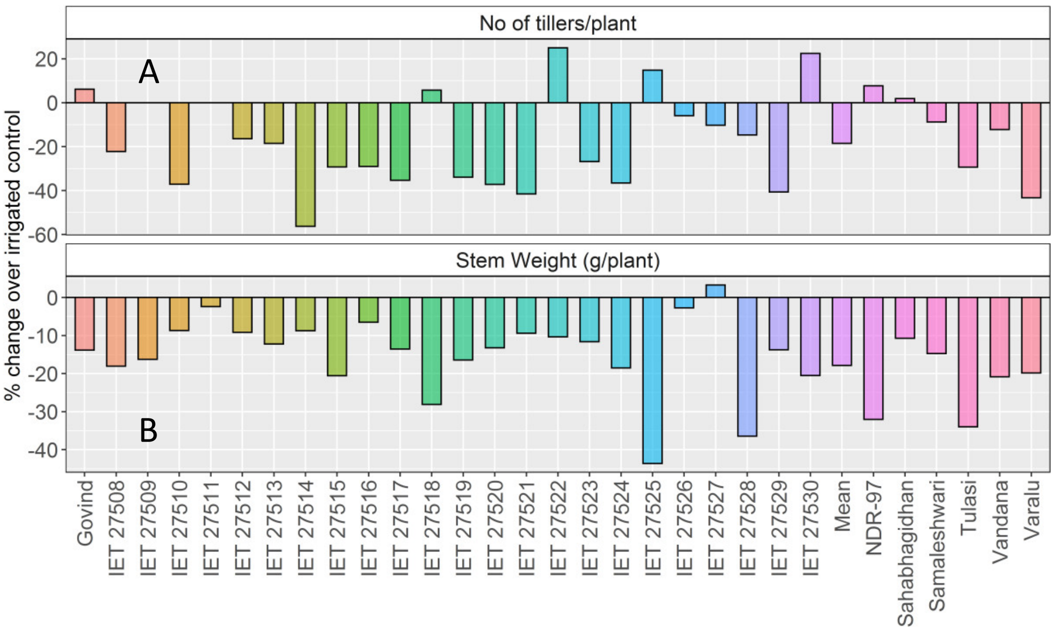


Fig. 6.2.2.1: Influence of water regimes on No. of tillers and stem weight recorded at flowering stage at TTB centre during Rabi-2018-19.

Stem weight recorded before anthesis is one of the important trait for drought tolerance as the accumulated carbon and nitrogen before anthesis will be remobilized into developing grain during grain filling stage which supplement the carbon from current photosynthesis. The stem weight was significantly reduced ($p<0.01$) by >17.8% reduction under rainfed condition over irrigated control. Significant differences were observed amongst the genotypes. The interaction between the Treatment x Genotype was found to be significant ($p<0.01$). The reduction in stem weight is lowest in IET 27527, IET 27526, IET 27511 and IET 27518 (*Fig.62.2.1B)*

Results on effect of water regimes on important yield traits like Panicle weight/ m2, Panicle number/m2, number of grain per panicle are presented in Table 6.2.2.2. All these parameter are significantly influenced by the water regimes. A significant variation was observed amongst the genotypes for these important traits and the interaction between the Treatment x Genotypes was also found to be highly significant indicating that the influence of the water regime treatment differs from genotypes to genotype.

Similarly, the number of spikelets and number of grains recorded after harvest also show significant changes under rainfed condition in comparison with irrigated treatment. Significant genotypic differences were observed for all these traits. The interaction between Treatment x Genotype was found to be significant for all these traits implying that significant differences exists amongst the genotypes in their response to imposed treatments.(Table 6.2.2.3).

Results on Grain yield, 1000 grains weight and harvest index was presented in table 6.2.2.4). Test weight or 1000 weight was significantly affected by water regimes. The mean test weight was significantly ($p<0.01$) reduced by <13% under rainfed condition in comparison with irrigated control. Significant differences were observed amongst the genotypes for mean test weight. Maximum test weight was recorded in IET 27519, IET 27511, IET 27525, IET 275 and IET 27514. Lowest test weight was observed in IET 27509 followed by Simaseswari (Table 6.2.2.4).

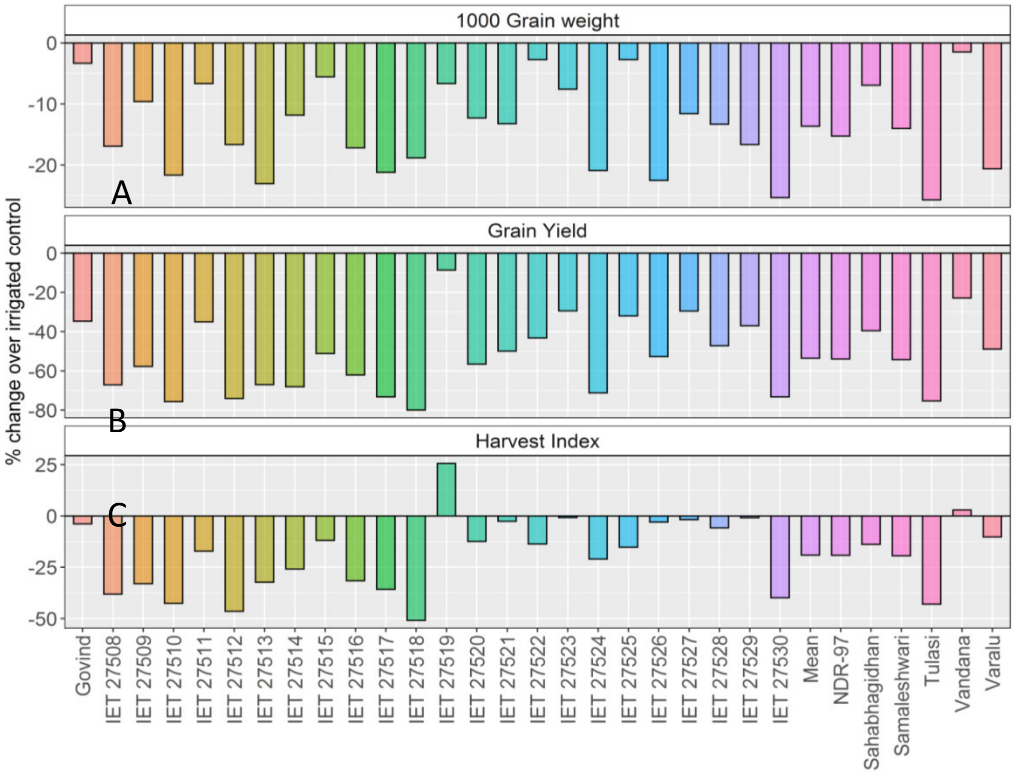


Fig.6.2.2.2: Influence of water regimes on 1000 grain weight, Harvest Index and grain yield in different rice genotypes

Significant ($p<0.01$) interaction was observed between Treatment x Genotype for test weight. The reduction in test weight was minimum in Vandana, IET 27522, IET27525 and IET 27515 (Fig.6.2.2.2A). Maximum reduction was observed in Tulasi.

Harvest index is one of the most important trait which was negetively affected by the water regimes. HI was reduced by >19% under rainfed treatment in comparison with irrigated treatment. Significant interaction was observed between Treatment x Genotype ($p<0.01$) for HI. The reduction in HI was minimum in Varalu, Vandana, sahabhagidhan, IET 25729, 25727, 25726, 25728, IET 27523, IET 27521 and Govind *(Fig.6.2.2.2C).*

Grain yield was significantly ($p<0.01$) affected by water regimes. The mean grain yield was reduced by >53% under rainfed condition in comparison with irrigated control. Significant differences were observed amongst the genotypes for grain yield. The grain yield varied between 360 g/m^2 (IET 25715) to a minimum of 195 g/m^2 (NDR-97) with a mean of 276 g/m^2 (Table 6.2.2.4). Significant interaction was observed between Treatment x Genotype. The reduction in grain yield was minimum in IET 27519, Vandana and Govind these varieties may be considered as drought tolerant and are suitable for rainfed cultivation (Fig.6.2.2.2B).

Different Drought tolerance indices including Drought susceptibility index (DSI), Relative Drought index (RDI), Drought tolerance index (DTI), Geometric mean productivity (GMP), Tolerance (TOL), Mean production (MP), Yield index (YI), Heatt resistance index (HI), Yield stability index (YSI), Modified stress tolerance index (KiSTI), were calculated. The data on the indices was presented in table 6.2.2.6. Genotypes were ranked for each index and the rank sum and mean rank and SEm was computed. Drought tolerant genotypes were identified based on the high mean rank and low SEm. The entries IET 27514, 27522, Govind, 27520, 27525, 27519 and Sammaleswari could be identified as drought tolerant and are suitable for cultivation and rainfed conditions. Multiple correlation analysis between yield obtained under ranfed condition and the computed yield indices revealed a strong positive association between yield for BMP, MP, YSI, YI and strong negetive relation was observed for DSI, TOL and, SDI these indices are useful for identification drought tolerant genotype.

Summary & Conclusions

A trial was conducted 30 rice genotypes taken from *IVT-E-DS* trial and 5 released varieties during Kharif-2019 at 5 locations and during Rabi-2018-19 season at TTB where in 22 AVT entries and 8 released varieties were tested for drought tolerance. Treatments consists of total rainfed condition with out any supplementary irrigation and another with recommended irrigation. Based on the reduction in grain yield under rainfed condition IET 28250, IET 28262, IET 28262, IET 28660 and US 314 could be identified as relatively drought tolerant and these entries are suitable for rainfed cultivation. Based on drought indices computed, IET 28252, IET 28256, IET 28245, Sahabhagidhan and US-314 have high Mean Rank with low SEm and they may be considered as relatively drought tolerant and are suitable for rain fed cultivation. Stability analysis indicated Based on stability analysis IET 28243, Sahabhagidhan, IET 28246, IET 28247, IET 28249, IET 282 51, IET 280 52, IET 28254, Tulsi, IET 28255, 28256, US314, IET 28260 and IET 28262 can be selected as stable genotypes which performed well across the locations. At TTB the trial was conducted during Rabi season. Based on the reduction in yield under rainfed condition IET 27519, Vandana and Govind can be identified as drought tolerant varieties. Various drought tolerance indices were computed and based on high mean rank and low SEm the genotypes IET 27514, IET27522, Govind, IET 27520, 27525, 27519 and sammaleswari could be identified as relatively drought tolerant and suitable for rainfed conditions.

Table 6.2.1 Screening for elite rice culture for drought tolerance on Days to flowering at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigated						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	90.0	89.0	66.7	89.7	79.3	98.0	85.3	81.0	89.0	70.3	90.3	85.3	97.0	81.0
2	IET 28241	74.0	79.0	60.0	84.7	72.0	97.0	81.1	72.0	80.0	70.7	78.0	76.0	98.0	72.0
3	IET 28242	91.0	88.0	67.0	92.0	80.0	117.0	85.0	82.0	82.7	69.7	92.0	86.0	88.0	82.0
4	IET 28243	79.0	88.0	68.3	77.7	75.3	92.0	80.2	81.0	83.0	70.3	87.0	81.0	95.0	81.0
5	IET 28244	91.0	90.0	74.3	97.0	84.3	93.0	90.4	95.0	95.7	70.3	95.7	95.7	93.0	95.0
6	IET 28245	74.3	78.0	68.3	84.0	73.3	106.0	79.3	79.0	80.0	70.7	82.3	79.3	106.0	79.0
7	Sahbhagidhan	91.0	84.7	67.7	88.7	78.0	98.0	83.7	90.0	86.7	71.3	90.3	83.0	89.0	90.0
8	IET 28246	84.0	86.0	65.7	89.7	79.7	92.0	82.7	91.0	84.0	76.0	88.7	86.3	93.0	91.0
9	IET 28247	75.0	87.0	70.0	92.0	82.3	91.0	83.6	91.0	88.7	70.7	91.0	91.3	91.0	91.0
10	IET 28248	74.0	84.3	57.0	84.0	74.3	95.3	77.6	71.0	83.0	71.0	80.7	80.3	96.3	71.0
11	IET 28249	86.0	100.0	68.3	101.3	93.0	92.0	92.8	102.0	95.0	77.0	102.7	97.3	94.0	102.0
12	IET 28250	81.0	87.0	69.7	1.3	79.0	108.0	68.9	90.0	87.3	70.7	22.0	85.3	109.0	90.0
13	Vandana	68.0	84.0	56.0	84.0	69.0	95.3	79.5	71.0	80.0	70.3	77.3	79.0	98.0	71.0
14	IET 28251	87.0	89.0	68.3	31.7	77.7	116.0	74.9	81.0	83.0	76.0	22.0	86.0	95.0	81.0
15	IET 28252	97.0	103.0	74.3	106.7	97.7	96.0	97.6	93.0	97.0	77.3	105.3	99.3	97.0	93.0
16	IET 28253	75.0	82.0	69.3	86.7	75.3	107.0	79.9	81.0	82.0	70.7	81.3	81.3	105.0	81.0
17	IET 28254	105.0	97.0	77.3	102.0	95.0	91.0	97.4	105.0	97.0	77.7	103.3	87.0	91.0	105.0
18	Tulasi	108.0	99.0	78.0	102.0	95.3	108.0	98.7	106.0	96.0	79.0	103.3	87.7	110.0	106.0
19	IET 28255	109.0	103.3	76.3	105.3	95.3	110.0	100.6	107.0	97.0	80.3	107.3	97.7	102.7	107.0
20	IET 28256	81.0	87.0	66.0	91.7	80.0	114.0	82.8	83.0	85.0	74.3	91.3	85.7	113.0	83.0
21	US 314	81.0	89.0	71.3	91.3	78.0	91.0	83.8	83.0	87.3	70.7	91.0	82.3	93.0	83.0
22	IET 28257	96.0	102.7	75.7	107.7	95.0	92.0	98.7	106.0	96.0	76.3	107.3	97.7	91.0	106.0
23	IET 28258	79.0	78.0	71.7	78.7	73.0	115.0	79.7	82.0	82.0	70.3	78.7	78.0	113.0	82.0
24	IET 28259	96.0	99.0	75.3	101.3	93.0	98.0	96.1	106.0	94.0	76.0	100.7	98.3	118.0	106.0
25	IET 28260	75.0	89.0	65.7	86.0	80.3	112.0	82.2	81.0	88.7	76.7	2.3	82.3	110.0	81.0
26	Gangavathi Ageti	69.0	81.0	69.7	81.3	71.7	97.0	76.8	74.0	79.0	71.0	79.3	77.0	96.0	74.0
27	IET 28261	87.0	88.0	69.3	86.0	83.7	88.0	86.0	93.0	92.0	79.7	65.3	97.7	88.0	93.0
28	Anjali	76.0	79.0	59.3	78.7	73.7	102.0	75.9	72.0	80.0	71.0	78.0	76.0	105.0	72.0
29	IET 28262	85.0	106.0	67.7	102.0	107.7	89.0	97.4	101.7	96.3	79.7	110.7	110.3	88.0	101.7
30	Local	87.0	87.0	59.0	88.3	91.7	116.0	82.6	95.0	88.0	79.3	2.3	97.7	116.0	95.0
	Mean	**85.0**	**89.5**	**68.4**	**86.4**	**82.8**	**100.6**	**85.5**	**88.2**	**87.8**	**73.8**	**80.3**	**87.6**	**99.3**	**88.2**
	LSD (Treat)			NS					LSD (Treat x Genotype)				NS		
	LSD (Location x Treat)			NS					LSD (Location x Treat x Genotype)				NS		
	LSD (Genotype)			6.17**					CV (%)				12.0		
	LSD (Location x Genotype)			NS											

Table 6.2.1 Screening for elite rice culture for drought tolerance on Days to Maturity at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigated						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	121.0	98.0	102.0	110.3	57.3	123.0	101.6	109.7	93.3	102.0	109.3	59.3	122.0	99.4
2	IET 28241	101.0	97.7	96.7	103.0	56.3	121.0	94.9	100.0	92.7	102.7	103.0	58.3	123.0	94.9
3	IET 28242	122.0	96.3	101.7	112.7	80.0	115.0	104.8	142.0	96.3	102.3	112.3	82.0	113.0	109.2
4	IET 28243	107.0	97.7	103.3	105.3	78.7	116.0	101.7	109.0	98.0	102.3	106.3	78.7	120.0	101.9
5	IET 28244	123.0	92.7	108.7	118.0	79.3	118.0	108.8	123.0	97.7	103.3	115.3	83.3	117.0	108.8
6	IET 28245	116.3	97.7	103.3	105.3	75.7	131.0	101.4	109.0	92.7	102.3	104.3	81.0	130.0	100.2
7	Sahbhagidhan	108.0	92.7	102.7	110.3	75.0	110.0	100.4	120.3	96.3	103.3	111.7	78.3	112.0	104.3
8	IET 28246	111.0	97.7	100.0	112.0	80.0	113.7	101.8	118.0	98.0	107.0	112.7	84.0	116.0	105.4
9	IET 28247	102.0	92.7	103.7	113.3	79.3	110.0	102.5	120.3	97.7	102.3	114.0	83.0	113.0	103.4
10	IET 28248	101.0	97.7	94.7	105.7	77.0	124.0	98.7	100.0	92.7	103.0	106.3	79.7	103.3	99.9
11	IET 28249	114.0	96.3	103.0	123.0	76.0	116.0	105.8	135.0	96.3	106.7	43.3	80.3	118.0	99.4
12	IET 28250	110.0	97.7	104.7	106.3	81.3	122.7	102.6	121.0	98.0	102.3	107.0	84.7	135.0	105.8
13	Vandana	96.0	92.7	94.7	103.0	78.7	115.7	97.2	109.3	97.7	102.3	103.0	82.0	122.0	100.4
14	IET 28251	118.0	97.7	103.0	112.0	78.3	118.3	104.8	111.0	92.7	107.0	111.3	84.0	108.0	102.8
15	IET 28252	127.0	92.7	109.0	129.3	76.3	120.0	111.6	122.0	96.3	107.0	127.3	79.0	110.7	110.6
16	IET 28253	102.0	97.7	105.7	138.3	78.3	135.0	106.5	100.0	98.0	102.3	139.3	82.0	132.0	106.6
17	IET 28254	122.7	92.7	112.3	124.7	77.3	117.0	110.3	134.0	97.7	106.7	124.7	80.3	118.0	111.2
18	Tulasi	136.0	97.7	110.0	125.7	78.7	132.0	113.8	136.0	92.7	107.3	126.0	85.0	123.7	113.3
19	IET 28255	136.0	96.3	110.3	128.3	76.3	135.0	114.6	136.0	96.3	107.0	128.3	80.3	133.0	114.3
20	IET 28256	108.0	97.7	102.0	112.3	76.3	140.0	105.7	142.0	98.0	105.3	112.7	75.0	138.0	112.2
21	US 314	109.7	92.7	105.3	110.3	74.7	138.0	100.8	141.7	97.7	102.0	110.7	77.0	140.0	107.2
22	IET 28257	134.0	97.7	111.3	130.7	71.7	112.0	114.1	125.3	92.7	106.3	130.3	74.0	114.0	110.9
23	IET 28258	106.0	92.7	106.7	106.0	72.0	139.0	99.1	110.0	96.3	102.3	106.0	72.7	137.0	99.9
24	IET 28259	136.0	97.7	110.3	123.7	75.3	111.0	111.3	137.0	98.0	106.7	124.7	79.3	112.0	111.6
25	IET 28260	105.0	92.7	103.0	112.7	74.0	124.7	101.7	111.0	97.7	108.0	113.7	78.3	123.7	105.1
26	Gangavathi Ageti	96.0	97.7	105.0	104.0	75.3	123.0	98.3	101.0	92.7	102.7	104.0	78.7	122.0	98.3
27	IET 28261	116.0	96.3	103.0	115.0	67.3	112.0	104.1	124.0	96.3	108.3	22.7	73.0	111.0	92.6
28	Anjali	102.0	97.7	95.7	103.3	61.3	127.0	95.2	101.0	98.0	102.7	103.0	65.0	131.0	96.4
29	IET 28262	115.0	92.7	102.0	117.7	75.7	111.0	107.0	137.0	97.7	108.3	76.3	79.7	109.0	106.3
30	Local	116.0	97.7	95.0	111.7	74.0	139.0	98.9	122.0	92.7	108.0	111.7	79.3	139.0	102.7
	Mean	**113.9**	**95.8**	**103.6**	**114.5**	**74.6**	**122.3**	**104.1**	**120.3**	**96.0**	**104.7**	**107.4**	**77.9**	**121.5**	**104.6**
	LSD (Treat)			NS					LSD (Treat x Genotype)				NS		
	LSD (Location x Treat)			NS					LSD (Location x Treat x Genotype)				NS		
	LSD (Genotype)			4.78*					CV (%)				12.0		
	LSD (Location x Genotype)			NS											

Table 6.2.3 Screening for elite rice culture for drought tolerance on tiller number/pant flowering at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand	Irrigated						Grand
		CBT	NRRI	PTB	RANCHI	REWA	RPR	Mean	CBT	NRRI	PTB	RANCHI	REWA	RPR	Mean
1	IET 28240	8.00	4.93	10.33	2.67	6.81	10.7	7.24	11.7	6.53	15.3	5.67	8.00	15.0	10.4
2	IET 28241	8.00	6.60	7.67	2.33	7.15	11.7	7.24	13.7	5.87	12.7	3.33	7.81	15.0	9.7
3	IET 28242	10.33	5.87	24.33	3.33	5.64	14.0	10.58	7.7	6.87	13.3	5.67	6.55	15.0	9.2
4	IET 28243	9.33	4.80	11.33	3.33	6.33	15.7	8.47	17.7	6.13	19.0	7.33	8.33	20.3	13.1
5	IET 28244	8.67	6.07	6.67	4.33	4.88	12.3	7.16	8.0	6.40	10.0	6.67	6.03	16.0	8.8
6	IET 28245	8.33	8.93	4.67	3.67	7.43	11.0	7.34	13.0	6.67	12.7	4.33	7.33	14.0	9.7
7	Sahbhagidhan	7.67	6.47	4.00	3.00	7.32	9.7	6.35	15.0	5.93	11.0	4.67	7.97	11.7	9.4
8	IET 28246	7.67	5.33	3.00	3.33	7.36	12.0	6.45	12.3	6.60	13.7	4.67	8.64	14.7	10.1
9	IET 28247	9.67	4.07	8.67	4.00	9.40	12.0	7.97	18.0	7.13	18.0	4.67	10.01	15.0	12.1
10	IET 28248	7.67	5.53	3.67	4.00	7.52	11.3	6.62	15.7	5.07	11.7	3.33	9.77	13.0	9.8
11	IET 28249	20.00	4.73	4.33	3.67	9.21	12.3	9.05	13.7	5.13	13.0	4.67	10.35	17.7	10.7
12	IET 28250	12.00	4.87	7.33	3.33	8.67	11.0	7.87	17.0	4.80	14.0	6.00	8.99	16.3	11.2
13	Vandana	8.33	6.47	7.33	3.33	8.43	11.7	7.59	13.7	7.07	12.0	3.00	9.27	14.0	9.8
14	IET 28251	11.00	6.20	5.33	3.00	9.13	10.0	7.44	13.7	6.13	15.3	5.33	9.83	13.3	10.6
15	IET 28252	18.00	5.60	4.33	3.00	8.91	12.0	8.64	12.3	6.33	9.3	3.33	8.85	13.7	9.0
16	IET 28253	12.00	5.87	8.00	3.67	9.47	12.7	8.61	13.3	6.00	11.3	3.00	10.01	13.3	9.5
17	IET 28254	12.33	5.60	4.33	4.33	5.72	12.7	7.50	12.7	5.53	8.3	4.33	7.00	11.0	8.1
18	Tulasi	11.67	5.40	4.00	4.33	9.09	10.0	7.42	9.7	5.40	10.7	3.67	10.31	11.7	8.6
19	IET 28255	10.00	5.07	4.33	3.00	8.57	14.3	7.55	11.7	6.60	10.0	4.00	9.16	16.0	9.6
20	IET 28256	11.67	4.60	6.00	4.00	8.36	12.7	7.88	14.3	5.27	10.7	4.67	8.97	15.0	9.8
21	US 314	7.67	4.80	7.33	5.67	5.27	14.7	7.57	11.3	6.07	13.3	4.67	5.68	20.0	10.2
22	IET 28257	18.67	6.00	4.33	3.00	5.56	14.3	8.65	12.0	6.00	11.0	5.33	6.28	17.7	9.7
23	IET 28258	7.33	7.47	4.33	3.00	8.33	12.0	7.08	10.7	6.07	14.3	4.00	9.69	13.3	9.7
24	IET 28259	10.67	5.73	5.00	4.00	9.36	12.7	7.90	10.3	5.87	12.0	5.33	10.24	14.3	9.7
25	IET 28260	7.00	6.07	7.67	2.67	8.48	11.3	7.20	9.7	5.47	10.0	4.33	9.49	13.3	8.7
26	Gangavathi Ageti	5.67	8.47	8.67	5.33	5.97	14.3	8.07	11.7	7.87	16.3	5.00	6.79	15.3	10.5
27	IET 28261	8.00	7.47	13.67	3.00	8.17	12.7	8.83	10.3	7.13	13.7	5.00	8.00	15.7	10.0
28	Anjali	4.67	4.73	5.00	2.33	7.67	11.3	5.96	12.7	7.33	15.3	3.00	10.09	14.0	10.4
29	IET 28262	12.33	6.33	5.00	4.67	6.39	14.0	8.12	11.3	6.40	13.3	4.00	8.03	18.3	10.2
30	Local	9.33	4.20	6.33	3.00	7.48	15.7	7.67	11.0	7.07	11.0	4.00	9.05	20.7	10.5
	Mean	**10.12**	**5.81**	**6.90**	**3.54**	**7.60**	**12.4**	**7.73**	**12.5**	**6.22**	**12.7**	**4.57**	**8.55**	**15.1**	**10.0**
	LSD (Treat)				0.26*				LSD (Treat x Genotype)				1.47*		
	LSD (Location x Treat)				0.86**				LSD (Location x Treat x Genotype)				NS		
	LSD (Genotype)				NS				CV (%)				25.3		
	LSD (Location x Genotype)				3.39**										

Table 6.2.4 Screening for elite rice culture for drought tolerance on shoot weight (g/m2) at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigated						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	713	304	270	758	567	630	540	830	318	1005	806	591	2314	977
2	IET 28241	712	282	208	804	703	592	550	818	400	1704	694	737	2376	1121
3	IET 28242	614	238	284	714	527	666	507	698	398	1512	704	553	2084	992
4	IET 28243	607	278	259	669	687	532	506	698	317	1335	737	717	1958	960
5	IET 28244	706	286	303	618	421	1224	593	821	444	952	686	458	2538	983
6	IET 28245	633	150	190	567	733	484	460	735	291	552	690	758	2634	944
7	Sahbhagidhan	817	225	189	652	699	681	544	939	353	911	748	727	3037	1119
8	IET 28246	819	242	213	646	724	1291	656	931	375	1183	710	751	1836	964
9	IET 28247	805	475	174	751	601	1415	703	958	441	1017	741	641	2153	992
10	IET 28248	832	251	318	839	715	751	618	946	457	984	700	747	2147	997
11	IET 28249	793	402	316	852	700	1213	712	933	468	1009	806	740	2204	1026
12	IET 28250	685	263	416	716	717	1123	653	796	377	784	774	742	2434	984
13	Vandana	684	315	132	654	670	752	534	796	323	1387	760	715	1211	865
14	IET 28251	814	331	344	613	730	848	613	936	455	952	722	742	2137	991
15	IET 28252	738	615	340	679	682	1413	745	838	620	1407	782	707	2469	1137
16	IET 28253	603	206	307	699	524	821	527	708	444	857	733	544	1434	787
17	IET 28254	604	309	299	682	589	979	577	702	570	560	735	639	2637	974
18	Tulasi	621	466	316	720	646	1329	683	723	525	811	678	687	2842	1044
19	IET 28255	621	458	261	773	535	1015	611	714	526	1223	701	557	3634	1226
20	IET 28256	606	269	165	708	766	526	507	704	364	994	725	789	2152	955
21	US 314	511	332	363	613	752	825	566	600	533	995	778	775	1556	873
22	IET 28257	522	527	279	661	587	816	565	600	496	874	682	632	2543	971
23	IET 28258	614	291	168	777	661	822	556	708	550	1872	680	690	1146	941
24	IET 28259	519	491	280	645	555	944	572	632	481	908	664	601	2018	884
25	IET 28260	678	399	231	771	672	917	611	779	450	709	647	697	1820	850
26	Gangavathi Ageti	665	217	225	653	581	724	511	773	289	593	669	625	1337	714
27	IET 28261	568	374	496	627	602	1361	671	661	454	880	675	617	2444	955
28	Anjali	568	244	536	639	485	653	521	660	418	791	640	511	1263	714
29	IET 28262	653	511	467	637	667	1073	668	777	637	1085	543	692	2328	1010
30	Local	585	165	493	621	521	721	518	696	402	1144	620	565	1156	764
	Mean	**664**	**331**	**295**	**692**	**634**	**905**	**587**	**770**	**439**	**1033**	**708**	**665**	**2128**	**957**
	LSD (Treat)			NS					LSD (Treat x Genotype)			NS			
	LSD (Location x Treat)			36.2**					LSD (Location x Treat x Genotype)			NS			
	LSD (Genotype)			NS					CV(%)			12.18			
	LSD (Location x Genotype)			140.2**											

Table 6.2.5 Screening for elite rice culture for drought tolerance on panicle number/m2 at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigation						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	188.2	192.0	146.0	176.3	78.7	266.7	174.7	231.0	286.7	293.7	161.0	110.0	375.0	242.9
2	IET 28241	174.2	196.5	176.3	103.0	168.7	291.7	185.1	214.0	265.0	231.0	134.3	205.3	375.0	237.4
3	IET 28242	175.4	196.5	193.3	112.7	34.7	350.0	177.1	215.3	261.7	279.7	139.3	68.0	375.0	223.2
4	IET 28243	222.7	227.6	233.0	171.3	163.7	391.7	235.0	273.3	291.7	230.7	174.7	202.0	508.3	280.1
5	IET 28244	178.4	215.3	110.3	150.7	42.0	308.3	167.5	219.0	288.3	249.3	130.3	52.3	400.0	223.2
6	IET 28245	208.8	220.9	154.7	103.7	58.3	275.0	170.2	256.3	313.3	214.3	123.7	74.7	350.0	222.1
7	Sahbhagidhan	193.6	204.2	168.0	148.0	108.0	241.7	177.3	237.7	308.3	210.0	157.7	129.3	291.7	222.4
8	IET 28246	183.3	223.1	127.3	124.0	127.7	300.0	180.9	225.0	291.7	301.3	138.3	150.0	366.7	245.5
9	IET 28247	182.1	216.5	156.3	167.3	179.0	300.0	200.2	223.3	360.0	269.0	184.7	198.3	375.0	268.4
10	IET 28248	230.0	167.6	215.7	125.0	169.3	283.3	198.5	283.0	225.0	218.0	144.3	194.7	325.0	231.7
11	IET 28249	186.9	176.5	71.3	187.7	145.7	308.3	179.4	229.0	268.3	182.3	182.7	173.0	441.7	246.2
12	IET 28250	162.6	192.0	210.0	133.7	141.7	275.0	185.8	199.3	288.3	229.3	158.0	177.0	408.3	243.4
13	Vandana	202.1	189.8	125.0	122.0	125.7	291.7	176.0	248.7	283.3	239.3	169.7	150.0	350.0	240.2
14	IET 28251	192.4	273.1	214.0	142.3	153.3	250.0	204.2	236.0	293.3	280.0	164.0	176.7	333.3	247.2
15	IET 28252	189.3	178.7	124.7	146.7	147.7	300.0	181.2	232.0	278.3	257.3	140.3	164.0	341.7	235.6
16	IET 28253	237.3	179.8	131.3	116.0	161.7	316.7	190.5	291.0	236.7	256.3	175.0	180.0	333.3	245.4
17	IET 28254	196.0	184.3	122.0	182.3	68.0	316.7	178.2	240.7	226.7	176.0	171.7	90.3	275.0	196.7
18	Tulasi	174.8	166.5	116.0	154.7	185.0	250.0	174.5	214.3	280.0	146.0	189.0	209.3	291.7	221.7
19	IET 28255	193.6	209.8	121.0	178.3	139.3	358.3	200.1	237.7	321.7	235.0	197.3	166.7	400.0	259.7
20	IET 28256	201.5	196.5	153.7	167.7	122.3	316.7	193.0	247.3	320.0	247.7	170.0	153.7	375.0	252.3
21	US 314	196.0	205.4	240.7	158.3	56.7	366.7	204.0	240.7	271.7	237.0	176.3	68.3	500.0	249.0
22	IET 28257	245.8	195.4	122.3	176.7	58.3	358.3	192.8	301.7	238.3	188.3	175.0	82.7	441.7	237.9
23	IET 28258	204.5	202.0	102.3	150.0	159.3	300.0	186.4	250.7	285.0	254.3	151.0	186.7	333.3	243.5
24	IET 28259	185.7	169.8	102.0	167.0	153.0	316.7	182.4	228.0	265.0	168.3	186.3	183.3	358.3	231.6
25	IET 28260	195.4	172.1	220.3	168.0	137.0	283.3	196.0	240.0	293.3	240.3	200.3	180.3	333.3	247.9
26	Gangavathi Ageti	183.3	227.6	154.7	182.3	59.3	358.3	194.2	225.0	350.0	331.3	159.3	76.7	383.3	254.3
27	IET 28261	184.5	199.8	192.7	153.7	120.7	316.7	194.7	226.3	325.0	226.3	153.7	189.0	391.7	252.0
28	Anjali	234.3	199.8	179.7	116.3	80.0	283.3	182.2	287.3	255.0	190.7	116.7	210.7	350.0	235.1
29	IET 28262	187.5	217.6	126.3	132.3	84.7	350.0	183.1	230.0	281.7	211.0	179.3	142.7	458.3	250.5
30	Local	219.7	184.3	171.0	186.3	107.3	391.7	210.0	269.7	208.3	219.0	191.3	136.7	516.7	256.9
	Mean	197.0	199.4	156.1	150.1	117.9	310.6	188.5	241.8	282.1	233.8	163.2	149.4	378.6	241.5
	LSD (Treat)				ns				LSD (Treat x Genotype)				ns		
	LSD (Location x Treat)				12.0**				LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)				ns				CV(%)				14.6		
	LSD (Location x Genotype)				46.4**										

Table 6.2.6 Screening for elite rice culture for drought tolerance on grain number/panicle at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigation						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	66	77	23	152	39	120	79	83	163	54	159	92	150	117
2	IET 28241	50	88	44	165	109	97	92	60	96	127	176	136	176	129
3	IET 28242	48	67	14	157	57	126	78	73	108	125	171	83	153	119
4	IET 28243	79	102	11	164	86	99	90	94	134	150	151	120	141	132
5	IET 28244	45	92	12	195	94	138	96	64	116	103	153	104	158	116
6	IET 28245	52	75	8	190	84	117	88	49	85	80	197	99	193	117
7	Sahbhagidhan	87	94	20	169	110	114	99	75	114	146	138	130	211	136
8	IET 28246	57	92	41	157	83	152	97	86	98	133	173	104	147	123
9	IET 28247	75	72	25	154	97	145	95	53	118	135	180	115	158	126
10	IET 28248	68	77	11	141	77	118	82	47	118	87	148	101	143	107
11	IET 28249	39	64	5	175	99	139	87	97	100	60	161	125	139	114
12	IET 28250	65	78	7	151	83	142	88	62	117	71	168	117	168	117
13	Vandana	46	55	3	157	119	117	83	36	95	35	144	142	136	98
14	IET 28251	68	93	3	133	118	152	94	65	134	102	172	140	145	126
15	IET 28252	82	105	38	165	89	153	105	172	158	138	195	104	140	151
16	IET 28253	86	74	28	165	83	123	93	100	119	65	158	100	120	110
17	IET 28254	63	65	16	161	107	145	93	68	139	66	150	128	161	119
18	Tulasi	74	89	7	180	78	156	97	71	83	137	185	101	175	125
19	IET 28255	80	90	17	182	114	150	106	113	170	79	181	140	188	145
20	IET 28256	100	107	32	170	62	113	97	85	131	105	175	92	143	122
21	US 314	100	145	43	147	101	116	109	79	209	84	174	113	123	130
22	IET 28257	73	81	10	168	105	121	93	22	169	134	169	128	158	130
23	IET 28258	69	94	21	152	105	127	95	49	150	78	164	131	113	114
24	IET 28259	57	84	8	183	86	142	93	47	123	69	170	115	122	107
25	IET 28260	56	65	6	197	71	130	87	72	128	74	149	113	137	112
26	Gangavathi Ageti	55	73	11	139	104	124	84	44	79	70	178	120	122	102
27	IET 28261	93	94	157	160	74	151	122	58	124	92	166	141	168	125
28	Anjali	47	106	85	186	43	114	97	52	96	147	146	130	204	129
29	IET 28262	83	71	167	141	75	129	111	79	164	117	151	126	128	127
30	Local	59	92	118	157	103	103	105	59	141	101	122	131	115	112
	Mean	**67**	**85**	**33**	**164**	**89**	**129**	**95**	**70**	**126**	**99**	**164**	**117**	**151**	**121**
	LSD (Treat)				2.76*				LSD (Treat x Genotype)				NS		
	LSD (Location x Treat)				8.91**				LSD (Location x Treat x Genotype)				NS		
	LSD (Genotype)				NS				CV(%)				21.5		
	LSD (Location x Genotype)				34.54**										

Table 6.2.7 Screening for elite rice culture for drought tolerance on spikelet number/panicle at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigation						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	71	130	90	79.7	80	11.3	77	93	201	92	76.7	112	13.3	98
2	IET 28241	55	121	195	79.0	151	12.3	102	68	109	141	82.3	143	14.3	93
3	IET 28242	53	106	146	80.3	111	13.3	85	82	119	148	83.3	119	16.0	95
4	IET 28243	86	167	134	80.3	125	13.3	101	106	168	171	80.0	162	17.3	117
5	IET 28244	49	131	27	73.7	157	13.7	75	72	140	159	81.3	132	15.7	100
6	IET 28245	57	106	43	77.0	148	12.3	74	55	93	124	85.3	140	14.3	85
7	Sahbhagidhan	95	131	99	80.3	170	13.7	98	85	130	168	83.0	157	15.7	107
8	IET 28246	62	114	115	74.7	126	12.0	84	97	113	160	85.7	130	14.7	100
9	IET 28247	82	128	107	76.0	195	12.3	100	60	155	161	87.7	163	12.7	107
10	IET 28248	74	100	20	77.0	122	11.7	67	53	136	113	87.0	140	14.3	91
11	IET 28249	42	96	56	78.7	133	13.7	70	109	138	84	80.3	184	16.0	102
12	IET 28250	70	124	30	82.3	116	13.0	73	70	133	128	83.7	174	15.3	101
13	Vandana	50	78	18	82.3	158	11.3	66	41	106	78	86.7	186	10.7	85
14	IET 28251	74	146	22	86.0	161	13.7	84	73	156	120	85.3	194	18.3	108
15	IET 28252	89	136	127	85.7	111	12.3	93	194	181	157	79.0	159	14.3	131
16	IET 28253	94	114	132	84.3	112	13.3	92	113	129	110	79.0	165	12.0	101
17	IET 28254	68	99	127	76.0	153	13.7	89	77	183	82	82.0	177	12.7	102
18	Tulasi	81	129	78	80.7	126	11.3	84	80	116	161	80.7	141	14.7	99
19	IET 28255	87	145	133	81.0	154	13.0	102	127	215	108	78.0	184	13.7	121
20	IET 28256	109	142	138	87.7	92	11.7	97	96	169	113	81.3	119	14.3	99
21	US 314	109	197	62	81.0	129	13.7	99	89	233	145	85.7	130	16.0	116
22	IET 28257	79	139	92	77.3	138	12.0	90	24	191	156	82.0	136	14.3	101
23	IET 28258	75	119	64	84.7	143	11.7	83	56	195	86	73.7	207	10.3	105
24	IET 28259	62	132	26	83.0	121	13.7	73	53	171	105	79.3	148	13.7	95
25	IET 28260	61	114	23	80.3	99	12.3	65	81	162	89	80.0	121	15.0	91
26	Gangavathi Ageti	60	88	174	80.0	127	11.7	90	50	92	98	81.7	135	13.0	78
27	IET 28261	101	139	184	77.7	95	12.7	101	66	169	127	81.7	177	13.7	106
28	Anjali	52	136	101	76.3	83	14.0	77	58	102	169	89.0	163	13.0	99
29	IET 28262	90	129	174	82.0	111	12.7	100	89	204	143	86.0	153	11.7	114
30	Local	64	134	222	78.7	135	11.7	108	66	166	120	78.7	141	13.3	98
	Mean	**73**	**126**	**99**	**80.1**	**129**	**12.6**	**87**	**80**	**152**	**127**	**82.2**	**153**	**14.1**	**101**
	LSD (Treat)				3.31*				LSD (Treat x Genotype)					ns	
	LSD (Location x Treat)				1067**				LSD (Location x Treat x Genotype)					ns	
	LSD (Genotype)				ns				CV (%)					29.4	
	LSD (Location x Genotype)				41.35**										

Table 6.2.8 Screening for elite rice culture for drought tolerance on grain number/m2 at different centers Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigation						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	12305	21811	3572	27564	3063	31900	16703	19080	30230	17086	25996	10111	56100	26434
2	IET 28241	8801	23241	8787	16864	18345	28200	17373	12889	19925	30982	23729	27923	65783	30205
3	IET 28242	8516	17617	3184	17599	1969	43942	15471	15544	20973	29691	23062	6667	57275	25535
4	IET 28243	17597	29343	2533	28076	14094	38667	21718	25557	30678	33571	26710	24155	71517	35365
5	IET 28244	8050	26594	1180	29273	3955	42517	18595	13986	24703	28018	20788	5464	63092	26008
6	IET 28245	10931	23985	1265	18848	4923	32208	15360	12632	18961	19900	24421	7426	67450	25132
7	Sahbhagidhan	16854	28923	3459	25958	11945	27483	19104	17902	23346	30145	21888	16874	61633	28631
8	IET 28246	10463	27022	6475	19957	10573	45675	20027	19287	21939	40633	24234	15571	53875	29257
9	IET 28247	13628	26066	4558	26356	17344	43617	21928	11816	25569	36530	33315	22736	59108	31512
10	IET 28248	15773	17282	2379	16961	13087	33300	16464	13372	20044	19349	21237	19729	46408	23357
11	IET 28249	7429	17101	387	32770	14441	42733	19144	22192	17557	11047	29687	21642	61517	27274
12	IET 28250	10650	22681	1518	21110	11804	39125	17815	12407	22509	16936	26404	20762	68708	27954
13	Vandana	9249	15503	471	19569	14916	34192	15650	9049	18124	7901	24134	21247	47417	21312
14	IET 28251	13032	27125	638	18656	18109	38100	19277	15287	36904	28521	28266	24776	48150	30317
15	IET 28252	15486	29323	5097	24365	13092	45750	22186	39806	28178	36340	27513	17033	47767	32773
16	IET 28253	20546	17553	4072	18927	13359	38908	18894	29125	21415	16767	28450	17915	40117	25631
17	IET 28254	12253	14692	1573	29471	7284	45742	18502	16396	25469	11813	26149	11564	44367	22626
18	Tulasi	12972	24825	736	27776	14472	39058	19973	15202	13396	21166	35045	21196	51133	26190
19	IET 28255	15662	29087	1669	32750	15910	53767	24807	26801	34928	16010	35690	23386	75067	35314
20	IET 28256	20263	34110	5030	29119	7550	35850	21987	21007	25415	24030	29582	14100	53650	27964
21	US 314	19659	39389	10416	23265	5779	42417	23488	18918	42227	19979	31538	7718	61417	30299
22	IET 28257	17911	19137	1220	30903	6146	43250	19761	6521	33443	25137	29974	10626	69800	29250
23	IET 28258	14114	26889	2247	22839	16731	38000	20137	12440	29807	20011	24940	24464	37575	24873
24	IET 28259	10696	22241	749	30710	13115	45008	20420	10688	20934	10775	31698	21062	43717	23146
25	IET 28260	10881	18931	834	33387	9673	36783	18415	17167	22092	17537	29911	20353	45700	25460
26	Gangavathi Ageti	10162	25421	1605	24737	6148	44467	18757	9993	18186	23079	28420	9175	46767	22603
27	IET 28261	17035	30211	28935	24501	8851	47933	26244	13281	24674	21973	25840	26760	65800	29721
28	Anjali	11033	26946	16029	21117	3364	32317	18468	14861	18970	28605	17319	27484	71517	29793
29	IET 28262	15456	20229	22155	19266	6272	45267	21441	18173	34951	24258	26609	17908	58767	30111
30	Local	12858	19082	17105	29182	11106	40342	21612	15877	25710	22694	23315	17971	59442	27501
	Mean	**13342**	**24079**	**5329**	**24729**	**10581**	**39884**	**19657**	**16908**	**25042**	**23016**	**26862**	**17793**	**56688**	**27718**
	LSD (Treat)				714*				LSD (Treat x Genotype)				ns		
	LSD (Location x Treat)				2301**				LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)				3639**				CV (%)				25.34		
	LSD (Location x Genotype)				8914**										

Table 6.2.9 Screening for elite rice culture for drought tolerance on spikelet number/m2 at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigation						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	13412	37175	14814	13983	6310	3017	14785	21561	37384	27937	12365	12332	4992	19428
2	IET 28241	9593	31894	16513	8030	25395	3600	15837	14564	22552	34223	11042	29293	5367	19507
3	IET 28242	9282	27687	24433	9290	3843	4667	13200	17565	23139	35539	11696	8063	6000	17000
4	IET 28243	19181	48218	30594	13765	20415	5217	22898	28879	38482	38260	13902	32649	8833	26834
5	IET 28244	8775	37879	3102	11138	6607	4208	11952	15805	29981	40038	10584	6905	6275	18264
6	IET 28245	11915	33549	6551	8021	8658	3383	12013	14274	20884	30829	10599	10460	5017	15344
7	Sahbhagidhan	18371	40329	16026	11729	18408	3300	18027	20229	26459	34732	12802	20387	4567	19863
8	IET 28246	11405	33423	17225	9160	16058	3608	15146	21794	25099	48597	11837	19529	5375	22039
9	IET 28247	14855	46362	15936	12605	34843	3717	21386	13352	33596	43529	16049	32328	4742	23933
10	IET 28248	17192	22351	4321	9706	20708	3300	12930	15111	23129	25098	12515	27323	4650	17971
11	IET 28249	8097	25936	3970	14795	19386	4208	12732	25076	24270	16009	14629	31842	7067	19816
12	IET 28250	11608	35801	5810	11259	16476	3575	14088	14019	25500	29670	13177	30879	6250	19916
13	Vandana	10081	22179	2472	10158	19814	3333	11340	10225	20271	19614	14802	27792	3717	16070
14	IET 28251	14204	42617	5230	12286	24724	3425	17081	17275	42870	33696	13940	34408	6092	24713
15	IET 28252	16880	38276	16118	12420	16374	3717	17298	44981	32394	41742	11148	26138	4892	26882
16	IET 28253	22395	27068	16041	9683	18039	4250	16246	32911	23328	28018	13788	29688	4000	21956
17	IET 28254	13356	22506	14177	13893	10396	4367	13116	18527	33545	14733	14136	16071	3483	16749
18	Tulasi	14139	35912	9178	12552	23358	2833	16329	17178	18680	24762	15239	29488	4283	18272
19	IET 28255	17072	46941	14038	14661	21494	4650	19809	30285	43885	20330	15251	30599	5467	24303
20	IET 28256	22086	45353	22000	14777	11216	3675	19851	23738	32837	26071	13848	18294	5367	20026
21	US 314	21428	53472	14777	12788	7287	5017	19128	21377	47165	34571	15257	8887	8000	22543
22	IET 28257	19523	33042	11694	13677	8085	4317	15056	7369	37808	28748	14610	11238	6333	17684
23	IET 28258	15384	33974	6749	12719	22793	3500	15853	14057	38623	22061	11102	38580	3458	21313
24	IET 28259	11658	35138	2730	13819	18495	4342	14364	12078	29023	15756	14699	27240	4892	17281
25	IET 28260	11860	33511	3009	13513	13542	3492	13154	19399	28009	21027	15941	21757	5000	18522
26	Gangavathi Ageti	11076	30701	26967	14525	7517	4183	15828	11293	21116	32194	13033	10394	4983	15502
27	IET 28261	18568	44971	33439	11933	11464	4025	20733	15007	33715	29956	12284	33532	5350	21641
28	Anjali	12026	34677	19037	8841	6611	3967	14193	16793	20188	32744	10461	34554	4550	19882
29	IET 28262	16847	36421	23005	10703	9330	4450	16793	20535	43755	30399	15480	21811	5342	22887
30	Local	14015	27860	32427	14690	14543	4567	18017	17941	30145	26753	15187	19292	6892	19368
	Mean	**14543**	**35507**	**14413**	**12037**	**15406**	**3930**	**15973**	**19107**	**30261**	**29588**	**13380**	**23392**	**5374**	**20184**
	LSD (Treat)				ns				LSD (Treat x Genotype)				ns		
	LSD (Location x Treat)				2316**				LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)				2784*				CV(%)				23.3		
	LSD (Location x Genotype)				8972**										

Table 6.2.10 Screening for elite rice culture for drought tolerance on grain yield (g/m2) at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigation						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	784	285	70	229	508	340	369	911	306	668	250	550	446	522
2	IET 28241	387	251	44	208	628	398	319	478	343	416	260	700	548	458
3	IET 28242	449	303	147	240	457	472	345	554	402	814	365	498	674	551
4	IET 28243	779	330	50	323	623	439	424	906	407	510	323	673	744	594
5	IET 28244	500	290	63	281	407	440	330	562	458	618	354	446	680	520
6	IET 28245	454	328	54	167	671	390	344	528	348	441	260	730	585	482
7	Sahbhagidhan	711	378	56	240	611	439	406	799	431	467	365	690	630	564
8	IET 28246	707	291	74	219	638	358	381	822	349	478	323	704	519	533
9	IET 28247	448	403	78	344	504	377	359	493	439	493	417	610	463	486
10	IET 28248	418	329	68	250	496	355	319	470	365	280	302	704	504	437
11	IET 28249	732	243	34	354	665	403	405	851	409	369	344	714	639	554
12	IET 28250	424	336	68	323	640	385	363	466	393	489	365	703	639	509
13	Vandana	370	247	25	135	599	306	281	407	271	241	167	679	281	341
14	IET 28251	533	328	72	313	638	426	385	519	570	564	365	689	823	588
15	IET 28252	1108	276	73	354	557	372	457	1217	493	572	292	665	531	628
16	IET 28253	774	296	67	167	412	403	353	850	359	381	281	498	362	455
17	IET 28254	642	230	47	333	507	428	365	747	423	268	229	608	427	450
18	Tulasi	484	363	68	406	533	364	370	597	404	337	365	652	562	486
19	IET 28255	857	221	46	406	399	392	387	1006	400	814	313	509	497	590
20	IET 28256	674	368	66	323	727	309	411	904	408	456	281	761	522	555
21	US 314	585	426	108	469	686	415	448	763	607	605	438	729	670	635
22	IET 28257	274	257	52	438	513	382	319	338	423	608	406	585	555	486
23	IET 28258	431	312	39	229	616	349	329	501	526	398	229	657	296	434
24	IET 28259	436	327	36	313	511	414	339	490	456	357	333	561	474	445
25	IET 28260	612	279	61	375	606	394	388	688	495	482	396	644	582	548
26	Gangavathi Ageti	440	279	26	250	510	317	304	512	292	312	375	569	390	408
27	IET 28261	475	358	142	229	499	392	349	571	483	570	198	577	490	482
28	Anjali	515	337	67	135	394	418	311	635	459	391	198	461	431	429
29	IET 28262	720	213	102	260	561	376	372	847	533	467	240	667	405	526
30	Local	498	255	96	240	430	322	307	618	411	517	323	534	441	474
	Mean	**574**	**305**	**67**	**285**	**552**	**386**	**361**	**668**	**422**	**479**	**312**	**626**	**527**	**506**
	LSD (Treat)				11.17*				LSD (Treat x Genotype)				ns		
	LSD (Location x Treat)				36.01**				LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)				43.28*				CV(%)				21.6		
	LSD (Location x Genotype)				139**										

Table 6.2.11 Screening for elite rice culture for drought tolerance on 1000 grain weight (g) at different centres Kharif 2019

S.No.	Genotypes	Drought						Grand Mean	Irrigation						Grand Mean
		CBT	NRRI	PTB	RANCHI	REWA	RPR		CBT	NRRI	PTB	RANCHI	REWA	RPR	
1	IET 28240	19.4	20.1	5.0	22.0	25.3	22.4	19.1	21.0	19.8	22.7	19.3	26.7	22.7	22.0
2	IET 28241	23.8	24.4	5.9	21.6	27.9	27.7	21.9	26.8	26.1	23.7	22.6	30.2	27.9	26.2
3	IET 28242	27.6	28.2	13.3	21.8	25.7	28.5	24.2	27.9	27.9	25.0	24.4	27.3	30.5	27.2
4	IET 28243	19.7	19.2	5.8	22.8	25.3	19.7	18.8	21.4	19.6	25.0	20.9	27.3	21.9	22.7
5	IET 28244	27.0	22.6	8.3	22.6	20.4	24.9	21.0	24.8	25.4	24.0	19.5	24.1	25.6	23.9
6	IET 28245	22.7	22.6	5.1	22.3	19.7	25.3	19.6	24.3	23.4	24.3	22.1	22.1	26.1	23.7
7	Sahbhagidhan	23.9	22.2	8.7	23.1	25.7	22.8	21.1	22.5	21.6	21.7	21.7	29.7	24.3	23.6
8	IET 28246	20.9	22.0	14.1	23.9	28.2	21.2	21.7	23.6	20.3	23.3	20.6	31.5	21.4	23.5
9	IET 28247	26.0	24.6	9.8	27.9	27.3	25.5	23.5	23.9	25.0	25.0	20.5	29.3	28.4	25.4
10	IET 28248	24.8	23.5	3.3	26.8	21.5	27.5	21.2	28.9	26.0	25.0	21.3	25.2	27.7	25.7
11	IET 28249	21.4	23.4	2.5	19.1	21.9	27.3	19.3	26.2	28.0	24.0	21.3	24.5	29.6	25.6
12	IET 28250	25.5	24.1	4.1	23.1	26.2	26.3	21.6	26.9	24.4	25.0	22.8	27.7	27.5	25.7
13	Vandana	18.9	22.6	4.8	26.5	34.1	24.3	21.9	22.4	24.8	24.3	24.3	37.1	25.9	26.5
14	IET 28251	22.6	23.2	9.0	24.6	26.4	25.1	21.8	24.7	22.9	22.7	22.4	28.0	25.1	24.3
15	IET 28252	17.7	14.7	15.0	24.4	25.2	19.0	19.3	18.8	18.6	22.0	24.3	28.9	19.1	22.0
16	IET 28253	19.4	21.9	10.8	26.6	25.9	25.5	21.7	25.6	25.1	23.3	26.8	28.5	26.4	26.0
17	IET 28254	22.2	21.4	8.5	21.2	26.6	25.4	20.9	22.3	25.1	24.0	21.9	30.3	27.2	25.1
18	Tulasi	20.9	29.9	12.6	23.5	20.1	30.6	22.9	26.1	32.6	19.3	25.2	23.8	32.2	26.5
19	IET 28255	19.6	13.4	6.4	19.3	28.8	16.7	17.4	22.2	16.7	24.0	21.5	31.4	17.3	22.2
20	IET 28256	20.8	23.1	11.7	24.6	18.4	23.7	20.4	22.4	21.7	23.3	25.1	18.7	23.8	22.5
21	US 314	20.8	21.2	10.0	22.9	28.0	18.2	20.2	24.1	20.9	23.3	21.1	29.9	24.4	24.0
22	IET 28257	21.1	20.5	5.3	21.4	24.7	25.7	19.8	20.3	20.9	25.0	25.1	26.2	25.8	23.9
23	IET 28258	20.2	23.3	8.2	25.8	27.4	25.5	21.7	24.8	24.6	25.0	26.3	29.0	28.6	26.4
24	IET 28259	21.4	22.1	2.5	20.7	26.7	25.2	19.8	21.9	24.8	23.0	20.1	27.9	28.1	24.3
25	IET 28260	21.8	24.3	10.0	22.9	17.5	25.3	20.3	24.9	24.5	21.0	26.3	17.8	25.8	23.4
26	Gangavathi Ageti	17.6	18.8	4.3	21.8	28.2	19.6	18.4	20.0	18.0	22.0	23.0	30.5	19.7	22.2
27	IET 28261	16.3	20.5	12.5	20.8	25.6	21.2	19.5	23.0	20.9	24.0	23.5	27.9	21.7	23.5
28	Anjali	23.6	24.8	12.2	23.7	21.3	25.8	21.9	23.8	24.9	23.0	27.7	24.6	30.8	25.8
29	IET 28262	19.7	14.7	16.4	24.0	20.1	16.3	18.5	21.7	19.9	25.0	20.5	22.4	21.3	21.8
30	Local	21.1	21.7	19.7	19.5	19.5	23.6	20.8	26.8	21.8	24.0	26.4	21.5	22.5	23.8
	Mean	**21.6**	**22.0**	**8.9**	**23.0**	**24.7**	**23.9**	**20.7**	**23.8**	**23.2**	**23.6**	**23.0**	**27.0**	**25.3**	**24.3**
	LSD (Treat)				ns				LSD (Treat x Genotype)				ns		
	LSD (Location x Treat)				1.07**				LSD (Location x Treat x Genotype)				ns		
	LSD (Genotype)				1.29*				CV(%)				12.4		
	LSD (Location x Genotype)				1.70**										

Table 6.2.12 Screening for elite rice culture for drought tolerance on Stability statistics at different centres Kharif 2019

S.No.	Genotypes	Mean	Sigma-square	.	s-square	.	Ecovalence
1	IET 28240	369.3	32004.1	**	33273.9	**	153656.5
2	IET 28241	319.5	24676.3	*	30729.5	**	119460.3
3	IET 28242	344.6	24005.9	*	12625.2	ns	116331.5
4	**IET 28243**	**424.2**	**17595.8**	**ns**	**6468.5**	**ns**	**86417.6**
5	IET 28244	330.3	14287.4	ns	11071.2	ns	70978.7
6	IET 28245	343.9	25871.2	*	32265.2	**	125036.1
7	Sahbhagidhan	405.8	12431.1	ns	7007.3	ns	62316.0
8	IET 28246	381.2	17144.1	ns	11496.0	ns	84309.7
9	IET 28247	358.9	19246.5	ns	13352.1	ns	94121.1
10	IET 28248	319.3	11709.4	ns	6313.9	ns	58947.8
11	IET 28249	405.0	22333.6	*	10010.6	ns	108527.5
12	IET 28250	362.7	20143.5	*	23609.5	*	98306.9
13	Vandana	280.6	23741.1	*	29563.5	**	115095.6
14	IET 28251	384.8	4682.9	ns	6082.2	ns	26157.4
15	IET 28252	456.7	150799.7	**	135576.0	**	708036.0
16	IET 28253	353.1	46324.5	**	55208.6	**	220485.1
17	IET 28254	364.7	9714.2	ns	11612.0	ns	49636.8
18	Tulasi	369.6	16159.1	ns	14591.1	ns	79712.9
19	IET 28255	386.8	77190.4	**	91839.6	**	364526.0
20	IET 28256	411.1	22989.1	*	19257.1	ns	111586.3
21	US 314	448.0	14590.6	ns	18436.7	ns	72393.5
22	IET 28257	319.3	67725.6	**	58878.8	**	320356.9
23	IET 28258	329.2	14460.5	ns	18137.9	ns	71786.3
24	IET 28259	339.5	12426.7	ns	11578.3	ns	62295.2
25	IET 28260	387.6	4883.0	ns	5386.1	ns	27091.6
26	Gangavathi Ageti	303.6	4248.9	ns	3412.8	ns	24132.1
27	IET 28261	349.1	14068.7	ns	5736.7	ns	69957.9
28	Anjali	311.0	23188.2	*	24566.1	*	112515.7
29	IET 28262	372.0	19103.6	ns	20262.7	ns	93454.2
30	Local	306.7	6974.4	ns	512.7	ns	36851.3

Signif. codes: 0 '**' 0.01 '*' 0.05 'ns' 1

Table 6.2.13 Simultaneous selection for yield and stability (++) at different centres Kharif 2019

S.No.	Genotypes	Yield	Rank Adj.	rank	Adjusted	Stab.var	Stab.rating	YSi	...
1	IET 28240	369.3	18.0	1.0	19.0	32004.1	-8.0	11.0	
2	IET 28241	319.5	7.0	-1.0	6.0	24676.3	-4.0	2.0	
3	IET 28242	344.6	12.0	-1.0	11.0	24005.9	-4.0	7.0	
4	**IET 28243**	**424.2**	**28.0**	**2.0**	**30.0**	**17595.8**	**0.0**	**30.0**	**+**
5	IET 28244	330.3	9.0	-1.0	8.0	14287.4	0.0	8.0	
6	IET 28245	343.9	11.0	-1.0	10.0	25871.2	-4.0	6.0	
7	**Sahbhagidhan**	**405.8**	**26.0**	**1.0**	**27.0**	**12431.1**	**0.0**	**27.0**	**+**
8	**IET 28246**	**381.2**	**21.0**	**1.0**	**22.0**	**17144.1**	**0.0**	**22.0**	**+**
9	**IET 28247**	**358.9**	**15.0**	**-1.0**	**14.0**	**19246.5**	**0.0**	**14.0**	**+**
10	IET 28248	319.3	5.0	-1.0	4.0	11709.4	0.0	4.0	
11	**IET 28249**	**405.0**	**25.0**	**1.0**	**26.0**	**22333.6**	**-4.0**	**22.0**	**+**
12	IET 28250	362.7	16.0	1.0	17.0	20143.5	-4.0	13.0	
13	Vandana	280.6	1.0	-2.0	-1.0	23741.1	-4.0	-5.0	
14	**IET 28251**	**384.8**	**22.0**	**1.0**	**23.0**	**4682.9**	**0.0**	**23.0**	**+**
15	**IET 28252**	**456.7**	**30.0**	**2.0**	**32.0**	**150799.7**	**-8.0**	**24.0**	**+**
16	IET 28253	353.1	14.0	-1.0	13.0	46324.5	-8.0	5.0	
17	**IET 28254**	**364.7**	**17.0**	**1.0**	**18.0**	**9714.2**	**0.0**	**18.0**	**+**
18	**Tulasi**	**369.6**	**19.0**	**1.0**	**20.0**	**16159.1**	**0.0**	**20.0**	**+**
19	**IET 28255**	**386.8**	**23.0**	**1.0**	**24.0**	**77190.4**	**-8.0**	**16.0**	**+**
20	**IET 28256**	**411.1**	**27.0**	**1.0**	**28.0**	**22989.1**	**-4.0**	**24.0**	**+**
21	**US 314**	**448.0**	**29.0**	**2.0**	**31.0**	**14590.6**	**0.0**	**31.0**	**+**
22	IET 28257	319.3	6.0	-1.0	5.0	67725.6	-8.0	-3.0	
23	IET 28258	329.2	8.0	-1.0	7.0	14460.5	0.0	7.0	
24	IET 28259	339.5	10.0	-1.0	9.0	12426.7	0.0	9.0	
25	**IET 28260**	**387.6**	**24.0**	**1.0**	**25.0**	**4883.0**	**0.0**	**25.0**	**+**
26	Gangavathi Ageti	303.6	2.0	-2.0	0.0	4248.9	0.0	0.0	
27	IET 28261	349.1	13.0	-1.0	12.0	14068.7	0.0	12.0	
28	Anjali	311.0	4.0	-1.0	3.0	23188.2	-4.0	-1.0	
29	**IET 28262**	**372.0**	**20.0**	**1.0**	**21.0**	**19103.6**	**0.0**	**21.0**	**+**
30	Local	306.7	3.0	-2.0	1.0	6974.4	0.0	1.0	
	Yield Mean:			361.3					
	YS Mean:			13.1					
	LSD (0.05):			51.46					

+ selected genotype, ++ Reference: Kang
Selection for yield and stability: Consequences for growers. Agron. J. 85:754-757.
M. S. 1993. Simultaneous selection for yield

Table 6.2.15 Screening for elite rice culture for drought tolerance on Indices of different rice genotypes grown at different centers Kharif 2019

S.No.	Genotypes	Yp	Ys	DSI	RDI	HTI	GMP	TOL	MP	YI	YSI	DI	SDI	HM	K1STI	K2STI	Ran Sum	Mean Rank	SEm±
1	IET 28240	522.1	369.3	1.02	1.39	0.39	439	153	446	1.03	0.71	0.73	0.29	433	0.55	1.06	195	14	1.1
2	IET 28241	457.6	319.5	1.06	1.37	0.29	382	138	389	0.89	0.70	0.62	0.30	376	0.42	0.79	98	7	0.9
3	IET 28242	551.3	344.6	1.31	1.23	0.38	436	207	448	0.96	0.63	0.60	0.37	424	0.61	0.92	129	9	2.4
4	IET 28243	594.0	424.2	1.00	1.40	0.50	502	170	509	1.18	0.71	0.84	0.29	495	0.71	1.40	278	20	2.2
5	IET 28244	519.6	330.3	1.28	1.25	0.34	414	189	425	0.92	0.64	0.58	0.36	404	0.54	0.85	108	8	1.6
6	IET 28245	482.0	343.9	1.00	1.40	0.33	407	138	413	0.96	0.71	0.68	0.29	401	0.46	0.92	309	22	9.0
7	Sahbhagidhan	563.6	405.8	0.98	1.42	0.46	478	158	485	1.13	0.72	0.81	0.28	472	0.64	1.28	313	22	1.6
8	IET 28246	532.6	381.2	1.00	1.41	0.41	451	151	457	1.06	0.72	0.76	0.28	444	0.57	1.13	271	19	0.8
9	IET 28247	485.9	358.9	0.91	1.45	0.35	418	127	422	1.00	0.74	0.74	0.26	413	0.47	1.00	252	18	1.0
10	IET 28248	437.4	319.3	0.95	1.44	0.28	374	118	378	0.89	0.73	0.65	0.27	369	0.38	0.79	165	12	2.2
11	IET 28249	554.1	405.0	0.94	1.44	0.45	474	149	480	1.13	0.73	0.82	0.27	468	0.61	1.27	311	22	0.8
12	IET 28250	509.1	362.7	1.01	1.40	0.37	430	146	436	1.01	0.71	0.72	0.29	424	0.52	1.02	221	16	0.6
13	Vandana	340.8	280.6	0.62	1.62	0.19	309	60	311	0.78	0.82	0.64	0.18	308	0.23	0.61	171	12	4.0
14	IET 28251	588.3	384.8	1.21	1.29	0.45	476	204	487	1.07	0.65	0.70	0.35	465	0.69	1.15	227	16	2.8
15	IET 28252	628.3	456.7	0.96	1.43	0.57	536	172	542	1.27	0.73	0.92	0.27	529	0.79	1.62	334	24	2.1
16	IET 28253	455.3	353.1	0.79	1.52	0.32	401	102	404	0.98	0.78	0.76	0.22	398	0.41	0.97	239	17	2.4
17	IET 28254	450.4	364.7	0.67	1.59	0.33	405	86	408	1.02	0.81	0.82	0.19	403	0.41	1.03	255	18	2.4
18	Tulasi	486.1	369.6	0.84	1.50	0.36	424	116	428	1.03	0.76	0.78	0.24	420	0.47	1.06	268	19	1.3
19	IET 28255	589.7	386.8	1.20	1.29	0.46	478	203	488	1.08	0.66	0.71	0.34	467	0.70	1.16	230	16	2.8
20	IET 28256	555.3	411.1	0.91	1.46	0.46	478	144	483	1.15	0.74	0.85	0.26	472	0.62	1.31	317	23	0.8
21	US 314	635.3	448.0	1.03	1.39	0.57	533	187	542	1.25	0.71	0.88	0.29	525	0.81	1.56	282	20	3.1
22	IET 28257	485.9	319.3	1.20	1.29	0.31	394	167	403	0.89	0.66	0.58	0.34	385	0.47	0.79	109	8	0.8
23	IET 28258	434.4	329.2	0.85	1.49	0.29	378	105	382	0.92	0.76	0.70	0.24	375	0.38	0.84	169	12	2.7
24	IET 28259	445.2	339.5	0.83	1.50	0.30	389	106	392	0.95	0.76	0.72	0.24	385	0.40	0.89	194	14	2.5
25	IET 28260	547.9	387.6	1.02	1.39	0.42	461	160	468	1.08	0.71	0.76	0.29	454	0.60	1.17	234	17	1.6
26	Gangavathi Ageti	408.3	303.6	0.90	1.46	0.25	352	105	356	0.85	0.74	0.63	0.26	348	0.33	0.72	130	9	3.1
27	IET 28261	481.6	349.1	0.96	1.43	0.34	410	133	415	0.97	0.72	0.70	0.28	405	0.46	0.95	185	13	0.8
28	Anjali	429.3	311.0	0.96	1.42	0.27	365	118	370	0.87	0.72	0.63	0.28	361	0.37	0.75	108	8	2.1
29	IET 28262	526.4	372.0	1.03	1.39	0.39	443	154	449	1.04	0.71	0.73	0.29	436	0.55	1.07	200	14	1.4
30	Local	474.1	306.7	1.24	1.27	0.29	381	167	390	0.85	0.65	0.55	0.35	372	0.45	0.73	60	4	0.7
	Mean	**505.7**	**361.3**	**1.0**	**1.4**	**0.4**	**427.2**	**144.5**	**433.5**	**1.0**	**0.7**	**0.7**	**0.3**	**421.1**	**0.5**	**1.0**	**212.1**	**15.1**	**2.1**

Yp = Yield under irrigated condition, Ys = Yield under rainfed condition, DSI= Drought susceptibility index, DTI= Drought Tolerance Index

TOL: Tolerance, MP = Mean Productivity, GMP = Geometric Mean of Productivity, HM = Hormonic Mean, YSI = Yield Stability Index

YI= Yield Index, SDI = susceptibility drought index, K1STI = Revised Stress Tolerance Index, K2STI = Revised Stress Tolerance Index

Table 6.2.2.1 Screening for elite rice culture for drought tolerance during Rabi 2018-19 at Titabar

S.No.	Genotypes	No. of tillers/plant		Mean	Stem Weight (g/plant)		Mean	Shoot Weight (g/m2)		Mean
		Drought	Irrigated		Drought	Irrigated		Drought	Irrigated	
1	IET 27508	16	21	19	12.3	15.0	13.6	389	559	474
2	IET 27509	17	17	17	10.7	12.7	11.7	385	500	443
3	IET 27510	15	23	19	11.5	12.6	12.1	350	690	520
4	IET 27511	20	20	20	13.6	13.9	13.7	500	611	555
5	IET 27512	15	18	17	10.9	12.0	11.5	347	552	449
6	IET 27513	15	18	16	9.6	10.9	10.2	361	665	513
7	IET 27514	9	21	15	8.0	8.8	8.4	278	570	424
8	IET 27515	10	14	12	7.7	9.7	8.7	336	602	469
9	IET 27516	16	23	20	13.8	14.8	14.3	386	606	496
10	IET 27517	15	23	19	12.7	14.7	13.7	356	714	535
11	Sahabhagidhan	18	18	18	13.3	14.9	14.1	437	611	524
12	IET 27518	18	17	18	9.2	12.8	11.0	385	685	535
13	IET 27519	12	18	15	10.5	12.6	11.5	333	580	456
14	IET 27520	9	14	12	9.8	11.3	10.6	273	556	414
15	IET 27521	10	18	14	13.5	14.9	14.2	288	606	447
16	IET 27522	13	11	12	9.8	11.0	10.4	411	611	511
17	IET 27523	14	19	16	7.4	8.3	7.9	299	523	411
18	IET 27524	11	17	14	13.5	16.6	15.0	275	688	481
19	IET 27525	21	18	19	11.5	20.4	16.0	450	520	485
20	Vandana	12	14	13	12.0	15.2	13.6	389	565	477
21	IET 27526	11	11	11	13.1	13.5	13.3	288	625	457
22	IET 27527	15	16	16	11.6	11.3	11.5	369	556	462
23	IET 27528	12	14	13	19.5	30.6	25.1	314	575	444
24	IET 27529	13	21	17	11.5	13.3	12.4	288	479	383
25	IET 27530	20	16	18	9.8	12.3	11.0	294	553	423
26	Tulasi	14	19	17	9.9	15.0	12.5	283	494	389
27	NDR-97	19	17	18	12.0	17.7	14.9	306	516	411
28	Govind	17	16	17	12.9	14.9	13.9	412	631	521
29	Samaleshwari	17	19	18	10.4	12.2	11.3	365	592	478
30	Varalu	13	22	18	6.7	8.4	7.6	311	539	425
	Mean	**15**	**18**	**16**	**11.3**	**13.8**	**12.5**	**348**	**586**	**467**
	LSD (Treat)		0.59**			0.644**			18.8**	
	LSD (Genotype)		2.29**			2.49**			72.78**	
	LSD (Treat x Genotype)		3.25**			3.5**			102.9**	
	C.V (%)		9.4			13.18			10.3	

Table 6.2.2 Screening for elite rice culture for drought tolerance during Rabi 2018-19 at Titabar

S.No.	Genotypes	Panicle wt g/m2		Mean	Panicle No/m2		Mean	grain no/pan		Mean
		Drought	Irrigated		Drought	Irrigated		Drought	Irrigated	
1	IET 27508	191	528	360	241	287	264	88	151	119
2	IET 27509	167	357	262	250	307	278	75	95	85
3	IET 27510	129	475	302	281	294	287	64	130	97
4	IET 27511	295	411	353	235	303	269	89	116	102
5	IET 27512	125	417	271	243	274	259	70	100	85
6	IET 27513	135	369	252	254	291	272	80	109	94
7	IET 27514	170	476	323	238	284	261	86	116	101
8	IET 27515	301	554	428	198	255	227	93	107	100
9	IET 27516	186	436	311	246	289	268	83	124	104
10	IET 27517	162	535	348	268	288	278	76	113	95
11	Sahabhagidhan	284	426	355	154	231	193	95	114	105
12	IET 27518	118	515	317	186	210	198	64	132	98
13	IET 27519	312	311	312	189	241	215	100	115	107
14	IET 27520	230	467	349	191	201	196	82	137	109
15	IET 27521	274	496	385	222	244	233	84	113	98
16	IET 27522	304	489	397	260	289	274	93	115	104
17	IET 27523	349	453	401	248	276	262	77	112	94
18	IET 27524	168	534	351	192	288	240	64	172	118
19	IET 27525	323	438	381	270	294	282	100	122	111
20	Vandana	322	383	353	228	308	268	96	117	106
21	IET 27526	199	379	289	217	261	239	71	113	92
22	IET 27527	327	425	376	256	322	289	81	89	85
23	IET 27528	289	498	393	236	298	267	89	135	112
24	IET 27529	250	363	307	226	286	256	73	109	91
25	IET 27530	112	381	247	235	279	257	61	122	91
26	Tulasi	114	422	268	204	224	214	70	98	84
27	NDR-97	156	308	232	268	282	275	66	85	75
28	Govind	291	406	348	228	243	235	96	114	105
29	Samaleshwari	207	414	311	253	281	267	72	120	96
30	Varalu	181	324	253	205	253	229	67	104	85
	Mean	**222**	**433**	**328**	**231**	**273**	**252**	**80**	**116**	**98**
	LSD (Treat)		4.4**			12.1**			3.4**	
	LSD (Genotype)		17.1**			47.5**			13.4**	
	LSD (Treat x Genotype)		3.4**			NS			18.9**	
	C.V (%)		3.44			12.5			9.07	

Table 6.2.3 Screening for elite rice culture for drought tolerance during Rabi 2018-19 at Titabar

S.No.	Genotypes	spikelet no/pan		Mean	No. of grains/m2		Mean	No.of Spikelets/m2		Mean
		Drought	Irrigated		Drought	Irrigated		Drought	Irrigated	
1	IET 27508	107	181	144	21119	43080	32100	25765	51696	38731
2	IET 27509	92	115	103	18835	29153	23994	22979	35224	29101
3	IET 27510	78	157	117	17939	38206	28072	21885	46048	33966
4	IET 27511	108	140	124	20827	35119	27973	25408	42441	33925
5	IET 27512	85	121	103	16927	27415	22171	20651	33124	26887
6	IET 27513	98	129	114	20331	31577	25954	24804	37658	31231
7	IET 27514	105	140	123	20462	32816	26639	24963	39817	32390
8	IET 27515	113	129	121	18465	27213	22839	22527	32833	27680
9	IET 27516	101	148	125	20442	35896	28169	24939	42925	33932
10	IET 27517	93	136	114	20399	32616	26507	24886	39233	32060
11	Sahabhagidhan	116	136	126	14542	26370	20456	17742	31400	24571
12	IET 27518	77	157	117	11887	27706	19797	14503	33112	23807
13	IET 27519	121	138	130	18777	27627	23202	22907	33358	28133
14	IET 27520	100	163	131	15725	27419	21572	19185	32689	25937
15	IET 27521	102	136	119	18397	27522	22960	22445	33146	27795
16	IET 27522	113	139	126	24038	33286	28662	29326	40230	34778
17	IET 27523	94	135	115	19115	30737	24926	23320	37308	30314
18	IET 27524	77	207	142	12076	49438	30757	14733	59603	37168
19	IET 27525	121	145	133	26834	35823	31328	32737	42712	37724
20	Vandana	117	139	128	21731	35820	28775	26511	42620	34566
21	IET 27526	86	136	111	15324	29471	22397	18695	35597	27146
22	IET 27527	99	106	103	20752	28491	24622	25317	34210	29763
23	IET 27528	109	161	135	21109	40121	30615	25753	47936	36845
24	IET 27529	88	131	110	16448	30972	23710	20067	37459	28763
25	IET 27530	74	145	110	14360	34037	24198	17519	40752	29135
26	Tulasi	85	118	101	13971	22170	18071	17045	26604	21824
27	NDR-97	81	101	91	17696	23867	20781	21589	28640	25115
28	Govind	117	137	127	21811	27714	24762	26609	33256	29933
29	Samaleshwari	87	143	115	18026	33527	25776	21991	40232	31112
30	Varalu	81	124	103	13845	26233	20039	16890	31480	24185
	Mean	**97**	**140**	**119**	**18407**	**31715**	**25061**	**22456**	**38111**	**30284**
	LSD (Treat)		4.1**			1564**			1874**	
	LSD (Genotype)		15.9**			6059**			7261**	
	LSD (Treat x Genotype)		22.6**			8568**			10269**	
	C.V (%)		8.9			15.9			15.9	

Table 6.2.2.4 Screening for elite rice culture for drought tolerance during Rabi 2018-19 at Titabar

S.No.	Genotypes	Grain Yield (g/m2)		Mean	1000 grain weight (g)		Mean	Harvest Index (%)		Mean
		Drought	Irrigated		Drought	Irrigated		Drought	Irrigated	
1	IET 27508	151	459	305	18.0	21.7	19.8	26.0	42.0	34.0
2	IET 27509	131	310	221	15.7	17.3	16.5	24.3	36.3	30.3
3	IET 27510	101	414	257	15.7	20.0	17.8	20.7	36.0	28.3
4	IET 27511	232	357	295	23.3	25.0	24.2	29.0	35.0	32.0
5	IET 27512	94	361	227	18.3	22.0	20.2	20.0	37.3	28.7
6	IET 27513	106	320	213	16.7	21.7	19.2	21.0	31.0	26.0
7	IET 27514	132	414	273	22.3	25.3	23.8	29.7	40.0	34.8
8	IET 27515	237	484	360	22.7	24.0	23.3	37.0	42.0	39.5
9	IET 27516	145	383	264	17.7	21.3	19.5	25.3	37.0	31.2
10	IET 27517	125	468	296	17.3	22.0	19.7	24.0	37.3	30.7
11	Sahabhagidhan	225	372	298	22.3	24.0	23.2	31.0	36.0	33.5
12	IET 27518	90	451	270	18.7	23.0	20.8	18.3	37.3	27.8
13	IET 27519	245	268	256	23.3	25.0	24.2	37.7	30.0	33.8
14	IET 27520	178	410	294	19.0	21.7	20.3	35.3	40.3	37.8
15	IET 27521	216	430	323	19.7	22.7	21.2	38.0	39.0	38.5
16	IET 27522	242	427	335	23.7	24.3	24.0	33.7	39.0	36.3
17	IET 27523	278	394	336	20.3	22.0	21.2	40.0	40.3	40.2
18	IET 27524	134	464	299	17.7	22.3	20.0	30.0	38.0	34.0
19	IET 27525	256	377	316	23.7	24.3	24.0	33.3	39.3	36.3
20	Vandana	255	331	293	22.0	22.3	22.2	36.0	35.0	35.5
21	IET 27526	158	334	246	18.3	23.7	21.0	32.3	33.3	32.8
22	IET 27527	260	368	314	20.3	23.0	21.7	37.0	37.7	37.3
23	IET 27528	230	435	332	17.3	20.0	18.7	38.0	40.3	39.2
24	IET 27529	199	315	257	16.7	20.0	18.3	37.0	37.3	37.2
25	IET 27530	89	333	211	18.7	25.0	21.8	21.7	36.0	28.8
26	Tulasi	91	367	229	17.3	23.3	20.3	23.0	40.3	31.7
27	NDR-97	124	268	196	20.3	24.0	22.2	26.7	33.0	29.8
28	Govind	231	353	292	19.3	20.0	19.7	33.0	34.3	33.7
29	Samaleshwari	165	360	262	16.3	19.0	17.7	29.0	36.0	32.5
30	Varalu	144	282	213	16.7	21.0	18.8	29.3	32.7	31.0
	Mean	**175**	**377**	**276**	**19.3**	**22.4**	**20.8**	**29.9**	**37.0**	**33.4**
	LSD (Treat)		3.73**			0.309**			0.833**	
	LSD (Genotype)		14.50**			1.20**			3.23**	
	LSD (Treat x Genotype)		20.46**			1.695**			4.57**	
	C.V (%)		3.49			3.86			6.4	

Table 6.2.2.5 Screening for elite rice culture for drought tolerance during Rabi 2018-19 at Titabar

	Yp	Ys	DSI	RDI	DTI	GMP	TOL	MP	YI	YSI	DI	SDI	HM	K1STI	K2STI
Yp	1.00	0.02	0.39	-0.39	0.41	0.41	0.69	0.71	0.02	-0.39	-0.21	0.39	0.22	1.00	0.02
Ys	0.02	1.00	-0.90	0.90	0.91	0.91	-0.71	0.72	1.00	0.90	0.95	-0.90	0.97	0.01	0.99
DSI	0.39	-0.90	1.00	-1.00	-0.64	-0.65	0.93	-0.36	-0.90	-1.00	-0.97	1.00	-0.78	0.39	-0.89
RDI	-0.39	0.90	-1.00	1.00	0.64	0.65	-0.93	0.36	0.90	1.00	0.97	-1.00	0.78	-0.39	0.89
DTI	0.41	0.91	-0.64	0.64	1.00	1.00	-0.37	0.93	0.91	0.64	0.76	-0.64	0.98	0.40	0.90
GMP	0.41	0.91	-0.65	0.65	1.00	1.00	-0.37	0.93	0.91	0.65	0.76	-0.65	0.98	0.40	0.90
TOL	0.69	-0.71	0.93	-0.93	-0.37	-0.37	1.00	-0.03	-0.71	-0.93	-0.84	0.93	-0.55	0.69	-0.71
MP	0.71	0.72	-0.36	0.36	0.93	0.93	-0.03	1.00	0.72	0.36	0.53	-0.36	0.84	0.70	0.72
YI	0.02	1.00	-0.90	0.90	0.91	0.91	-0.71	0.72	1.00	0.90	0.95	-0.90	0.97	0.01	0.99
YSI	-0.39	0.90	-1.00	1.00	0.64	0.65	-0.93	0.36	0.90	1.00	0.97	-1.00	0.78	-0.39	0.89
DI	-0.21	0.95	-0.97	0.97	0.76	0.76	-0.84	0.53	0.95	0.97	1.00	-0.97	0.86	-0.22	0.96
SDI	0.39	-0.90	1.00	-1.00	-0.64	-0.65	0.93	-0.36	-0.90	-1.00	-0.97	1.00	-0.78	0.39	-0.89
HM	0.22	0.97	-0.78	0.78	0.98	0.98	-0.55	0.84	0.97	0.78	0.86	-0.78	1.00	0.21	0.95
K1STI	1.00	0.01	0.39	-0.39	0.40	0.40	0.69	0.70	0.01	-0.39	-0.22	0.39	0.21	1.00	0.01
K2STI	0.02	0.99	-0.89	0.89	0.90	0.90	-0.71	0.72	0.99	0.89	0.96	-0.89	0.95	0.01	1.00

Table 6.2.2.6 Drought tolerance indices of different rice genotypes during Rabi 2018-19 season at TTB

Genotype	Yp	Ys	DSI	RDI	DTI	GMP	TOL	MP	YI	YSI	DI	SDI	HM	K1STI	K2STI
IET 27508	459	151	2.28	0.65	0.14	263	308	305	0.42	0.33	0.14	0.67	227	0.42	0.18
IET 27509	310	131	1.96	0.83	0.08	202	179	221	0.36	0.42	0.15	0.58	184	0.19	0.13
IET 27510	414	101	2.57	0.48	0.08	204	314	257	0.28	0.24	0.07	0.76	162	0.34	0.08
IET 27511	357	232	1.19	1.28	0.17	288	125	295	0.65	0.65	0.42	0.35	281	0.25	0.42
IET 27512	361	94	2.51	0.51	0.07	184	268	227	0.26	0.26	0.07	0.74	149	0.26	0.07
IET 27513	320	106	2.27	0.65	0.07	184	215	213	0.29	0.33	0.10	0.67	159	0.20	0.09
IET 27514	414	132	2.31	0.63	0.11	234	282	273	0.37	0.32	0.12	0.68	200	0.34	0.14
IET 27515	484	237	1.73	0.96	0.23	338	248	360	0.66	0.49	0.32	0.51	318	0.47	0.43
IET 27516	383	145	2.11	0.74	0.11	236	238	264	0.40	0.38	0.15	0.62	210	0.29	0.16
IET 27517	468	125	2.49	0.53	0.12	242	343	296	0.35	0.27	0.09	0.73	197	0.44	0.12
Sahabhagidhan	372	225	1.34	1.19	0.17	289	147	298	0.63	0.60	0.38	0.40	280	0.28	0.39
IET 27518	451	90	2.71	0.39	0.08	201	361	270	0.25	0.20	0.05	0.80	150	0.41	0.06
IET 27519	268	245	0.29	1.80	0.13	256	23	256	0.68	0.91	0.62	0.09	255	0.14	0.46
IET 27520	410	178	1.92	0.85	0.15	270	232	294	0.50	0.43	0.22	0.57	248	0.34	0.25
IET 27521	430	216	1.69	0.99	0.19	304	215	323	0.60	0.50	0.30	0.50	287	0.37	0.36
IET 27522	427	242	1.47	1.12	0.21	322	185	335	0.68	0.57	0.38	0.43	309	0.36	0.46
IET 27523	394	278	1.00	1.39	0.22	330	116	336	0.77	0.71	0.55	0.29	325	0.31	0.60
IET 27524	464	134	2.42	0.57	0.12	249	330	299	0.37	0.29	0.11	0.71	207	0.43	0.14
IET 27525	377	256	1.09	1.34	0.19	310	121	316	0.71	0.68	0.48	0.32	305	0.28	0.51
Vandana	331	255	0.78	1.52	0.17	291	76	293	0.71	0.77	0.55	0.23	288	0.22	0.51
IET 27526	334	158	1.79	0.93	0.11	230	176	246	0.44	0.47	0.21	0.53	215	0.22	0.19
IET 27527	368	260	1.00	1.39	0.19	309	109	314	0.72	0.71	0.51	0.29	304	0.27	0.52
IET 27528	435	230	1.60	1.04	0.20	316	206	332	0.64	0.53	0.34	0.47	300	0.38	0.41
IET 27529	315	199	1.25	1.24	0.13	250	117	257	0.55	0.63	0.35	0.37	244	0.20	0.31
IET 27530	333	89	2.48	0.53	0.06	172	244	211	0.25	0.27	0.07	0.73	140	0.22	0.06
Tulasi	367	91	2.56	0.48	0.07	182	277	229	0.25	0.25	0.06	0.75	145	0.27	0.06
NDR-97	268	124	1.83	0.91	0.07	182	145	196	0.34	0.46	0.16	0.54	169	0.14	0.12
Govind	353	231	1.18	1.28	0.16	285	122	292	0.64	0.65	0.42	0.35	279	0.25	0.41
Samaleshwari	360	165	1.84	0.90	0.12	243	196	262	0.46	0.46	0.21	0.54	226	0.26	0.21
Varalu	282	144	1.66	1.00	0.08	202	138	213	0.40	0.51	0.20	0.49	191	0.16	0.16
Mean	**377**	**175**	**1.78**	**0.94**	**0.13**	**252**	**202**	**276**	**0.49**	**0.48**	**0.26**	**0.52**	**232**	**0.29**	**0.27**

6.3 Screening for high temperature tolerance in rice genotypes.

Locations: IIRR, MTU, PNR, PTB, MTU, CHN ,TTB and NRRI

The General Circulation Models (GCMs) of earth's atmosphere predicted that, when rapidly increasing CO_2 concentration ([CO_2]) in the atmosphere would double the concentration of the beginning of the last century, then the global mean temperature would increase as much as more than 4 °C. At present rice is mainly grown in areas where the current temperatures are more or less optimum for rice cultivation. An increase in temperatures due to climate change resulting in increased mean temperatures or short episodes of high temperature during critical growth stages will reduce grain yield. It was estimated that rice grain yield may be reduced by 41% by the end of 21st century. Thus, identifying and developing high temperature tolerant cultivars is essential to develop new tolerant varieties to meet the demand for food in future climates. The objectives of this work is to screen rice cultivars for high temperature tolerance and to understand the impact of high temperature stress on rice. The trial was conducted in 8 AICRIP centres with 27 entries from IVT-IME trial along with N-22(Tolerant Check), Vandana (Susceptible check) and Gontra Bidhan-3. Heat stress was imposed by enclosing the field grown crop with transparent polyethylene sheet supported by metal or bamboo frame. Enclosing the field crop during reproductive phase with polythene sheet had resulted in significant increase in temperature. The temperature inside the polythene tunnel was recorded until the crop was harvested.

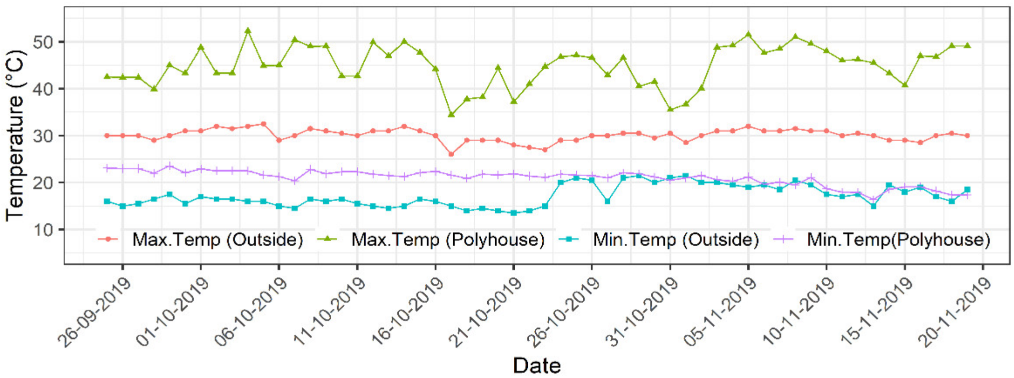


Fig. 6.3.1 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at IIRR Hyderabad during Kharif-2019.

The mean maximum temperature recorded during reproductive stage is > 12°C higher inside the polythene tunnel than ambient temperature recorded during the same period. Similarly, the mean minimum temperature was >2.5°C higher inside the polythene tunnel than ambient temperature at IIRR. The mean maximum temperature recorded during reproductive stage is

> 9.5°C higher inside the polythene tunnel than ambient temperature recorded during the same period. Similarly, the mean minimum temperature was >1.4°C higher inside the polythene tunnel than ambient temperature at PNR *(Fig.6.3.2)*. At PTB centre, mean maximum temperature recorded during reproductive period is >9°C higher inside polythene tunnel than ambient temperature recorded. Similarly, the mean minimum temperature is >1.6 higher inside the polythene tunnel (*Fig.6.3.3)*. At MTU centre mean maximum temperature recorded during reproductive phase of the crop is >4.1°C higher and mean minimum temperature is >2.0°C higher inside the polythene tunnel than the temperature recorded outside *(Fig.6.3.4)*. The temperature recorded during reproductive stage of the crop inside and outside the polythene tunnel show that the mean maximum temperature is >3.4°C higher and mean minimum temperature is <1.0°C higher inside the polythene tunnel in comparison with outside the polythene tunnel at TTB (*Fig.6.3.5)*

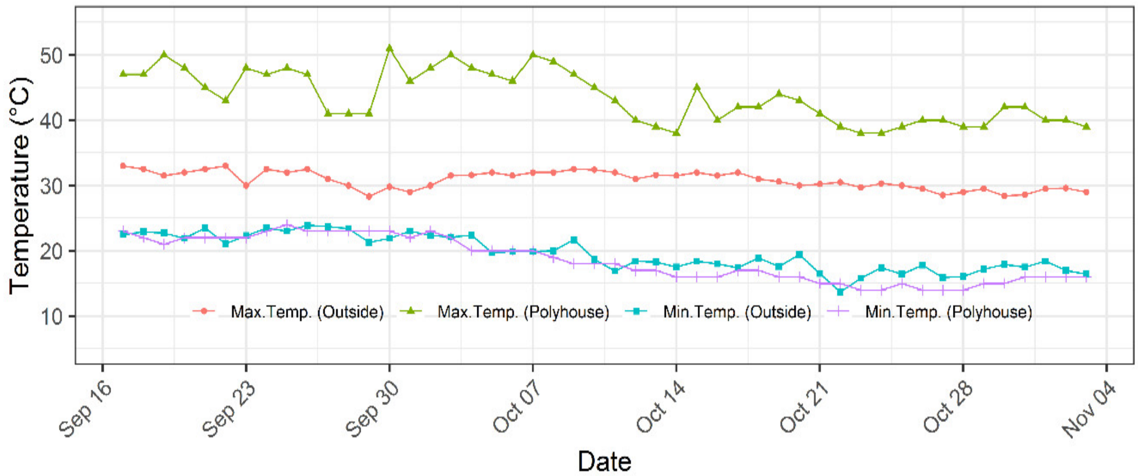


Fig. 6.3.2 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at PNR (G.B.P.A &T) during Kharif-2019.

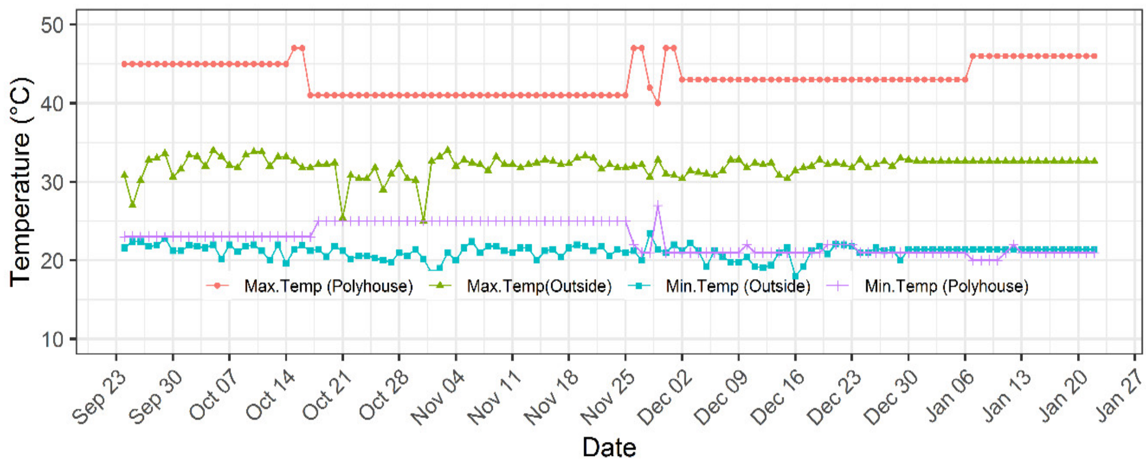


Fig. 6.3.3. Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at PTB centre during Kharif-2019.

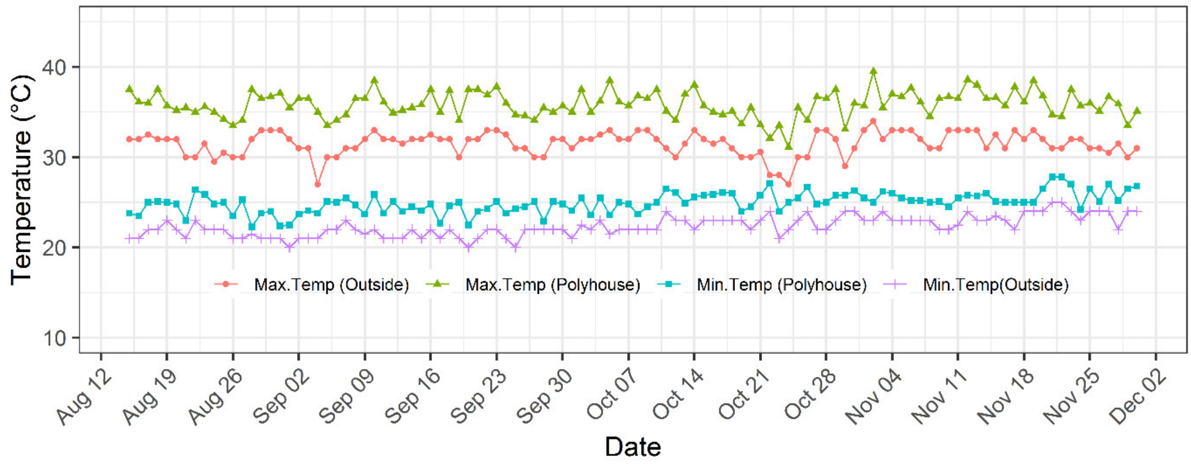


Fig. 6.3.4 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at MTU centre during Kharif-2019.

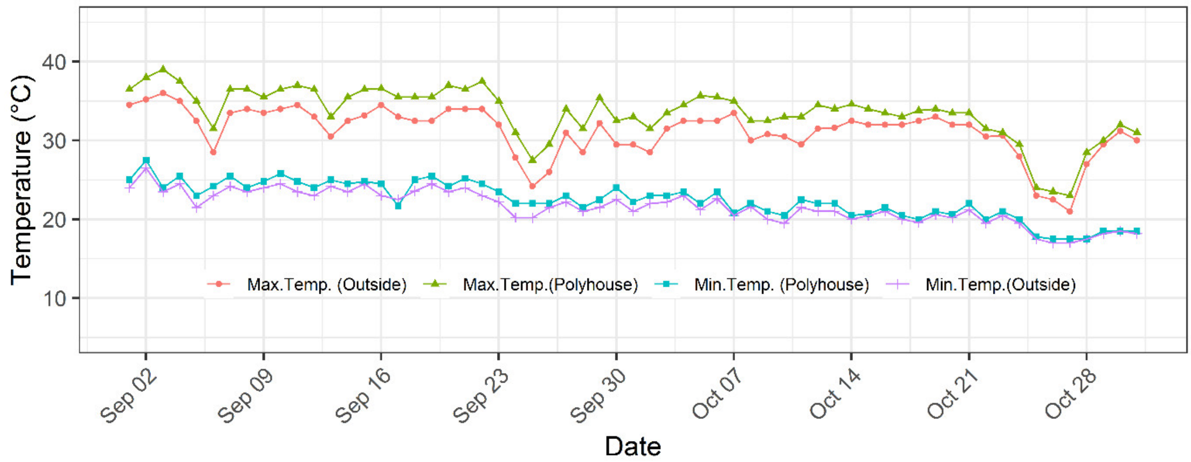


Fig. 6.3.5 Maximum and minimum temperatures recorded between PI and maturity stages of rice crop inside and outside (ambient) the polythene tunnel at TTB centre during Kharif-2019.

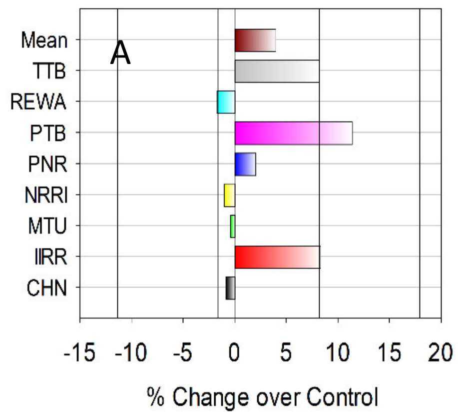
The crop was allowed to grow inside the enclosure from PI stage until harvest. The experiment was conducted in 2 factor RCBD design with treatments (Control and Heat stressed) as first factor and genotypes as 2nd factor treatment with 3 replications.

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

(Table 6.3.1). The three-way interaction between Treatment x Genotype x Location was also found to be non-significant.

The mean days for physiological maturity (mean of all genotypes and locations) was not significantly influenced by temperature regime. However, the interaction between Treatment x Location was found to be significant *($p<0.01$)* indicating that the influence of elevated temperature differs from location to location. It is pertinent to mention that the increase in temperature inside the polythene tunnel is not uniform across the locations. The differences in the mean days to maturity (mean of all locations & treatment) were found to be significant *($p<0.01$).* Non-significant interaction between Treatment x Genotype interaction indicated that the genotypes did not differed significantly under different temperature regimes (*Table 6.3.2).*

The mean Plant height (PH) was not significantly affected by elevated temperature *(Table 6.3.3).* However, the mean (mean of all locations and genotypes) PH was increased by <4% by high temperature treatment. However, the interaction between Treatment x Location was found to be significant *($p<0.01$).* High temperature exposure increased PH at PTB, IIRR and TTB where as PH was affected at the remaining centres (*Table 6.3.3).* The mean PH (mean of all locations and Treatments) for the genotypes was significantly influenced by high temperature. The mean PH recorded marginal increase for most of the tested entries.



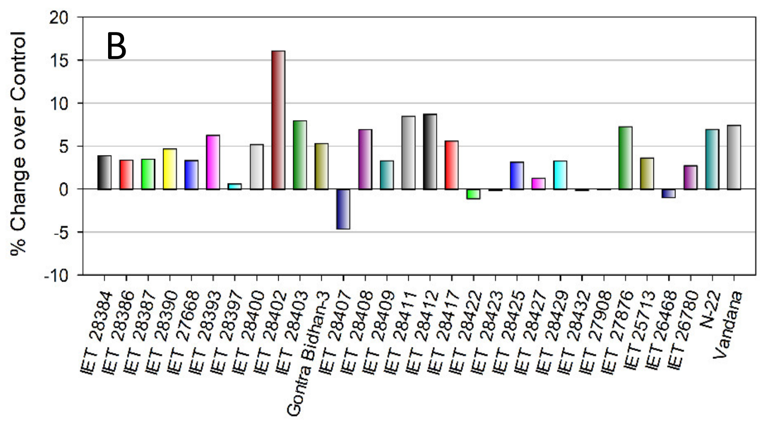


Fig. 6.3.6 Influence of high temperature on mean plant height (cm) recorded at maturity stage (A) Mean of all Genotypes (B) Mean of all locations. Each bar represents % change under high temperature treatment in Plant height in relation to ambient control treatment.(A) Mean of all genotypes (B) Mean of all locations.

However, the % change in PH was <5% in many genotypes *(Fig.6.3.6*). The increase in >15% over control in IET8402. The interaction between Location x Genotype was found to be significant implying that the genotypes differed differently at different AICRIP locations (Fig. *6.3.6A)*. The interaction Treatment x Genotype was non-significant. Similarly the three-way interaction between Treatment x Genotype x Location was also non-significant.

Leaf Area Index (LAI) was measured at flowering stage. The mean LAI (mean of all locations and genotypes) was not significantly affected by high temperature (AC42088 show maximum survival percentage (98%) followed by Sabita (61%) Swarna Sub-1 (61%) andIC516009 (<58%). As many as 7 genotypes did not survived the submergence treatment However, the interaction between Treatment x Location was significant *($p<0.01$*) indicating that the treatment effect was not uniform across the locations. This is due to the fact that the increase in temperature in the polythene tunnel (heat treatment) is not uniform across locations. The differences between the mean LAI amongst the tested entries was also non-significant. Nevertheless, the interaction between Location x Genotype was found to be significant *($p<0.01$)* indicating that the tested entries recorded differences across the locations. All the remaining interactions were non-significant (*Table 6.3.4).*

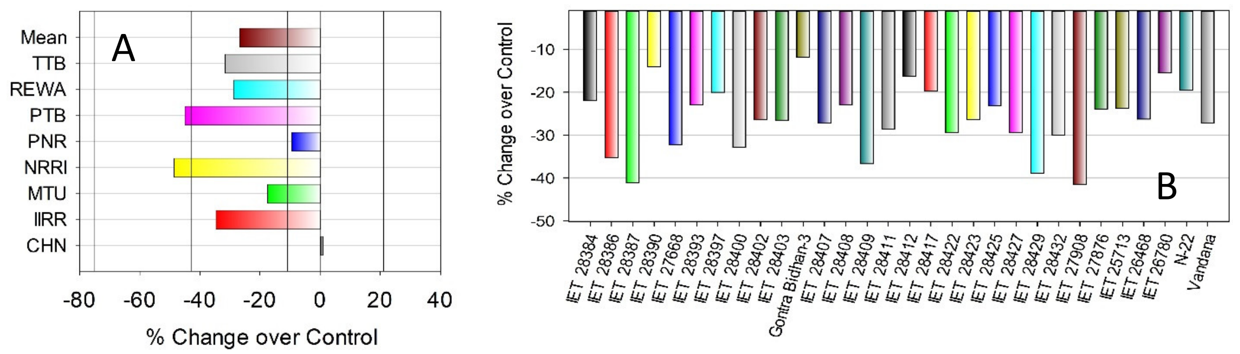


Fig.6.3.7 : Influence of high temperature on number of grains per panicle in different rice genotypes during Kharif-2019 season. Each bar represents % change in No.of grains under high temperature in comparison with ambient control temperature. (A) Mean of all genotypes (B) Mean of all Locations

Total number of grains per panicle is one of the most important trait which was affected by the high temperature conditions during reproductive growth of rice crop resulting in significant yield loss. In the present study, the mean grain number was reduced by >26% under high temperature condition (*Table 6.3.12 & Fig,6.3.7A).* Significant differences were observed between the locations. Maximum reduction was observed at NRRI followed by PTB and at PNR and CHN centres the reduction is negligible. Similarly, significant differences were observed amongst the genotypes in their response to exposure to high temperature. Maximum reduction was observed in IET 28387 followed by IET 27908. The entries IET28429, IET28400 and IET28407 recorded more reduction in grain number than the susceptible check Vandana (Fig.9B). The entries Gontra Bidhan-3, IET 28390 and IET26780 performed better than the tolerant check N22 in terms of reduction in number of grains per panicle (*Table 6.3.12*).

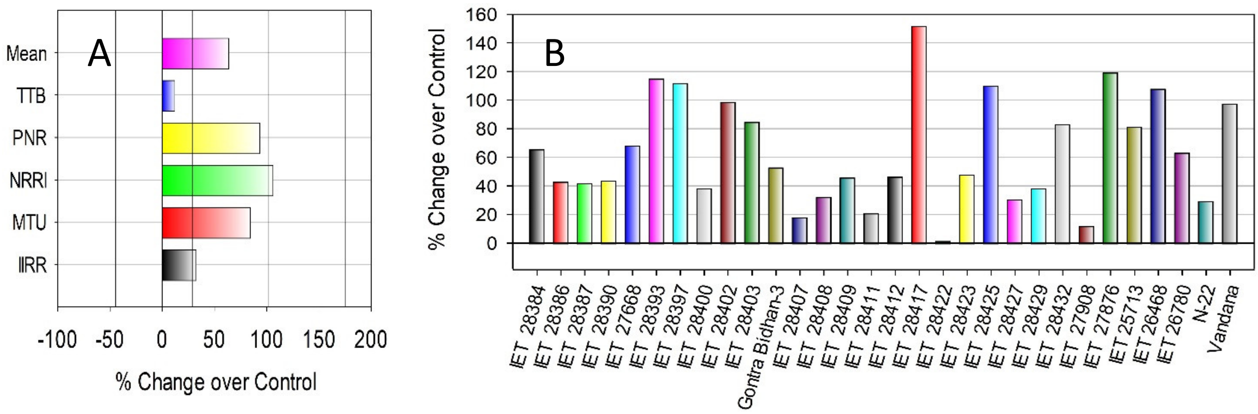


Fig.6.3.8: Influence of high temperature on number of unfilled grains per panicle in different rice genotypes during Kharif-2019 season. Each bar represents % change in No.of un-filled grains under high temperature in comparison with ambient control temperature. (A) Mean of all genotypes (B) Mean of all locations

Exposure to the high temperature during reproductive stage, especially grain filling stage significantly influenced the number of un-filled grains per panicle. The mean (average of all locations and genotypes) number of un-filled grains increased by 63% under high temperature stress in comparison with ambient control conditions (*Fig 6.3.8).* In entries IET28407, IET28422, 28411 and IET27908 the increase in un-filled grains per panicle is less than the tolerant check variety N-22. Similarly, IET28417 and IET 28393 recorded more number of un-filled grains per panicle than the susceptible check Vandana *(Fig.6.3.8).* Similarly, significant differences were observed between locations. Maximum increase in number of un-filled grains was observed at NRRI, Cuttack followed by PNR and MTU. Minimum increase was observed in case of TTB.

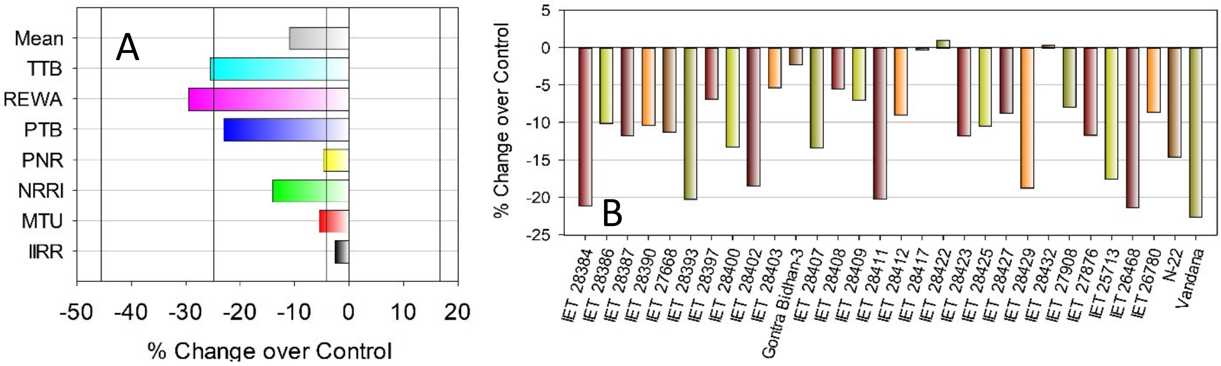


Fig.6.3.9: Influence of high temperature on number of Number of panicle/m^2 in different rice genotypes during Kharif-2019 season. Each bar represents % change in No.of of panicle/m^2 under high temperature in comparison with ambient control temperature. (A) Mean of all genotypes (B) Mean of all locations

The mean number of of panicle/m^2 was another important yield attribute which show marginal non-significant reduction (>10% in comparison with control) under high temperature stress. The interaction between Treatment x Location was found to be significant implying that the effect of elevated tempeature is not uniform across the locations. Maximum reduction in the mean number of of panicle/m^2 was observed at REWA followed by TTB and PTB. The reduction was very low in case of PNR, IIRR and MTU. Significant ($p<0.01$) differences were observed between the tested entries. Maximum reduction was observed in Vandana, IET 28384 and IET 26468. The reduction was significantly lower in Gotra Bidhan-3, IET28432, IET28417 and IET28422. Many entries recorded less reduction in number of panicles per sq.m than the tolerant check N-22 (*Fig.6.3.9*).

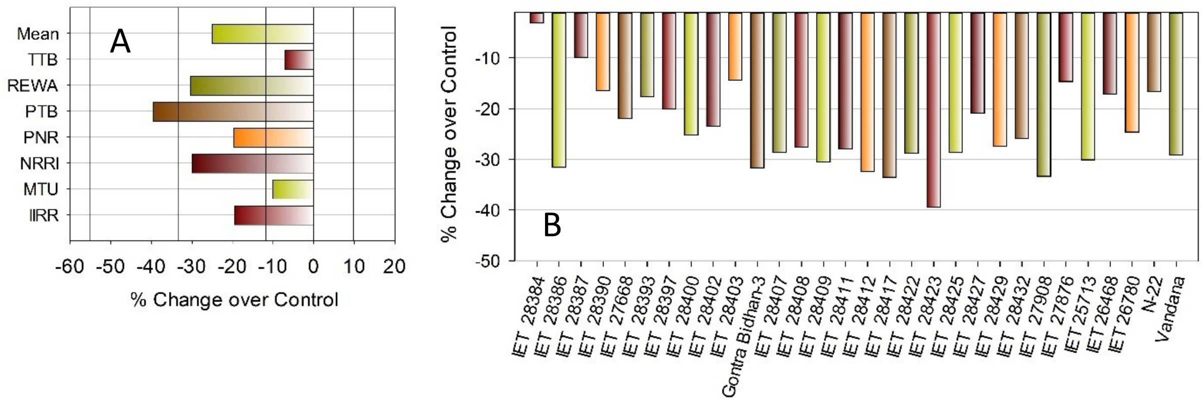


Fig 6.3.10: Influence of high temperature on TDM in different rice genotypes during Kharif-2019 season. Each bar represents % change in TDM under high temperature in comparison with ambient control temperature. (A) Mean of all genotypes (B) Mean of all locations

The above ground biomass (TDM g/m^2) was recorded after harvest. The mean TDM was reduced by >24% under high temperature in comparison with ambient temperature

(Table 6.3.16). The interaction between Treatment x Location was significant indicating that the effect of treatment differed from location to location. Maximum reduction in mean (average of all genotypes) was observed at PTB followed by REWA and NRRI. The reduction in TDM was lower than the mean of all locations in MTU and TTB. Significant ($p<0.01$) differences were observed amongst the tested entries. The reduction in TDM is lower in IET28384 and IET28387 which is lower than the tolerant check N-22. The entries IET28423 and IET28908 showed higher reduction in TDM than the susceptible check Vandana.

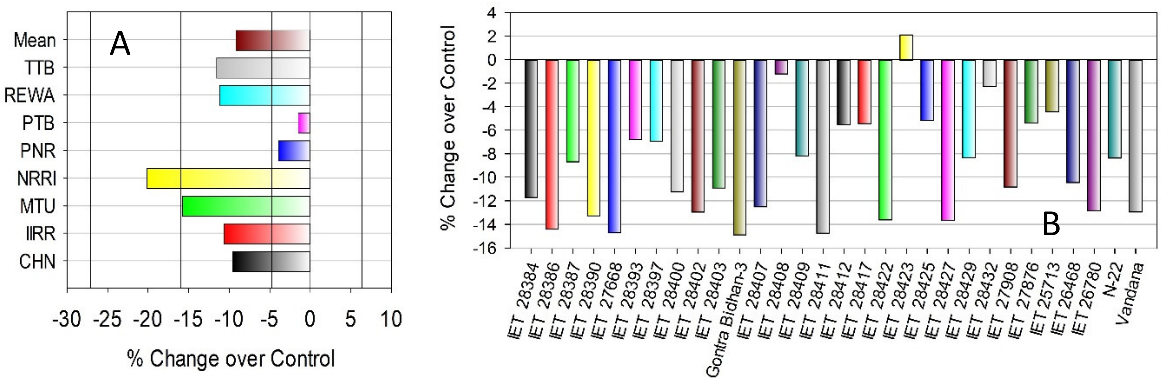


Fig.6.3.11 : Influence of high temperature on 1000 grain weight (g)in different rice genotypes during Kharif-2019 season. Each bar represents % change in 1000 grain weight under high temperature in comparison with ambient control temperature (A) Mean of all genotypes (B) Mean of all locations

Exposure to high temperature during reproductive stage of rice crop resulted in significant ($p<0.01$) reduction in 1000 grain weight (*Table 6.3.18).* The mean 1000 grain weight was reduced by <9.0% under high tempeatue stress in comparison with control treatment. The interaction between Treatment x Location was found to be significant ($p<0.01$). Maximum reduction in test weight was obsered at NRRI followed by MTU and TTB. The reduction is <5% over control at PTB and PNR centres (Fig. 11). Significant differences were observed amongst the tested entries in their response to exposure to high temperature. In entries IET28408, IET28412, IET 28417, IET28432, IET28422, IET28425, IET28423, IET27876, and IET 26413 the reduction in 1000 grain weight was less than the tolerant check N-22. All other entiries show significant reduction in test weight which is either at par or higher than the susceptible check Vandana *(Fig. 6.3.11)*

Exposure to high temperatue during reprodutive stage of rice crop significantly ($p<0.05$) influenced the grain yield *(Table 6.3.17).* High temperatue stress resulted in >35% reduction in grain yield in comparison with the control treatment. Significant ($p<0.01$)

Treatment x Location interaction was observed indicating that the treatment effect is not uniform across the locations (*Table6.3.17)*. The reduction in grain yield due to exposure to high temperature was maximum at NRRI followed by REWA and PTB. The reduction of minimum in MTU followed by CHN centre (Fig.6.3.12A).

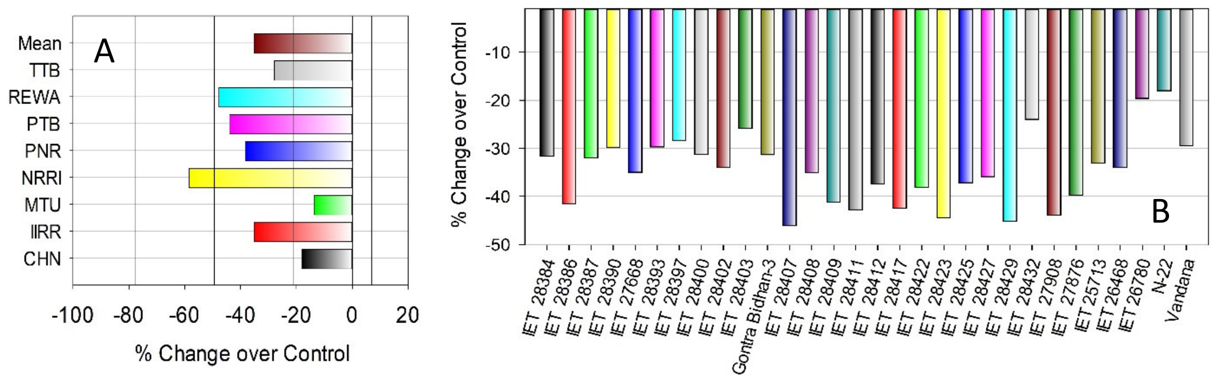


Fig.6.3.12: Influence of high temperature on Grain Yield (g/m^2) in different rice genotypes during Kharif-2019 season. Each bar represents % change in 1000 grain weight under high temperature in comparison with ambient control temperature. (A) Mean of all genotypes (B) Mean of all lcoations

Significant differences were observed amongst the genotypes for mean grain yield *(Fig. 6.3.12)*. The results show all the tested genotypes suffered substantial yield loss under high temperature condition. None of the tested entries performed better than the tolerant check N-22 (>17% reduction over control) in terms of grain yield. Only IET26780 with 19.5% reduction and IET28403 (>25% reduction over control) showed any tolerance to high temperature. These entries may be considered as moderately tolerant. All the remaining entries showed substantial yield reduction under high temperature condition. The reduction is higher than the susceptible check Vandana (>29% reduction in yield in relation to control treatment).

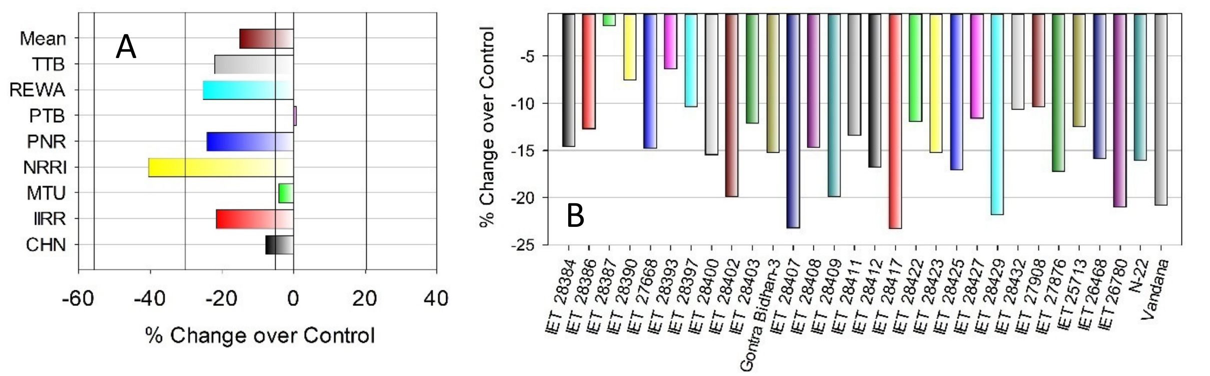


Fig.6.3.13: Influence of high temperature on Harvest Index (%) in different rice genotypes during Kharif-2019 season. Each bar represents % change harvest index under high temperature in comparison with ambient control temperature (A) Mean of all genotypes (B) Mean of all locations

Exposure to high temperature during reproductive growth period significantly (14% reduction in comparison with control) reduced the harvest index (HI). The reduction in HI is not uniform across the locations as indicated by significant ($p<0.01$) interaction between Treatment x Location (*Fig.6.3.13 & Table 6.3. 19*). HI was not affected by high temperature stress at PTB centre and at CHN and MTU the reduction in HI over control was <6%. Maximum reduction was observed at NRRI centre *(Fig 6.3.13A).* Significant differences were observed in mean HI amongst the genotypes. All the tested entries recorded significant reduction in HI. In most entries the reduction is <17% including tolerant check N-22. The Mean HI was not affected by high temperature in IET 28387, IET 28393 and IET 28397 in which the reduction in HI is <10% over control which is less than the reduction suffered by N-22 (Table).

In order to identify genotypes tolerant to high temperature, different indices were computed based on the grain yield recorded under ambient (control) and high temperature conditions. Different heat indices including Heat susceptibility index (HSI), Relative Heat index (RHI), Heat tolerance index (HTI), Geometric mean productivity (GMP), Tolerance (TOL), Mean production (MP), Yield index (YI), Heat resistance index (HI), Yield stability index (YSI), Modified stress tolerance index (KiSTI), were calculated following the equations published (Fischer and Maurer, 1978; Fischer et al., 1998; Fernandez, 1992; Rosielle and Hamblin, 1981; Bouslama and Schapaugh, 1984; Blum, 1988; Moosavi et al., 2008; Farshadfar and Sutka, 2002). The results are presented in Table (6.3.20) . Significant Variation was observed amongst the genotypes for most of the indices. The genotypes were ranked for each index and rank-sum and mean rank for each genotype was calculated. The genotype with high mean rank and low SEm± was considered as heat tolerant genotype. Based on the mean rank IET28387, IET28390, IET28393, IET28397, IET28403, Gontra bidhan-3 and IET28432 performed better than the tolerant check N-22. These entries may be considered as relatively heat tolerant.

To determine the most desirable heat stress tolerant criteria, the correlation coefficients between Ys, and other quantitative indices of heat tolerance were calculated. The correlation analysis between grain yield and heat tolerance indices can be a good criterion for screening the best cultivars and indices used. A suitable index must have a significant association with yield recorded under stress condition {*Table 6.3.21*} presents the results of correlation analysis which indicate that the indices like GMP(Geometric Mean

Production),HM (Hormonic Mean), K2STI (Modified Stress Tolerance Index), Yield index (YI) showed highly significant positive association with grain yield recorded under stress condition. These indices are useful in selecting suitable genotypes for heat tolerance. When the analysis was done with data collected from IIRR the relationships between tolerance indices and grain yield recorded under stress show stronger relationships (*Fig.6.3.14).*

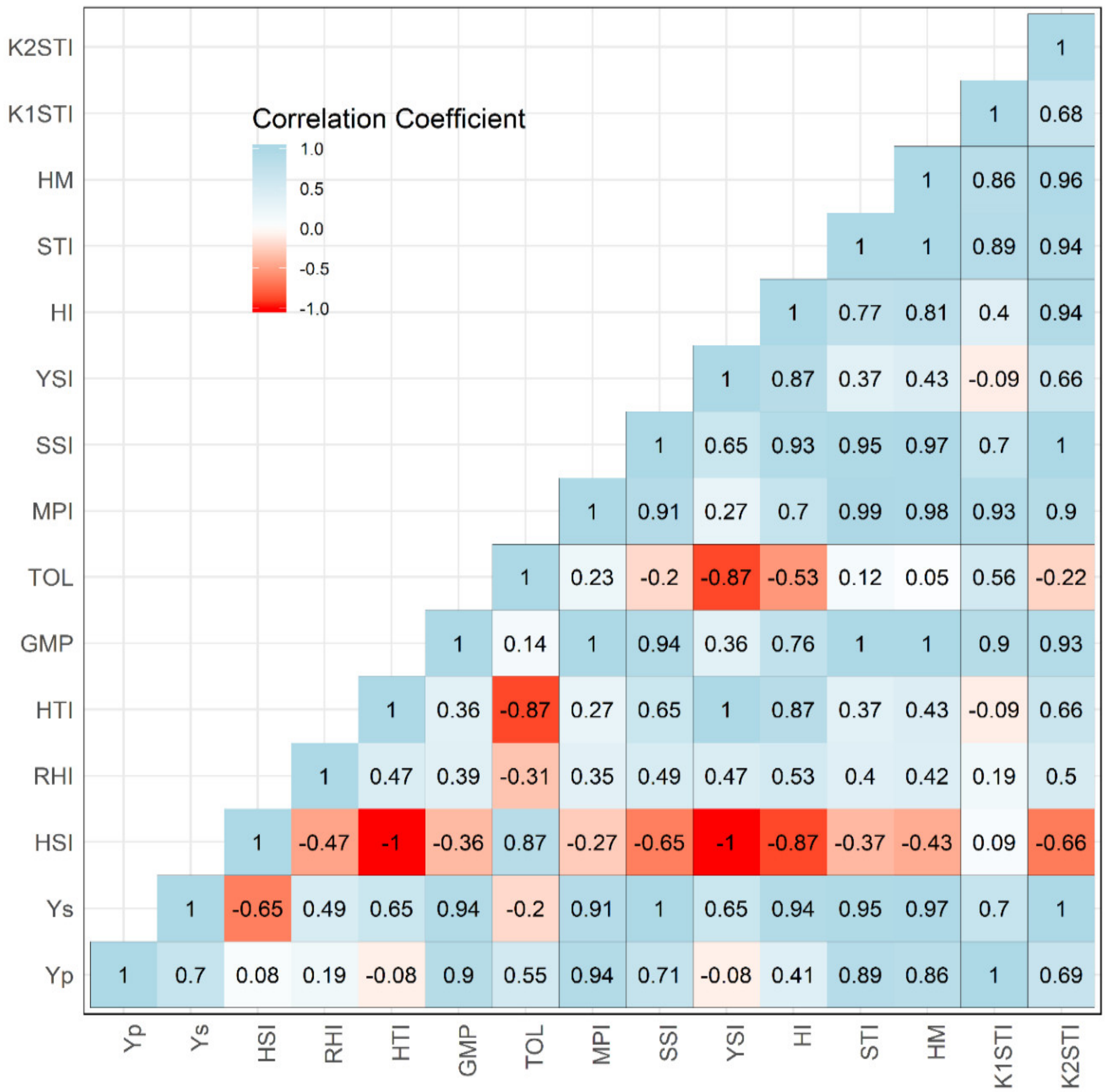


Fig. 6.3.14 Relation between yield under stress (Ys) and other heat tolerance indices. Mean yield recorded at different locations was used to compute the indices.

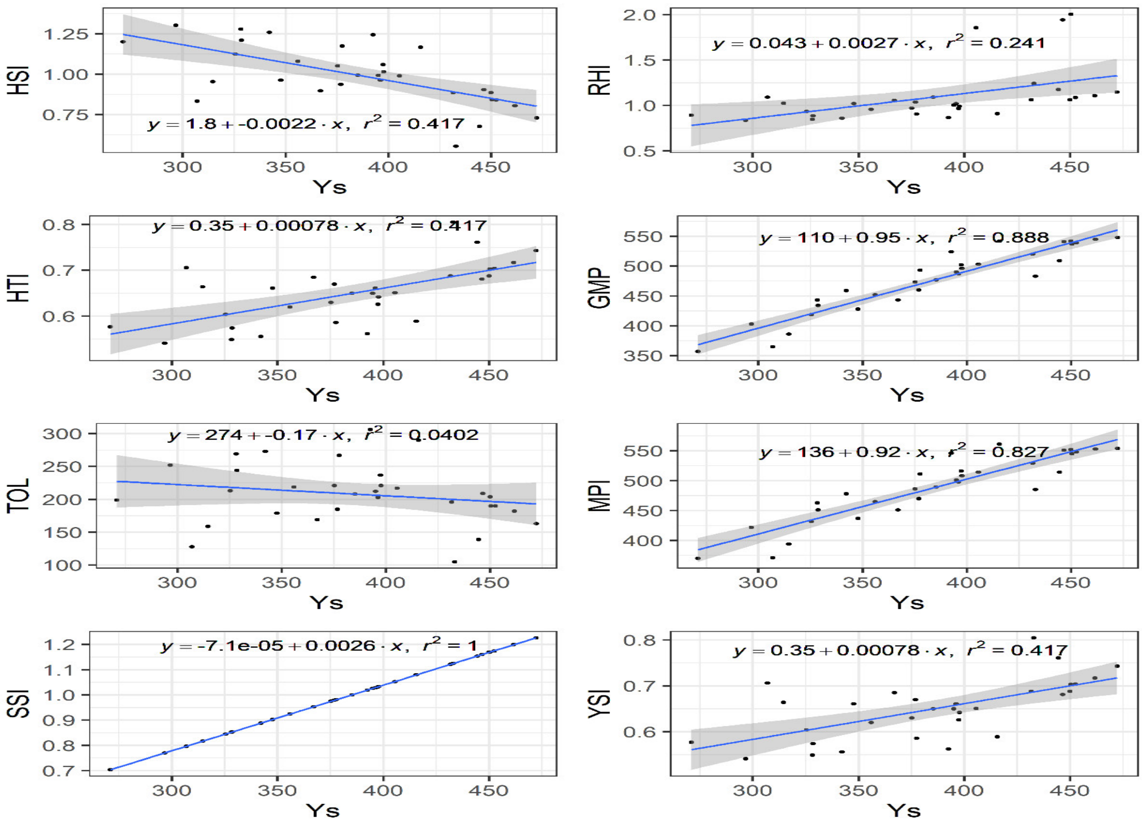


Fig.6.3.15 Relationship between heat tolerance indices and yield recorded under heat stress condition (Ys). Average yield recorded under both control and heat stress treatments at different locations was used to compute various heat tolerance indices.

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

In order to simultaneously select genotypes with higher yield and stability of performance across locations under elevated temperature conditions, a parametric model for simultaneous selection in yield and stability "shukla's stability variance and kang's" statistic was performed and the results were presented in (Table). Based on the YS_i values genotypes can be selected as they produced relatively higher yield under heat stress condition and also they show non-significant stability variance (σ_i^2). These genotypes have a higher yield and a lower variation. According to the ANOVA, the interaction is significant.

Based on stability variance and stability rating IET 28386, 28387,28390, 27668, 28393, 28397, 28400, 28403, Gontra bidhan-3, IET28408, 28409, 28511, 28422, 28425, 27908 and IET25713 performed well and are selected as genotypes with high yield and stability.

Summary & Conclusions

Covering the field grown crop with polythene supported by metal frame immediately after PI stage had resulted in an increase in temperature inside the tunnel. The increase in temperature is <4.0 C at most of the centres with an exception at IIRR, PTB and PNR where the temperature difference is >8.0 C. The results show all the tested genotypes suffered substantial yield loss under high temperature condition. None of the tested entries performed better than the tolerant check N-22 (>17% reduction over control) in terms of grain yield. Only IET26780 with 19.5% reduction and IET28403 (>25% reduction over control) showed any tolerance to high temperature. These entries may be considered as moderately tolerant. The grain yield recorded under elevated temperature showed strong association with GMP, YI, MP, K2STI and HIS and these indices are useful in screening for high temperature tolerance. The genotypes were ranked for each index and rank-sum and mean rank for each genotype was calculated. The genotype with high mean rank and low SEm± was considered as heat tolerant genotype. Based on the mean rank IET28387, IET28390, IET28393, IET28397, IET28403, Gontra bidhan-3 and IET28432 performed better than the tolerant check N-22. These entries may be considered as relatively heat tolerant. Stability analysis was performed to identify genotypes which produced high yield and high stability. Based on stability variance and stability rating IET 28386, 28387,28390, 27668, 28393, 28397, 28400, 28403, Gontra bidhan-3, IET28408, 28409, 28511, 28422, 28425, 27908 and IET25713 performed well and are selected as genotypes with high yield . However, in IET 28407 and IET27876 show non-significant stability variance (σ_i^2) .

Simultaneous selection for yield and stability under high temperature regimes

Genotypes	*Mean yield*	*Yield Rank (Y^n)*	*Adjusted[$] Y^n*	*Adjusted Y*	*Stability variance (σ_i^2)*	*Stability Rating (S)*	*Ys_i = (Y + S)*	…
IET 28384	407.1	13	-1	12	14611	-4	8	
IET 28386	457.2	24	2	26	28394	-8	18	+
IET 28387	510.5	30	3	33	46669	-8	25	+
IET 28390	494.5	29	3	32	62463	-8	24	+
IET 27668	447.1	21	1	22	46002	-8	14	+
IET 28393	485.9	26	2	28	62979	-8	20	+
IET 28397	490.9	28	2	30	26989	-8	22	+
IET 28400	455.3	23	2	25	40495	-8	17	+
IET 28402	400.3	11	-1	10	26118	-8	2	
IET 28403	489.1	27	2	29	27592	-8	21	+
Gontra Bidhan-3	443.5	20	1	21	56922	-8	13	+
IET 28407	327.4	4	-3	1	13555	-2	-1	
IET 28408	417.9	15	1	16	14514	-4	12	+
IET 28409	477.5	25	2	27	50650	-8	19	+
IET 28411	419.4	16	1	17	85322	-8	9	+
IET 28412	399.8	10	-1	9	28775	-8	1	
IET 28417	312.2	2	-3	-1	22921	-8	-9	
IET 28422	442.5	18	1	19	75046	-8	11	+
IET 28423	361.7	7	-2	5	28344	-8	-3	
IET 28425	447.8	22	1	23	63314	-8	15	+
IET 28427	415.5	14	1	15	20691	-8	7	
IET 28429	340.3	5	-2	3	37442	-8	-5	
IET 28432	400.3	12	-1	11	20794	-8	3	
IET 27908	424.8	17	1	18	88886	-8	10	+
IET 27876	363.4	8	-2	6	6562	0	6	
IET 25713	442.6	19	1	20	46461	-8	12	+
IET 26468	354.6	6	-2	4	24261	-8	-4	
IET 26780	378.8	9	-1	8	58244	-8	0	
N-22	319.5	3	-3	0	12403	-2	-2	
Vandana	275	1	-3	-2	62852	-8	-10	
Yield Mean	**413.4**							
YS Mean	8.5							
LSD (p<0.05)	39.2							
+ Selected Genotypes								

Table 6.3.1 Influence of Heat Stress on Days to flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control								Grand Mean	Treated								Grand Mean
		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	100	116	91	101	88	77	95	108	97	99	114	88	100	90	76	96	106	96
2	IET 28386	101	116	91	102	88	73	96	99	96	100	114	89	102	88	69	96	98	95
3	IET 28387	103	119	91	103	86	82	99	107	99	102	117	89	107	91	82	98	106	99
4	IET 28390	100	116	89	100	87	83	94	93	95	100	113	91	100	89	78	96	91	95
5	IET 27668	99	116	86	101	86	73	93	98	94	100	114	86	101	91	65	95	97	93
6	IET 28393	99	115	87	102	85	67	107	108	96	99	113	87	105	91	62	108	106	96
7	IET 28397	102	123	87	102	88	64	104	103	97	103	121	86	100	93	59	104	102	96
8	IET 28400	101	116	84	97	80	70	104	93	93	101	114	81	105	91	64	104	91	94
9	IET 28402	100	109	85	101	89	73	108	98	95	99	106	81	102	89	65	107	97	93
10	IET 28403	99	115	86	104	87	77	110	97	97	99	113	83	100	86	77	110	97	96
11	Gontra Bidhan-3	100	108	82	100	86	77	99	99	94	101	107	82	100	90	73	100	97	94
12	IET 28407	103	119	93	100	88	83	102	115	100	102	116	91	113	88	80	99	113	100
13	IET 28408	103	115	84	105	88	82	102	110	99	102	113	83	109	91	77	101	108	98
14	IET 28409	102	119	92	107	88	67	103	112	99	104	116	88	107	91	63	103	110	98
15	IET 28411	99	119	94	106	91	69	99	103	97	99	117	91	109	94	63	100	102	97
16	IET 28412	97	116	88	102	88	67	95	98	94	99	114	85	102	91	59	97	97	93
17	IET 28417	95	106	80	96	88	73	93	97	91	96	104	79	102	84	69	96	97	91
18	IET 28422	102	123	92	105	94	77	106	111	101	103	121	89	107	86	77	106	110	100
19	IET 28423	103	116	86	107	85	95	103	114	101	103	114	91	107	90	67	105	113	99
20	IET 28425	100	119	91	102	81	73	102	100	96	99	117	91	107	89	69	103	98	97
21	IET 28427	103	116	91	105	88	70	103	99	97	103	114	92	107	89	63	103	97	96
22	IET 28429	103	115	88	105	84	83	104	104	98	103	113	86	109	92	77	104	102	98
23	IET 28432	98	116	89	107	94	63	96	91	94	97	114	82	101	90	59	96	89	91
24	IET 27908	105	123	84	105	85	73	100	114	99	101	120	84	107	94	76	97	113	99
25	IET 27876	94	108	84	99	86	69	94	94	91	94	107	81	100	90	68	95	91	91
26	IET 25713	102	109	84	100	89	77	94	92	94	102	107	81	100	92	76	96	91	93
27	IET 26468	103	109	88	100	89	77	93	93	94	104	107	86	103	90	76	94	91	94
28	IET 26780	101	110	87	100	86	77	96	92	94	101	108	82	101	90	77	96	91	93
29	N-22	91	106	81	106	90	65	79	91	89	91	104	80	108	91	59	79	89	88
30	Vandana	82	106	78	96	89	61	78	101	86	72	104	76	102	92	59	78	100	85
	Mean	**100**	**115**	**87**	**102**	**87**	**74**	**98**	**101**	**96**	**99**	**113**	**85**	**104**	**90**	**69**	**99**	**100**	**95**
	LSD (Treatment)				NS						LSD (Treatment x Genotype)					ns			
	LSD (Location x Treatment)				0.81**						LSD (Location x Treatment x Genotype)					ns			
	LSD (Genotype)				1.11**						CV (%)					2			
	LSD (Location x Genotype)				3.15**														

Table 6.3.2 Influence of Heat Stress on Days to Maturity in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control								Grand	Treated								Grand
		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	Mean	CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	Mean
1	IET 28384	131	149	120	138	119	120	117	137	129	129	146	117	133	118	113	121	135	127
2	IET 28386	130	150	120	139	120	120	117	131	128	130	147	119	135	117	113	118	129	126
3	IET 28387	133	152	120	140	117	120	115	137	129	133	149	117	140	119	119	117	135	129
4	IET 28390	130	148	118	137	118	120	117	126	127	130	146	121	133	116	113	122	122	126
5	IET 27668	130	148	116	138	117	120	116	127	127	130	146	115	134	117	113	117	125	125
6	IET 28393	129	147	117	139	115	120	123	138	129	130	145	117	138	116	113	125	135	127
7	IET 28397	133	153	116	139	120	120	117	135	129	133	153	115	133	118	113	124	132	128
8	IET 28400	132	149	114	134	108	120	122	123	125	131	146	113	138	115	113	126	121	125
9	IET 28402	131	137	115	138	120	120	125	127	127	129	139	110	135	117	113	128	124	124
10	IET 28403	130	148	116	141	118	120	125	129	128	129	142	111	133	114	119	126	127	125
11	Gontra Bidhan-3	131	138	111	137	115	120	118	129	125	131	139	111	133	116	113	122	126	124
12	IET 28407	133	151	122	137	110	120	123	145	130	133	148	120	146	116	119	124	142	131
13	IET 28408	133	147	113	142	118	120	123	140	129	132	146	112	142	118	119	125	137	129
14	IET 28409	134	151	121	144	119	120	123	142	132	134	148	118	140	119	113	125	140	130
15	IET 28411	130	150	123	143	122	120	119	132	130	129	149	121	142	122	113	119	130	128
16	IET 28412	127	148	117	139	119	120	117	127	127	129	147	115	135	119	113	121	125	126
17	IET 28417	125	135	109	133	115	120	117	126	123	127	137	116	135	108	113	124	125	123
18	IET 28422	133	153	122	142	117	120	124	141	131	132	154	119	140	114	119	128	138	130
19	IET 28423	132	116	115	144	115	120	118	143	126	133	147	121	140	118	113	122	140	129
20	IET 28425	131	119	120	139	109	120	123	129	124	130	149	121	140	113	113	124	126	127
21	IET 28427	133	149	120	142	119	120	118	128	129	133	147	121	140	117	113	122	125	127
22	IET 28429	133	146	117	142	114	120	123	136	129	132	145	113	142	118	119	125	132	128
23	IET 28432	129	147	118	144	124	120	118	121	128	127	146	112	134	117	119	118	118	124
24	IET 27908	132	153	114	142	114	120	115	146	130	132	152	114	140	118	119	116	142	129
25	IET 27876	125	137	113	136	115	120	117	126	124	124	139	110	133	116	119	120	123	123
26	IET 25713	133	137	114	137	120	120	116	124	125	132	139	110	133	116	113	119	120	123
27	IET 26468	134	138	117	137	120	120	115	123	125	134	139	115	136	114	113	117	119	123
28	IET 26780	132	137	117	137	117	120	117	124	125	132	140	112	134	117	119	121	121	125
29	N-22	122	135	111	143	121	120	113	122	123	122	136	110	141	118	119	115	117	122
30	Vandana	112	135	107	133	120	120	113	131	121	101	136	105	135	118	119	116	127	120
	Mean	**130**	**143**	**117**	**139**	**117**	**120**	**119**	**132**	**127**	**130**	**145**	**115**	**137**	**117**	**115**	**122**	**129**	**126**
	LSD (Treatment)					NS					LSD (Treatment x Genotype)						ns		
	LSD (Location x Treatment)					0.85**					LSD (Location x Treatment x Genotype)						ns		
	LSD (Genotype)					1.17**					CV (%)						1.75		
	LSD (Location x Genotype)					3.30**													

Table 6.3.3 Influence of Heat Stress on plant height (cm) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control								Grand Mean	Treated								Grand Mean
		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	111.3	117.2	159.7	108.3	116.3	87.3	126.0	117.2	117.9	109.7	131.2	168.7	111.3	125.3	96.7	122.0	115.7	122.6
2	IET 28386	102.7	100.3	144.0	104.8	113.0	96.0	131.7	91.7	110.5	102.7	105.2	141.7	109.8	111.0	120.0	130.3	93.7	114.3
3	IET 28387	103.3	96.5	130.0	107.2	98.7	85.0	116.3	105.0	105.3	100.7	105.2	127.7	116.4	112.7	91.7	110.3	107.3	109.0
4	IET 28390	108.7	121.0	142.7	118.9	113.7	76.7	126.3	111.3	114.9	106.7	124.8	159.3	117.4	108.7	105.0	124.0	116.7	120.3
5	IET 27668	103.0	103.0	158.0	101.8	104.7	95.3	124.7	103.7	111.8	102.7	109.2	153.3	99.6	122.7	108.0	123.3	105.3	115.5
6	IET 28393	104.0	99.5	150.0	111.1	85.7	93.3	113.0	95.2	106.5	103.0	101.7	152.7	112.0	82.0	121.7	111.0	121.3	113.2
7	IET 28397	110.7	121.7	148.3	119.5	136.8	84.3	106.0	109.3	117.1	105.0	127.8	150.0	110.7	112.3	110.0	103.7	123.0	117.8
8	IET 28400	103.7	97.8	155.3	102.5	116.7	75.0	121.0	100.5	109.1	102.3	107.3	138.7	112.2	109.3	115.0	120.3	112.7	114.7
9	IET 28402	89.0	95.0	137.5	82.9	91.6	45.7	126.0	87.2	94.4	85.7	97.7	151.3	91.7	126.0	94.3	124.7	105.3	109.6
10	IET 28403	97.0	98.5	144.3	105.0	104.3	64.3	119.3	86.5	102.4	95.3	104.2	147.7	109.6	105.7	103.0	115.3	104.0	110.6
11	Gontra Bidhan-3	92.3	99.2	151.5	95.7	104.7	83.3	124.0	96.2	105.9	94.0	109.2	142.3	95.0	116.3	115.7	122.3	97.2	111.5
12	IET 28407	95.8	99.5	135.0	97.0	103.0	94.3	116.0	93.3	104.2	84.3	105.2	124.3	88.6	95.7	98.3	112.7	86.3	99.4
13	IET 28408	96.0	90.3	132.3	106.9	85.3	71.3	107.3	85.2	96.8	95.3	105.0	129.0	101.9	81.7	113.3	106.0	96.3	103.6
14	IET 28409	103.3	101.7	172.0	127.2	101.7	82.0	111.0	110.7	113.7	103.0	115.5	172.3	125.5	96.7	110.3	107.0	109.7	117.5
15	IET 28411	96.3	102.5	144.0	122.1	100.7	42.0	124.3	104.3	104.5	100.3	107.0	154.3	104.6	102.0	111.7	122.7	105.0	113.4
16	IET 28412	93.0	93.5	122.7	103.7	88.2	64.7	101.7	91.0	94.8	95.0	99.5	120.3	111.8	99.3	95.7	102.0	101.0	103.1
17	IET 28417	95.7	88.5	139.3	98.3	97.7	75.3	104.7	79.2	97.3	98.7	100.2	132.7	97.0	112.0	79.0	103.7	99.3	102.8
18	IET 28422	92.7	101.3	125.3	104.8	118.0	106.7	117.3	101.3	108.4	95.7	103.0	133.7	96.7	108.3	103.5	114.7	102.3	107.2
19	IET 28423	104.0	101.3	156.5	106.2	97.7	84.0	105.7	101.5	107.1	102.0	110.0	120.0	94.1	105.3	112.0	104.3	108.0	107.0
20	IET 28425	103.0	106.8	144.7	114.9	116.0	95.7	117.7	102.7	112.7	104.0	114.7	152.0	108.4	113.0	111.0	119.0	108.0	116.3
21	IET 28427	101.0	100.0	136.0	106.0	107.3	93.3	115.3	97.2	107.0	100.7	116.2	129.0	108.9	97.7	93.3	112.7	109.0	108.4
22	IET 28429	101.0	102.3	123.3	115.8	102.3	90.7	108.7	110.7	106.9	102.3	130.5	128.7	111.1	107.7	81.7	108.3	112.7	110.4
23	IET 28432	116.7	102.7	138.0	118.1	136.7	95.0	107.3	126.8	117.7	111.7	110.3	145.3	129.8	108.7	113.3	104.3	116.3	117.5
24	IET 27908	108.7	111.5	161.0	119.9	135.5	80.0	104.0	109.7	116.3	103.0	112.8	150.0	119.9	102.7	116.7	98.7	127.0	116.3
25	IET 27876	98.0	93.5	131.0	96.3	93.7	75.3	105.3	90.7	98.0	99.7	96.5	155.3	90.2	97.3	90.0	103.7	108.3	105.1
26	IET 25713	90.0	90.7	135.0	100.2	86.2	100.0	108.3	91.2	100.2	98.3	98.3	121.0	97.5	130.5	85.3	104.0	95.8	103.9
27	IET 26468	95.0	95.0	131.0	97.9	124.2	96.3	114.7	90.8	105.6	97.0	102.2	139.3	86.7	105.7	95.3	113.3	97.3	104.6
28	IET 26780	93.0	92.8	159.3	90.7	94.7	94.0	130.3	81.5	104.5	88.7	98.3	135.0	88.7	131.8	91.7	131.7	93.7	107.4
29	N-22	87.3	93.3	132.7	83.4	93.7	90.0	118.0	72.0	96.3	87.7	101.7	132.0	93.0	103.7	95.7	118.0	92.7	103.0
30	Vandana	92.7	90.7	127.7	112.5	100.3	99.3	104.0	98.7	103.2	88.0	107.0	142.7	106.4	101.0	128.3	103.0	111.0	110.9
	Mean	**99.6**	**100.3**	**142.3**	**106.0**	**105.6**	**83.9**	**115.2**	**98.1**	**106.4**	**98.8**	**108.6**	**141.7**	**104.9**	**107.8**	**103.6**	**113.2**	**106.1**	**110.6**
	LSD (Treatment)					NS					LSD (Treatment x Genotype)						ns		
	LSD (Location x Treatment)					2.887**					LSD (Location x Treatment x Genotype)						ns		
	LSD (Genotype)					3.953**					CV (%)						6.92		
	LSD (Location x Genotype)					11.18**													

Table 6.3.4 Influence of Heat Stress on Leaf Area Index flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control					Grand Mean	Treated					Grand Mean
		IIRR	NRRI	PNR	PTB	REWA		IIRR	NRRI	PNR	PTB	REWA	
1	IET 28384	3.59	3.87	3.31	3.50	6.11	4.08	5.89	2.17	4.15	3.73	4.42	4.07
2	IET 28386	5.39	5.94	1.67	3.40	6.26	4.53	6.03	3.78	2.87	2.63	4.64	3.99
3	IET 28387	4.60	5.25	4.24	1.63	6.79	4.50	5.61	3.02	5.44	2.70	5.75	4.50
4	IET 28390	5.74	5.07	4.07	2.10	5.70	4.54	5.36	3.49	5.31	1.67	5.06	4.18
5	IET 27668	5.18	5.21	2.60	3.43	6.60	4.60	5.31	2.93	3.82	2.97	5.27	4.06
6	IET 28393	4.09	5.29	1.89	3.53	5.06	3.97	4.12	3.36	3.09	2.37	3.42	3.27
7	IET 28397	6.05	6.10	2.38	3.50	6.39	4.88	6.38	3.47	3.65	6.80	4.69	5.00
8	IET 28400	4.21	4.53	3.74	3.97	4.86	4.26	5.56	3.13	5.10	2.20	3.45	3.89
9	IET 28402	4.40	5.84	1.41	1.87	7.50	4.20	4.67	4.07	2.69	2.20	6.29	3.98
10	IET 28403	4.14	5.77	3.56	1.57	6.24	4.26	4.92	4.01	4.70	2.03	4.74	4.08
11	Gontra Bidhan-3	3.73	4.79	2.56	2.23	6.58	3.98	3.34	3.31	3.46	2.57	5.34	3.60
12	IET 28407	6.10	3.86	5.15	3.50	6.26	4.97	6.09	2.17	6.53	3.27	5.41	4.70
13	IET 28408	3.82	4.85	2.52	3.03	5.31	3.91	5.51	3.09	3.30	2.57	4.44	3.78
14	IET 28409	5.07	5.06	5.23	2.80	5.32	4.70	5.11	3.51	6.43	3.03	4.34	4.48
15	IET 28411	3.95	5.88	3.48	2.10	6.47	4.37	5.09	3.34	4.63	3.03	5.14	4.25
16	IET 28412	4.26	4.92	1.22	2.60	4.81	3.56	4.78	3.13	2.60	2.30	3.27	3.22
17	IET 28417	3.63	4.03	2.75	1.50	4.46	3.27	5.51	2.27	4.03	2.80	2.57	3.44
18	IET 28422	7.00	4.07	3.79	4.40	5.71	4.99	6.55	2.83	4.99	2.57	4.25	4.24
19	IET 28423	6.48	4.85	4.39	5.20	5.88	5.36	4.35	3.37	5.59	1.73	4.53	3.92
20	IET 28425	6.08	3.88	4.34	3.50	5.86	4.73	6.59	2.19	5.54	3.30	4.56	4.44
21	IET 28427	4.03	3.62	2.28	3.80	6.59	4.06	6.64	2.31	3.48	3.27	5.24	4.19
22	IET 28429	6.07	3.79	3.29	3.07	5.44	4.33	5.79	2.13	4.49	2.97	4.31	3.94
23	IET 28432	3.95	4.99	3.48	2.83	6.43	4.34	5.62	3.18	4.68	4.07	5.18	4.54
24	IET 27908	5.78	3.81	2.88	4.20	6.72	4.68	7.04	2.64	4.08	2.40	5.44	4.32
25	IET 27876	4.28	6.12	4.54	4.43	6.31	5.14	4.61	4.24	5.95	2.40	5.42	4.52
26	IET 25713	5.19	5.39	1.42	3.17	4.19	3.87	4.69	3.01	2.62	2.97	2.78	3.21
27	IET 26468	4.83	5.32	1.69	3.07	5.88	4.16	4.44	3.38	2.89	2.53	5.23	3.69
28	IET 26780	3.20	4.28	4.60	3.23	6.37	4.34	3.83	2.96	5.80	2.50	4.07	3.83
29	N-22	3.64	5.77	2.65	3.87	6.88	4.56	3.75	3.99	3.73	2.87	4.93	3.85
30	Vandana	3.64	5.52	3.37	3.27	4.90	4.14	4.08	3.10	4.57	3.27	3.83	3.77
	Mean	**4.74**	**4.92**	**3.15**	**3.14**	**5.93**	**4.38**	**5.24**	**3.12**	**4.34**	**2.86**	**4.60**	**4.03**
	LSD (Treatment)			ns				LSD (Treatment x Genotype)				ns	
	LSD (Location x Treatment)			0.300**				LSD (Location x Treatment x Genotype)				ns	
	LSD (Genotype)			ns				CV (%)				18.53	
	LSD (Location x Genotype)			1.16**									

Table 6.3.5 Influence of Heat Stress on Leaf weight (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	NRRI	PNR	PTB	REWA	TTB		IIRR	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	142	170	344	165	379	172	229	208	134	360	176	301	106	214
2	IET 28386	243	196	409	385	333	158	287	252	160	435	484	264	107	283
3	IET 28387	209	204	299	66	293	140	202	244	154	331	253	240	150	229
4	IET 28390	246	144	527	99	298	90	234	219	111	516	451	277	95	278
5	IET 27668	219	174	309	539	267	135	274	195	130	259	462	249	106	234
6	IET 28393	177	177	430	561	300	101	291	162	138	371	671	256	69	278
7	IET 28397	240	173	475	165	359	141	259	223	131	478	385	268	104	265
8	IET 28400	210	169	197	187	198	120	180	258	124	200	682	172	103	256
9	IET 28402	191	163	393	88	267	145	208	193	125	404	429	254	123	255
10	IET 28403	170	169	353	44	253	171	193	177	131	290	88	229	144	177
11	Gontra Bidhan-3	197	161	240	66	242	139	174	138	122	300	121	239	95	169
12	IET 28407	295	186	320	165	216	128	218	250	143	352	154	198	126	204
13	IET 28408	165	187	295	143	250	133	195	211	140	271	121	248	126	186
14	IET 28409	206	207	469	132	150	126	215	201	161	448	242	146	63	210
15	IET 28411	172	214	287	99	225	180	196	213	162	259	143	218	104	183
16	IET 28412	172	201	312	44	211	125	178	185	148	296	374	197	117	220
17	IET 28417	159	151	297	44	210	106	161	203	116	267	462	214	81	224
18	IET 28422	352	209	163	528	256	125	272	240	162	190	121	207	106	171
19	IET 28423	284	219	448	363	243	159	286	168	165	414	385	229	150	252
20	IET 28425	300	197	334	165	276	160	239	274	152	269	352	283	172	250
21	IET 28427	171	146	355	671	304	120	295	240	110	320	264	224	89	208
22	IET 28429	233	223	481	407	211	189	291	283	173	399	297	191	135	246
23	IET 28432	194	185	432	363	192	149	253	291	140	386	264	178	119	230
24	IET 27908	285	215	541	198	218	128	264	259	166	521	836	208	117	351
25	IET 27876	164	200	298	209	151	140	194	170	151	304	319	177	91	202
26	IET 25713	219	194	486	693	117	89	300	167	150	449	297	196	81	223
27	IET 26468	208	167	357	633	240	150	292	156	125	337	484	243	105	242
28	IET 26780	154	209	412	638	251	132	299	159	162	354	308	248	96	221
29	N-22	159	174	351	517	225	135	260	155	133	291	484	206	89	226
30	Vandana	165	179	221	154	192	118	171	175	131	161	154	190	99	152
	Mean	**210**	**185**	**361**	**284**	**244**	**137**	**237**	**209**	**142**	**341**	**342**	**225**	**109**	**228**
	LSD (Treatment)				ns				LSD (Treatment x Genotype)					ns	
	LSD (Location x Treatment)				26.16**				LSD (Location x Treatment x Genotype)					ns	
	LSD (Genotype)				ns				CV (%)					29.2	
	LSD (Location x Genotype)				101.3**										

Table 6.3.6 Influence of Heat Stress on Stem weight (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	NRRI	PNR	PTB	REWA	TTB		IIRR	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	589	514	688	363	508	504	528	685	338	719	682	364	297	514
2	IET 28386	690	542	819	726	502	345	604	514	397	869	1331	350	281	624
3	IET 28387	528	502	597	66	401	315	402	499	383	662	605	248	263	443
4	IET 28390	820	466	1055	165	316	251	512	463	347	1032	1232	261	234	595
5	IET 27668	618	394	617	1903	383	357	712	448	280	518	1166	293	229	489
6	IET 28393	563	416	859	1782	477	342	740	349	309	742	1793	214	194	600
7	IET 28397	720	703	950	363	541	422	617	729	476	956	869	380	215	604
8	IET 28400	509	529	395	132	472	221	376	548	373	399	1199	267	157	490
9	IET 28402	416	338	786	88	631	334	432	413	253	808	935	324	242	496
10	IET 28403	549	613	706	99	375	299	440	346	438	579	297	256	265	364
11	Gontra Bidhan-3	574	674	480	187	400	249	427	344	505	600	363	265	188	378
12	IET 28407	816	351	641	330	274	381	465	536	247	703	220	189	291	364
13	IET 28408	331	388	590	165	375	314	360	638	288	543	638	243	275	438
14	IET 28409	553	603	938	330	383	254	510	443	412	896	638	355	195	490
15	IET 28411	554	499	574	495	421	431	496	461	379	518	781	211	310	443
16	IET 28412	571	379	624	55	421	377	405	486	265	593	1001	323	295	494
17	IET 28417	335	432	594	66	289	313	338	343	313	533	1342	260	192	497
18	IET 28422	967	433	325	2134	502	374	789	345	309	380	330	318	254	323
19	IET 28423	668	297	896	1144	466	480	659	368	223	828	1265	349	309	557
20	IET 28425	960	601	668	319	503	377	571	513	432	537	1144	282	290	533
21	IET 28427	415	429	711	1771	592	302	703	576	322	640	704	412	213	478
22	IET 28429	616	550	961	1661	329	342	743	648	346	797	1001	242	289	554
23	IET 28432	614	283	865	1265	476	346	642	482	199	772	1232	406	324	569
24	IET 27908	803	482	1081	946	509	323	691	364	365	1043	2310	334	295	785
25	IET 27876	407	400	596	1804	356	326	648	328	286	607	1089	433	195	490
26	IET 25713	473	412	972	2706	529	322	902	266	309	897	693	451	195	468
27	IET 26468	498	394	714	8352	364	320	1773	330	288	674	1232	287	212	504
28	IET 26780	383	396	823	1980	303	255	690	368	300	708	704	460	181	454
29	N-22	471	394	703	2013	507	304	732	383	274	582	990	420	282	488
30	Vandana	403	429	441	1056	374	238	490	405	329	321	814	296	214	397
	Mean	**580**	**462**	**722**	**1149**	**433**	**334**	**613**	**454**	**333**	**682**	**953**	**316**	**246**	**497**
	LSD (Treatment)				86.6**					LSD (Treatment x Genotype)				ns	
	LSD (Location x Treatment)				ns					LSD (Location x Treatment x Genotype)				ns	
	LSD (Genotype)				ns					CV (%)				29.2	
	LSD (Location x Genotype)				821**										

Table 6.3.7 Influence of Heat Stress on Panicle weight (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control						Grand Mean	Treated						Grand Mean
		IIRR	NRRI	PNR	PTB	REWA	TTB		IIRR	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	123	139	328	66	189	220	177	148	89	241	66	109	182	139
2	IET 28386	233	212	414	165	169	180	229	139	121	319	297	66	154	183
3	IET 28387	198	213	514	66	128	183	217	187	184	413	121	105	198	201
4	IET 28390	222	151	554	55	192	158	222	118	92	435	154	76	83	160
5	IET 27668	196	119	385	198	188	262	225	131	125	261	517	89	155	213
6	IET 28393	146	201	406	165	199	151	211	102	120	304	407	135	86	192
7	IET 28397	124	91	510	55	192	191	194	128	100	377	187	166	114	179
8	IET 28400	122	92	411	66	169	156	169	188	105	298	407	173	120	215
9	IET 28402	158	105	409	66	197	215	191	184	72	286	176	160	201	180
10	IET 28403	152	200	435	66	143	263	210	91	112	329	341	101	183	193
11	Gontra Bidhan-3	189	220	466	132	189	182	230	146	156	259	451	99	143	209
12	IET 28407	267	94	394	209	177	158	217	128	114	230	341	98	111	170
13	IET 28408	201	161	443	209	162	212	231	209	87	263	418	151	148	213
14	IET 28409	151	155	567	132	117	193	219	110	100	401	165	68	94	156
15	IET 28411	141	216	281	99	150	228	186	103	110	184	649	60	191	216
16	IET 28412	141	234	344	55	138	232	191	147	152	212	429	105	183	205
17	IET 28417	91	78	247	77	264	183	156	118	79	159	275	175	145	158
18	IET 28422	133	105	415	242	81	188	194	56	127	272	418	96	157	188
19	IET 28423	156	53	416	132	191	222	195	61	107	261	352	55	178	169
20	IET 28425	218	122	281	231	164	266	213	135	255	184	110	84	227	166
21	IET 28427	118	121	447	132	194	154	194	113	219	304	176	174	158	191
22	IET 28429	158	86	432	264	149	249	223	118	125	265	319	132	214	196
23	IET 28432	198	133	377	363	213	230	252	103	103	243	286	130	205	178
24	IET 27908	158	189	587	132	232	236	256	72	91	417	165	146	207	183
25	IET 27876	86	88	340	176	233	194	186	87	60	230	154	176	98	134
26	IET 25713	206	175	453	451	265	190	290	55	88	297	143	129	112	137
27	IET 26468	130	50	324	385	178	204	212	93	120	213	374	104	113	170
28	IET 26780	103	151	395	330	153	189	220	83	214	259	231	95	116	166
29	N-22	184	190	379	308	141	193	233	174	73	222	264	102	156	165
30	Vandana	87	196	280	363	187	145	210	119	52	145	99	83	157	109
	Mean	**160**	**145**	**408**	**180**	**178**	**201**	**212**	**121**	**118**	**276**	**283**	**115**	**153**	**178**
	LSD (Treatment)				ns				LSD (Treatment x Genotype)					ns	
	LSD (Location x Treatment)				25.13**				LSD (Location x Treatment x Genotype)					ns	
	LSD (Genotype)				ns				CV (%)					24	
	LSD (Location x Genotype)				97.67**										

Table 6.3.8 Influence of Heat Stress on Total dry matter (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	854	400	823	1360	594	1076	896	858	1042	352	561	1320	924	774	584	794
2	IET 28386	1166	427	949	1642	1276	1005	683	1021	905	392	678	1623	2112	680	542	990
3	IET 28387	934	415	920	1410	198	822	639	762	930	370	721	1407	979	593	611	802
4	IET 28390	1287	329	761	2136	319	806	498	877	799	295	550	1983	1837	615	412	927
5	IET 27668	1033	376	688	1311	2640	839	754	1091	774	375	536	1037	2145	630	489	855
6	IET 28393	886	286	794	1695	2508	976	594	1105	613	271	566	1417	2871	605	349	956
7	IET 28397	1084	398	967	1935	583	1092	755	973	1079	365	707	1810	1441	815	432	950
8	IET 28400	841	438	789	1003	385	839	497	684	993	386	602	897	2288	612	380	880
9	IET 28402	765	356	605	1587	242	1095	694	763	791	374	450	1498	1540	738	566	851
10	IET 28403	871	329	982	1494	209	771	733	770	614	350	681	1197	726	586	593	678
11	Gontra Bidhan-3	960	309	1055	1187	385	831	571	757	628	276	783	1159	935	603	426	687
12	IET 28407	1378	348	631	1356	704	667	667	821	914	337	504	1285	715	485	528	681
13	IET 28408	696	343	735	1327	517	787	659	724	1058	356	515	1078	1177	642	549	768
14	IET 28409	910	375	965	1974	594	650	573	863	754	351	672	1746	1045	569	352	784
15	IET 28411	867	314	929	1143	693	796	839	797	778	302	650	961	1573	488	604	765
16	IET 28412	884	387	815	1280	154	770	734	718	817	384	565	1101	1804	626	595	842
17	IET 28417	585	323	660	1137	187	763	602	608	663	323	508	959	2079	648	419	800
18	IET 28422	1452	375	747	903	2904	838	687	1129	641	355	598	841	869	622	517	635
19	IET 28423	1109	326	569	1760	1639	900	860	1023	596	278	495	1504	2002	634	637	878
20	IET 28425	1477	321	920	1283	715	944	803	923	921	282	839	990	1606	649	690	854
21	IET 28427	704	343	696	1513	2574	1090	576	1071	928	317	652	1264	1144	810	460	796
22	IET 28429	1007	389	860	1874	2332	689	780	1133	1049	308	645	1461	1617	566	639	898
23	IET 28432	1006	375	602	1675	1991	882	725	1036	876	367	441	1401	1782	715	648	890
24	IET 27908	1246	372	886	2209	1276	960	688	1091	695	305	623	1982	3311	689	619	1175
25	IET 27876	656	309	689	1234	2189	741	661	926	584	289	497	1141	1562	786	384	749
26	IET 25713	897	377	782	1911	3850	911	601	1333	488	336	547	1643	1133	776	388	759
27	IET 26468	835	283	611	1395	9370	781	674	1993	579	240	534	1224	2090	633	430	819
28	IET 26780	640	313	755	1629	2948	707	576	1081	609	322	676	1322	1243	804	393	767
29	N-22	814	365	758	1433	2838	872	632	1102	713	336	479	1095	1738	729	527	802
30	Vandana	654	409	804	942	1573	754	500	805	699	382	512	627	1067	569	470	618
	Mean	**950**	**357**	**792**	**1491**	**1613**	**855**	**672**	**961**	**784**	**333**	**593**	**1299**	**1579**	**656**	**508**	**822**
	LSD (Treatment)				79.31**					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				ns					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				ns					CV (%)					29.6		
	LSD (Location x Genotype)				814**												

Table 6.3.9 Influence of Heat Stress on Shoot weight (g/m2) maturity in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control								Grand Mean	Treated								Grand Mean
		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	862	625	502	667	1413	2840	568	788	1033	863	526	489	601	1373	1131	425	522	741
2	IET 28386	569	474	573	651	1692	777	559	681	747	568	401	549	585	1673	1380	407	543	763
3	IET 28387	744	429	558	543	1465	2223	462	795	902	802	432	519	488	1462	1402	305	716	766
4	IET 28390	794	614	414	813	2187	1510	373	1021	966	786	681	374	731	2034	1950	324	818	962
5	IET 27668	643	537	515	726	1367	1780	440	983	874	662	606	509	652	1093	1905	353	848	829
6	IET 28393	712	619	368	801	1752	2186	540	633	951	677	547	341	720	1474	2029	274	811	859
7	IET 28397	890	715	516	900	1987	1309	601	808	966	810	639	511	809	1862	1896	442	748	964
8	IET 28400	676	500	590	616	1053	898	532	531	674	636	633	543	553	947	1991	327	712	793
9	IET 28402	606	470	497	818	1638	741	693	991	807	528	546	489	735	1549	1544	386	693	809
10	IET 28403	697	626	441	721	1547	1259	435	991	840	577	638	434	649	1250	1251	316	624	717
11	Gontra Bidhan-3	591	592	382	637	1244	637	462	722	658	457	560	319	574	1216	2010	322	603	758
12	IET 28407	778	615	430	573	1413	680	334	778	700	741	487	426	516	1342	1140	250	667	696
13	IET 28408	712	581	422	755	1383	634	432	732	706	672	408	440	680	1134	1115	301	717	683
14	IET 28409	753	575	470	806	2026	871	444	810	844	752	561	434	727	1798	2091	412	547	915
15	IET 28411	620	549	384	694	1194	1535	478	926	797	554	588	375	625	1012	2701	273	642	846
16	IET 28412	499	646	486	524	1337	522	478	858	669	484	538	482	472	1158	2047	383	668	779
17	IET 28417	573	526	395	491	1187	478	352	619	578	530	639	393	443	1009	1930	320	614	735
18	IET 28422	922	669	468	869	953	1361	562	503	788	1029	661	440	783	891	2421	380	525	891
19	IET 28423	1023	714	395	803	1818	912	526	753	868	980	609	370	722	1562	3149	409	589	1049
20	IET 28425	557	633	413	732	1334	856	565	847	742	590	609	372	660	1041	1847	344	688	769
21	IET 28427	652	662	445	632	1567	2149	652	473	904	627	527	433	570	1318	2117	472	494	820
22	IET 28429	624	679	503	1181	1927	1333	391	782	928	588	538	393	1064	1514	1758	299	701	857
23	IET 28432	528	728	511	850	1734	1459	536	921	908	559	766	496	766	1460	2361	467	689	946
24	IET 27908	744	782	503	901	2266	907	566	704	922	689	673	393	812	2039	2225	392	634	982
25	IET 27876	740	531	384	589	1285	1212	417	879	755	608	573	388	531	1192	1428	490	695	738
26	IET 25713	660	557	498	543	1966	409	587	619	730	623	472	464	489	1698	1749	514	701	839
27	IET 26468	651	483	377	616	1450	1412	421	750	770	752	647	288	555	1279	1966	350	574	802
28	IET 26780	593	456	415	613	1684	682	365	761	696	584	550	394	553	1377	1818	521	544	793
29	N-22	424	583	466	459	1492	1394	567	823	776	451	445	403	414	1154	2423	481	678	806
30	Vandana	651	526	519	420	994	193	434	862	575	524	768	493	378	679	1273	355	622	637
	Mean	**683**	**590**	**461**	**698**	**1545**	**1172**	**492**	**778**	**803**	**657**	**576**	**432**	**629**	**1353**	**1868**	**376**	**654**	**818**
	LSD (Treatment)					ns					LSD (Treatment x Genotype)						ns		
	LSD (Location x Treatment)					40.75**					LSD (Location x Treatment x Genotype)						ns		
	LSD (Genotype)					55.80**					CV (%)						13.7		
	LSD (Location x Genotype)					157.8**													

Table 6.3.10 Influence of Heat Stress on Panicle weight (g/m2) maturity in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	967	732	644	754	339	797	450	669	539	405	496	554	895	396	265	507
2	IET 28386	943	855	948	953	273	740	416	733	590	461	520	733	920	235	321	540
3	IET 28387	767	803	802	1182	370	549	418	699	756	612	308	951	775	514	387	615
4	IET 28390	789	827	958	1275	372	553	393	738	742	526	674	1000	747	362	274	618
5	IET 27668	800	707	747	886	354	762	545	686	838	579	473	599	947	230	400	581
6	IET 28393	936	833	796	933	523	830	238	727	833	634	574	700	759	310	213	574
7	IET 28397	722	743	923	1173	511	585	378	719	481	557	471	867	834	408	232	550
8	IET 28400	761	743	819	945	492	774	323	694	718	635	581	686	979	440	162	600
9	IET 28402	752	740	951	940	635	672	523	745	664	594	433	657	974	326	418	581
10	IET 28403	1005	701	989	1000	538	704	454	770	820	504	663	756	737	353	384	602
11	Gontra Bidhan-3	890	777	999	1073	234	782	394	736	799	600	747	595	822	351	253	595
12	IET 28407	835	670	1109	907	507	717	442	741	540	574	410	530	897	275	273	500
13	IET 28408	1007	641	683	1019	259	638	510	680	591	465	421	606	795	459	282	517
14	IET 28409	890	697	1381	1305	330	582	423	801	614	586	668	923	884	239	287	600
15	IET 28411	873	732	793	647	492	499	352	627	584	612	360	424	995	468	330	539
16	IET 28412	1040	690	871	791	367	626	468	693	690	541	678	488	661	293	428	540
17	IET 28417	692	681	664	567	198	659	387	550	479	592	464	367	895	208	298	472
18	IET 28422	751	762	973	954	468	474	296	668	552	653	460	625	1112	322	182	558
19	IET 28423	828	755	695	957	227	684	576	675	332	656	349	601	665	311	361	468
20	IET 28425	1075	710	1094	647	517	545	603	741	602	586	792	424	1008	247	398	580
21	IET 28427	831	674	991	1029	516	566	370	711	456	557	485	698	678	185	180	463
22	IET 28429	946	699	1149	994	635	554	483	780	312	552	511	609	680	217	373	465
23	IET 28432	727	710	1070	868	414	575	469	690	504	576	404	559	712	275	341	482
24	IET 27908	924	755	1209	1350	165	691	451	792	509	648	310	960	578	296	374	525
25	IET 27876	789	732	793	783	398	690	459	664	593	395	381	529	582	418	369	467
26	IET 25713	831	657	787	1042	685	612	346	709	385	557	446	683	859	296	312	505
27	IET 26468	698	581	658	746	729	552	426	627	448	480	528	490	629	380	288	463
28	IET 26780	766	745	1123	908	496	521	408	710	657	512	554	597	719	314	276	518
29	N-22	821	685	649	873	613	658	431	676	463	525	262	511	603	277	345	427
30	Vandana	769	475	646	644	563	544	402	577	385	407	244	333	498	341	337	364
	Mean	**848**	**717**	**897**	**938**	**441**	**638**	**428**	**701**	**583**	**553**	**489**	**635**	**795**	**325**	**311**	**527**
	LSD (Treatment)				ns					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				33.7**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				37.5*					CV (%)					14.26		
	LSD (Location x Genotype)				130.5**												

Table 6.3.11 Influence of Heat Stress on Panicle number/m2 maturity in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	493	363	273	200	229	205	197	280	293	341	258	195	179	162	118	221
2	IET 28386	317	440	223	242	175	162	288	264	337	396	218	267	235	87	122	237
3	IET 28387	280	363	203	308	170	137	267	247	367	341	155	250	189	80	145	218
4	IET 28390	360	363	249	325	163	163	250	268	397	330	270	267	155	112	149	240
5	IET 27668	263	418	232	283	271	196	282	278	400	407	203	258	155	129	175	247
6	IET 28393	510	440	218	183	511	189	271	332	487	429	164	192	253	120	209	265
7	IET 28397	330	440	360	267	278	206	259	306	390	352	270	267	340	146	229	285
8	IET 28400	237	418	171	283	272	156	213	250	360	407	133	242	105	96	176	217
9	IET 28402	353	396	339	383	523	172	211	340	430	374	255	383	198	120	182	277
10	IET 28403	410	407	228	267	282	172	197	280	467	407	218	258	219	122	168	266
11	Gontra Bidhan-3	340	462	202	300	132	263	218	274	360	451	206	267	232	196	163	268
12	IET 28407	503	385	293	300	275	254	243	322	427	385	258	258	272	179	175	279
13	IET 28408	397	363	233	300	156	221	229	271	420	352	245	258	193	172	154	256
14	IET 28409	347	396	234	300	177	203	300	279	373	363	215	308	216	155	188	260
15	IET 28411	393	418	229	275	428	229	265	319	403	385	188	242	250	181	136	255
16	IET 28412	403	374	209	217	126	187	266	255	407	363	173	225	209	114	132	232
17	IET 28417	340	440	199	167	153	203	171	239	417	429	172	217	157	131	146	238
18	IET 28422	293	462	287	283	217	163	235	277	413	451	215	318	275	114	174	280
19	IET 28423	317	418	154	267	114	213	258	249	263	396	115	238	209	164	150	219
20	IET 28425	307	396	258	250	340	254	285	299	340	396	206	283	201	205	241	267
21	IET 28427	413	385	237	283	196	229	262	287	363	352	267	267	202	155	225	262
22	IET 28429	293	385	234	383	391	205	279	310	270	374	176	342	237	131	236	252
23	IET 28432	237	407	215	275	155	247	274	258	370	374	164	270	198	196	243	259
24	IET 27908	323	451	205	383	175	197	298	290	263	429	167	340	264	145	264	267
25	IET 27876	377	440	283	217	438	255	181	313	483	363	221	242	244	204	178	276
26	IET 25713	363	396	204	183	327	246	202	275	310	385	206	163	182	169	170	226
27	IET 26468	283	407	168	217	458	172	192	271	353	363	139	240	141	97	160	213
28	IET 26780	287	418	225	358	364	171	199	289	423	407	206	323	182	120	188	264
29	N-22	500	407	236	333	493	188	140	328	517	407	189	315	261	137	136	280
30	Vandana	333	440	190	283	296	228	128	271	537	418	144	237	227	155	127	263
	Mean	**353**	**410**	**233**	**277**	**276**	**203**	**235**	**284**	**388**	**388**	**200**	**264**	**213**	**143**	**175**	**253**
	LSD (Treatment)					ns				LSD (Treatment x Genotype)						ns	
	LSD (Location x Treatment)					12.3**				LSD (Location x Treatment x Genotype)						ns	
	LSD (Genotype)					13.7*				CV (%)						11.92	
	LSD (Location x Genotype)					47.7**											

Table 6.3.12 Influence of Heat Stress on Grain number/panicle in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control								Grand Mean	Treated								Grand Mean
		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	182	79	108	108	145	115	209	100	131	129	88	95	66	128	145	167	54	109
2	IET 28386	154	112	191	148	174	97	166	164	151	158	78	154	98	143	243	92	58	128
3	IET 28387	207	95	127	131	143	67	142	140	132	117	77	109	60	131	224	83	69	109
4	IET 28390	102	80	147	107	134	173	167	128	130	127	70	117	60	139	149	117	70	106
5	IET 27668	131	105	118	110	152	67	200	147	129	122	81	99	94	114	211	133	85	118
6	IET 28393	103	58	119	96	141	46	192	140	112	114	57	104	77	114	119	125	110	102
7	IET 28397	118	89	153	92	127	101	208	134	128	119	55	134	61	124	147	150	113	113
8	IET 28400	219	115	153	167	141	79	158	105	142	184	76	128	118	132	283	100	85	138
9	IET 28402	108	69	108	83	126	57	175	109	104	90	54	96	63	124	168	125	87	101
10	IET 28403	133	111	197	166	131	107	175	96	139	124	91	153	112	146	263	125	78	136
11	Gontra Bidhan-3	143	121	118	172	121	114	267	108	145	157	113	101	137	157	144	200	76	136
12	IET 28407	146	77	159	140	121	100	258	128	141	154	70	136	2	135	153	183	81	114
13	IET 28408	166	123	146	153	153	82	225	119	146	201	71	121	41	153	102	175	70	117
14	IET 28409	173	95	150	170	141	59	208	182	147	165	63	129	77	140	269	158	91	137
15	IET 28411	120	83	118	121	143	161	233	139	140	101	66	95	46	125	217	183	64	112
16	IET 28412	121	103	131	122	173	115	192	141	137	132	65	118	98	165	60	117	63	102
17	IET 28417	129	69	108	109	142	91	208	80	117	118	39	87	75	147	99	133	68	96
18	IET 28422	137	102	176	107	132	129	167	128	135	105	55	155	4	122	142	117	84	98
19	IET 28423	117	114	213	181	157	87	217	142	153	237	55	169	35	126	148	167	74	126
20	IET 28425	120	113	157	112	149	113	258	155	147	144	61	84	91	133	203	208	143	133
21	IET 28427	154	80	152	121	106	130	233	139	139	124	50	124	50	102	221	158	115	118
22	IET 28429	151	175	148	246	113	114	208	151	163	202	61	120	24	99	240	133	125	126
23	IET 28432	166	98	170	142	119	68	250	152	146	138	40	135	131	90	211	200	114	133
24	IET 27908	184	126	203	197	129	61	200	170	159	168	91	145	0	95	216	150	127	124
25	IET 27876	110	61	128	65	138	43	258	90	112	104	31	111	44	115	117	208	80	101
26	IET 25713	131	78	144	102	135	82	250	100	128	130	39	119	62	109	105	175	81	103
27	IET 26468	139	80	135	120	167	77	175	98	124	192	40	122	86	125	192	100	74	116
28	IET 26780	128	99	152	145	144	106	175	106	132	160	69	128	68	117	71	125	91	103
29	N-22	118	68	149	83	135	89	192	72	113	118	31	135	66	117	127	142	62	100
30	Vandana	112	78	111	86	114	59	233	57	106	125	24	92	55	85	92	158	46	85
	Mean	**141**	**95**	**146**	**130**	**138**	**93**	**207**	**124**	**134**	**142**	**62**	**121**	**67**	**125**	**169**	**147**	**85**	**115**
	LSD (Treatment)					ns					LSD (Treatment x Genotype)						ns		
	LSD (Location x Treatment)					5.4**					LSD (Location x Treatment x Genotype)						ns		
	LSD (Genotype)					7.93**					CV (%)						11.3		
	LSD (Location x Genotype)					20.9**													

Table 6.3.13 Influence of Heat Stress on Spikelet number/panicle in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	114	119	139	195	150	199	123	149	134	120	149	208	155	197	70	147
2	IET 28386	191	203	191	213	147	165	201	187	162	180	210	204	261	170	75	180
3	IET 28387	154	141	163	210	119	179	171	162	134	129	111	269	250	178	89	166
4	IET 28390	94	164	143	192	191	160	157	157	97	140	116	232	157	140	91	139
5	IET 27668	136	133	153	175	113	191	178	154	107	123	209	164	220	191	111	161
6	IET 28393	65	132	116	177	64	180	170	129	66	127	150	202	124	189	144	143
7	IET 28397	121	163	113	164	121	169	164	145	70	153	207	182	152	162	147	153
8	IET 28400	184	162	265	196	122	200	127	180	145	145	243	248	330	206	110	204
9	IET 28402	99	120	103	151	75	181	131	123	110	117	123	179	231	177	113	150
10	IET 28403	146	210	215	163	123	160	114	162	137	186	232	197	272	165	101	184
11	Gontra Bidhan-3	163	129	272	149	166	190	130	171	167	119	307	235	149	185	98	180
12	IET 28407	146	171	167	153	113	173	155	154	155	157	4	200	180	173	105	139
13	IET 28408	163	154	212	233	98	167	143	167	121	138	76	312	105	167	91	144
14	IET 28409	165	159	216	175	104	154	219	170	119	146	148	256	278	151	117	174
15	IET 28411	137	134	147	159	181	147	166	153	101	120	102	157	226	131	82	131
16	IET 28412	149	140	159	214	130	185	169	164	118	137	191	220	64	184	82	142
17	IET 28417	126	117	148	166	139	180	94	139	116	108	282	186	103	177	89	151
18	IET 28422	147	189	132	162	157	169	153	158	75	180	9	181	151	168	109	125
19	IET 28423	164	224	215	179	131	139	169	175	152	198	68	162	153	142	96	139
20	IET 28425	142	172	136	186	121	132	186	153	96	120	188	218	207	135	171	162
21	IET 28427	118	164	177	131	158	121	168	148	99	147	113	142	236	119	148	143
22	IET 28429	215	163	290	159	123	104	181	176	168	142	52	151	254	102	159	147
23	IET 28432	141	187	195	161	94	181	182	163	124	167	243	169	217	178	148	178
24	IET 27908	179	224	295	150	84	229	207	195	151	179	0	133	226	227	164	154
25	IET 27876	74	146	80	186	54	149	109	114	76	141	97	211	131	151	104	130
26	IET 25713	139	155	122	200	102	143	120	140	102	142	122	261	118	148	105	142
27	IET 26468	154	148	150	202	120	189	119	155	105	144	278	184	226	190	96	175
28	IET 26780	146	163	178	168	130	175	125	155	109	152	138	172	81	176	118	135
29	N-22	74	164	98	148	95	172	86	119	211	158	144	138	168	172	80	153
30	Vandana	117	121	107	154	99	166	67	119	74	110	148	149	124	166	60	118
	Mean	**139**	**159**	**170**	**176**	**121**	**168**	**149**	**155**	**120**	**144**	**149**	**197**	**185**	**167**	**109**	**153**
	LSD (Treatment)				ns					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				7.15**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				10.46**					CV (%)					12.08		
	LSD (Location x Genotype)				27.69**												

Table 6.3.14 Influence of Heat Stress on Grain number/m2 in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand	Treated							Grand
		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	Mean	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	Mean
1	IET 28384	38702	39490	19539	29233	27148	34767	19672	29793	25856	32604	17065	25133	25770	5820	6416	19809
2	IET 28386	35170	83974	24782	41967	16870	21574	47337	38811	26377	60819	21316	38083	57232	2964	7039	30547
3	IET 28387	26608	45848	19197	44075	11165	19491	37471	29122	28254	36960	9239	32533	42351	4768	9964	23438
4	IET 28390	28669	53460	26860	43383	28375	19839	32045	33233	27643	38676	16294	36983	23198	2219	10501	22216
5	IET 27668	27731	49126	25491	42783	17696	30749	41508	33584	32055	40183	19188	29600	32645	2973	14964	24515
6	IET 28393	29064	52426	21390	25700	23353	28210	37964	31158	28115	44594	12592	21758	30097	5100	23122	23626
7	IET 28397	29432	67474	30231	33833	27383	28053	34796	35886	21277	47421	16296	32967	50011	7666	26013	28807
8	IET 28400	26869	63580	25703	39867	21590	26365	22381	32336	26966	51887	15787	31767	31181	1302	14922	24830
9	IET 28402	24246	43010	23965	47983	30079	24862	22874	31003	23324	35860	15988	47650	33095	3222	15951	25013
10	IET 28403	44982	79937	34709	35133	30209	22070	18812	37979	42028	62304	24393	37817	57474	6204	13084	34758
11	Gontra Bidhan-3	40982	54813	31705	36333	15018	40334	23634	34688	40909	45507	28175	41950	33304	8768	12420	30148
12	IET 28407	38966	61050	32425	36133	27408	35960	31197	37591	28764	52613	486	34750	41843	14112	14296	26695
13	IET 28408	48117	53042	30692	45867	12776	29747	27172	35345	26851	42504	10154	39700	19557	17183	10760	23816
14	IET 28409	32766	59224	36791	42267	10315	23440	54490	37042	24595	46629	16525	43142	58089	13074	17061	31302
15	IET 28411	31818	49302	26370	39225	69120	24542	37015	39627	26789	36729	8696	30208	53876	18669	8964	26276
16	IET 28412	41153	48741	23343	37350	14709	28394	37406	33014	26765	42933	16903	36917	12489	6265	8431	21529
17	IET 28417	23423	47344	21714	23600	13927	30433	13818	24894	16074	37389	12735	31500	15528	3248	9998	18067
18	IET 28422	29732	81213	25305	37617	27861	22390	30236	36336	22959	70092	906	38747	39063	5185	14740	27385
19	IET 28423	36116	89001	25029	41783	10124	22255	36719	37290	14084	67122	4014	29990	30847	5802	11164	23289
20	IET 28425	33533	62095	24636	37233	38270	24018	44232	37717	20528	33165	18675	38000	40783	4965	34196	27187
21	IET 28427	32336	58575	29145	30167	25507	20051	36509	33184	18226	43439	13398	26967	44802	5216	25913	25423
22	IET 28429	51429	56925	36280	43517	44342	13518	42395	41201	14750	44858	4264	33933	56519	4824	29540	26955
23	IET 28432	23140	68849	29057	32717	10282	37033	41741	34688	14976	50677	21512	24493	42045	18219	27810	28533
24	IET 27908	40674	91630	40224	49417	10180	40840	50675	46234	23906	62392	0	32270	57243	11424	33509	31535
25	IET 27876	22751	56001	17983	29967	18693	29262	16408	27295	15149	40370	9714	27862	28630	12347	14307	21197
26	IET 25713	28005	57167	20968	24800	26877	25906	20773	29214	12159	45837	12875	17813	19375	7422	13883	18481
27	IET 26468	22330	54912	18313	36483	35728	27166	18929	30552	14327	44253	11993	29903	26939	2353	11919	20241
28	IET 26780	28512	63426	23071	51500	38399	23843	23123	35982	29135	52140	13926	37667	12832	3779	17837	23902
29	N-22	33197	60764	18768	44800	43765	26702	10288	34041	16182	55011	12561	36758	33428	3692	8556	23741
30	Vandana	26186	48928	13082	32467	17114	30278	7344	25057	12371	38654	7962	20127	21008	12446	5970	16934
	Mean	**32555**	**60044**	**25892**	**37907**	**24809**	**27070**	**30632**	**34130**	**23380**	**46787**	**13121**	**32900**	**35709**	**7374**	**15775**	**25007**
	LSD (Treatment)				ns					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				1845**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				2702**					CV (%)					16.22		
	LSD (Location x Genotype)				7149**												

Table 6.3.15 Influence of Heat Stress on Spikelet number/m2 in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	56202	43263	47875	39200	34491	34377	24288	39956	38522	40865	38397	40708	27543	5437	8317	28541
2	IET 28386	60162	89232	55734	51283	25097	21252	57959	51531	54762	70961	45830	54433	61381	2633	9125	42732
3	IET 28387	43069	51029	33568	65442	19627	19143	45828	39672	49240	43714	17092	67433	47686	4419	12916	34643
4	IET 28390	33711	59587	51298	62233	31283	19527	39297	42420	38607	46409	31448	61783	24598	1948	13613	31201
5	IET 27668	35508	55550	41327	49267	30307	30375	50126	41780	42306	50237	42405	42400	33958	2600	19397	33329
6	IET 28393	32685	57992	25410	31800	32585	27857	46062	36342	32085	54461	24555	38633	31362	4733	30137	30852
7	IET 28397	39740	71863	40738	43550	33580	27721	42510	42815	27267	54153	55840	48567	51583	7351	33721	39783
8	IET 28400	43090	67650	47135	54950	33187	25969	27173	42736	52192	58718	32363	59958	34846	898	19343	36903
9	IET 28402	35015	47696	34939	57833	39117	24508	27553	38095	47271	43725	31337	68483	45666	2878	20677	37148
10	IET 28403	59354	85382	62564	43667	34726	21756	22454	47129	63667	75603	50738	50992	59662	5880	16961	46215
11	Gontra Bidhan-3	55061	59730	74700	45217	21772	39960	28352	46399	60158	53504	63394	62783	34535	8405	16100	42697
12	IET 28407	73930	65813	57178	45567	30978	35623	37691	49540	65283	60478	1044	51492	49581	13775	18532	37169
13	IET 28408	64262	56177	69455	68867	15272	29420	32782	48034	47508	48554	18785	80833	20332	16857	13948	35260
14	IET 28409	57319	62810	61939	53350	17500	23143	65509	48796	45369	52756	31893	78942	59807	12779	22116	43380
15	IET 28411	53052	55704	36803	43575	77764	24258	44090	47892	40858	46288	19218	37900	56279	18411	11620	32939
16	IET 28412	59560	52261	36734	46117	16265	28032	45057	40575	47780	49995	32961	49333	13239	5902	10929	30020
17	IET 28417	43108	51612	35759	27567	21026	30083	16293	32207	48257	46211	51213	39717	16069	2899	12960	31047
18	IET 28422	43604	87208	37771	46200	33928	22060	36052	43832	31047	81411	1857	57745	41669	4855	19108	33956
19	IET 28423	52250	93874	33079	47833	14963	21985	43691	43954	38959	78650	7867	38642	31785	5525	14472	30843
20	IET 28425	42236	67815	37320	47067	40837	23762	52926	44566	32583	47795	38844	61917	41627	4702	40994	38352
21	IET 28427	48956	63349	62819	37250	30995	19816	43890	43868	35961	51524	30145	37633	47776	4984	33356	34483
22	IET 28429	63278	62700	68164	60583	47858	13316	50452	52336	41465	53185	9167	51558	59671	4626	37397	36724
23	IET 28432	32768	75878	42632	44458	13440	36677	49782	42234	45547	62370	39797	45667	43268	17871	36049	41510
24	IET 27908	58144	100760	65454	57567	13600	40387	61821	56819	39641	76747	0	45073	59994	10980	43438	39410
25	IET 27876	27586	63866	23681	40700	23200	28971	19764	32538	37036	51216	21467	51152	32076	12053	18546	31935
26	IET 25713	49770	61787	33533	36117	33410	25627	24847	37870	31602	54791	25106	42580	21517	7138	17997	28676
27	IET 26468	42051	60324	27975	43883	54673	26794	22926	39804	37270	52338	38798	44143	32049	1980	15450	31718
28	IET 26780	41772	68024	48781	60475	47143	23500	27186	45269	45926	62018	28549	55420	14786	3438	23122	33323
29	N-22	36448	66748	27997	49133	46590	26365	12158	37920	106537	64229	30988	43373	43849	3358	11091	43347
30	Vandana	38648	53207	33129	43800	28717	29956	8655	33730	39227	45826	34449	35323	28450	12121	7738	29019
	Mean	**47411**	**65296**	**45183**	**48152**	**31464**	**26741**	**36906**	**43022**	**45464**	**55958**	**29852**	**51487**	**38888**	**7048**	**20306**	**35572**
	LSD (Treatment)					ns				LSD (Treatment x Genotype)						ns	
	LSD (Location x Treatment)					3088**				LSD (Location x Treatment x Genotype)						ns	
	LSD (Genotype)					3437*				CV (%)						20.42	
	LSD (Location x Genotype)					11962**											

Table 6.3.16 Influence of Heat Stress on Total dry matter (g/m2) in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated							Grand Mean
		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	1591	1004	1311	2167	3179	1731	845	1690	1065	956	1097	1926	2026	1189	941	1314
2	IET 28386	1417	1195	1599	2646	1050	1633	1365	1558	991	1056	1105	2406	2300	906	815	1368
3	IET 28387	1196	1122	1345	2647	2593	1305	1155	1623	1188	1012	795	2413	2177	1059	816	1351
4	IET 28390	1404	835	1771	3462	1882	1157	1080	1656	1423	722	1405	3034	2697	963	950	1599
5	IET 27668	1336	1034	1472	2252	2134	1436	1138	1543	1444	942	1125	1692	2853	832	833	1389
6	IET 28393	1555	735	1597	2685	2709	1670	1205	1736	1380	620	1293	2174	2788	840	1071	1452
7	IET 28397	1438	1059	1823	3161	1820	1479	1102	1697	1120	1005	1280	2729	2730	1085	1194	1592
8	IET 28400	1262	1229	1434	1998	1390	1470	839	1375	1351	1073	1134	1633	2970	939	869	1424
9	IET 28402	1222	1011	1769	2578	1375	1598	869	1489	1210	959	1168	2206	2517	1000	943	1429
10	IET 28403	1631	904	1710	2547	1797	1359	869	1545	1458	846	1312	2006	1988	927	1087	1375
11	Gontra Bidhan-3	1482	780	1637	2316	871	1486	1167	1391	1359	645	1322	1811	2832	912	1088	1424
12	IET 28407	1451	870	1682	2319	1187	1234	1117	1408	1026	842	926	1872	2038	756	1049	1216
13	IET 28408	1588	866	1437	2402	894	1287	908	1340	999	853	1101	1739	1909	1075	882	1223
14	IET 28409	1465	995	2188	3331	1200	1093	1285	1651	1175	775	1395	2721	2975	898	1115	1579
15	IET 28411	1422	768	1487	1840	2027	1169	1077	1398	1172	734	985	1437	3696	959	953	1420
16	IET 28412	1686	1001	1394	2128	890	1282	1163	1363	1228	964	1150	1647	2709	874	937	1358
17	IET 28417	1218	810	1155	1754	676	1154	805	1082	1119	774	907	1376	2825	775	847	1232
18	IET 28422	1420	943	1842	1906	1829	1291	1183	1488	1213	876	1243	1515	3534	909	1061	1479
19	IET 28423	1542	793	1499	2776	1139	1420	1096	1466	940	716	1071	2163	3814	917	901	1503
20	IET 28425	1708	821	1826	1980	1373	1320	1185	1459	1211	740	1452	1465	2855	874	1245	1406
21	IET 28427	1492	884	1623	2595	2665	1522	1119	1700	983	840	1055	2017	2795	881	1090	1380
22	IET 28429	1625	951	2330	2922	1968	1156	1153	1729	850	763	1576	2123	2438	741	1116	1372
23	IET 28432	1456	1046	1920	2601	1872	1304	1220	1631	1271	983	1170	2019	3073	921	1134	1510
24	IET 27908	1706	951	2110	3616	1072	1476	1269	1743	1181	763	1122	2999	2803	896	1269	1576
25	IET 27876	1320	807	1382	2068	1610	1259	808	1322	1166	761	912	1721	2010	1084	994	1236
26	IET 25713	1389	1023	1330	3009	1093	1315	1021	1454	857	934	935	2381	2608	1005	983	1386
27	IET 26468	1181	757	1275	2195	2141	1112	901	1366	1095	558	1083	1769	2595	972	697	1253
28	IET 26780	1222	841	1736	2592	1178	1105	1003	1382	1207	757	1107	1974	2537	1083	1028	1385
29	N-22	1404	947	1108	2365	2007	1383	782	1428	908	784	675	1666	3026	964	702	1246
30	Vandana	1295	1044	1065	1422	756	1137	709	1061	1153	957	622	1012	1771	886	605	1001
	Mean	**1437**	**934**	**1595**	**2476**	**1613**	**1345**	**1048**	**1493**	**1158**	**840**	**1117**	**1988**	**2663**	**937**	**974**	**1383**
	LSD (Treatment)					ns				LSD (Treatment x Genotype)						ns	
	LSD (Location x Treatment)					47.9**				LSD (Location x Treatment x Genotype)						ns	
	LSD (Genotype)					70.1**				CV (%)						8.65	
	LSD (Location x Genotype)					185.54**											

Table 6.3.17 Influence of Heat Stress on Grain yield (g/m2) in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control								Grand Mean	Treated								Grand Mean
		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	929	805	501	238	604	159	718	333	536	659	455	467	303	404	148	312	189	367
2	IET 28386	800	751	621	477	803	469	672	560	644	653	454	507	351	583	78	192	203	378
3	IET 28387	900	641	564	407	1032	715	521	463	655	731	586	493	182	801	75	465	241	447
4	IET 28390	832	706	421	667	1125	586	361	424	640	749	650	348	310	850	165	286	246	450
5	IET 27668	830	718	519	607	736	518	573	480	623	622	760	433	338	449	200	142	299	406
6	IET 28393	914	853	367	601	783	533	631	459	643	909	759	279	251	550	243	275	355	453
7	IET 28397	913	634	543	693	1023	510	393	442	644	698	422	495	245	717	478	242	397	462
8	IET 28400	654	627	639	540	795	713	705	344	627	418	575	530	280	536	452	367	296	432
9	IET 28402	699	639	515	592	790	641	565	353	599	459	532	470	276	507	370	251	304	396
10	IET 28403	983	895	463	620	850	403	561	308	635	733	716	412	382	606	405	252	272	472
11	Gontra Bidhan-3	1048	780	398	601	923	540	593	351	654	763	706	326	404	445	438	252	265	450
12	IET 28407	658	663	440	524	757	387	540	418	548	542	382	415	7	380	186	177	284	297
13	IET 28408	780	852	444	519	869	432	577	387	607	638	460	413	146	456	394	408	245	395
14	IET 28409	819	680	526	829	1155	577	472	590	706	687	470	341	332	773	234	171	317	416
15	IET 28411	764	705	383	606	497	729	449	450	573	586	501	359	147	274	130	408	223	329
16	IET 28412	722	892	515	502	641	857	488	458	634	494	567	482	283	338	549	244	222	397
17	IET 28417	666	536	415	469	451	568	395	255	469	473	335	380	223	217	143	156	239	271
18	IET 28422	776	679	474	582	804	474	393	414	575	731	484	436	14	475	187	226	295	356
19	IET 28423	698	714	398	472	807	880	493	457	615	710	246	346	67	451	379	278	260	342
20	IET 28425	752	950	408	698	540	536	381	502	596	763	491	368	439	274	59	163	444	375
21	IET 28427	800	730	439	642	879	639	372	453	619	738	352	408	215	548	413	135	372	398
22	IET 28429	657	844	447	539	844	556	405	488	597	577	206	370	79	459	335	185	415	328
23	IET 28432	751	626	535	755	718	432	362	491	584	677	352	487	406	409	580	245	400	444
24	IET 27908	793	797	447	822	1200	511	459	560	699	684	422	370	0	810	160	250	444	392
25	IET 27876	823	724	422	536	633	419	457	294	539	526	465	373	213	379	124	242	282	325
26	IET 25713	759	687	526	534	892	429	347	324	562	691	274	470	234	533	261	267	284	377
27	IET 26468	758	543	380	452	596	787	374	321	526	641	321	270	221	340	378	352	260	348
28	IET 26780	818	640	426	489	758	432	402	338	538	703	551	363	233	447	615	232	319	433
29	N-22	482	756	481	416	723	183	518	231	474	441	359	381	231	361	351	175	217	315
30	Vandana	668	664	526	344	345	391	356	182	435	519	244	464	172	183	452	258	163	307
	Mean	**782**	**724**	**473**	**559**	**786**	**534**	**484**	**404**	**593**	**641**	**470**	**409**	**233**	**485**	**299**	**254**	**292**	**385**
	LSD (Treatment)				8.51*						LSD (Treatment x Genotype)					NS			
	LSD (Location x Treatment)				31.6**						LSD (Location x Treatment x Genotype)					NS			
	LSD (Genotype)				43.3**						CV (%)					16.8			
	LSD (Location x Genotype)				122.6**														

Table 6.3.18 Influence of Heat Stress on 1000 grain weight (g) in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	Grand Mean	CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	Grand Mean
1	IET 28384	22.5	20.7	21.8	18.7	24.5	20.0	30.3	23.3	22.7	21.0	17.6	17.2	17.8	22.0	17.0	24.9	23.0	20.1
2	IET 28386	23.7	21.4	21.5	19.8	24.8	17.7	28.1	20.7	22.2	19.5	17.2	18.3	16.5	23.4	19.0	23.6	14.7	19.0
3	IET 28387	26.6	24.1	22.5	21.5	24.7	20.7	30.1	21.8	24.0	26.5	20.7	19.0	19.7	17.6	23.7	28.5	19.7	21.9
4	IET 28390	28.3	24.6	21.0	24.9	32.5	22.7	27.4	24.5	25.7	27.1	23.5	17.0	19.0	23.4	21.0	26.0	21.7	22.3
5	IET 27668	28.2	25.9	22.7	23.8	30.3	19.3	27.2	23.7	25.2	26.3	23.7	19.5	17.6	25.7	21.3	18.9	18.7	21.5
6	IET 28393	32.6	29.4	21.8	28.0	29.6	17.7	27.0	23.3	26.2	32.9	27.0	19.7	20.0	28.2	22.0	24.4	21.0	24.4
7	IET 28397	21.8	21.7	22.1	22.7	19.9	20.7	32.1	24.8	23.2	22.5	19.8	17.8	15.3	24.6	20.0	30.0	23.0	21.6
8	IET 28400	24.5	23.4	21.1	21.1	21.8	22.0	28.7	24.5	23.4	21.3	21.5	18.6	17.9	24.3	19.3	21.2	22.0	20.8
9	IET 28402	23.9	26.4	23.5	24.6	28.8	23.3	26.5	22.7	25.0	27.5	22.5	17.5	16.9	24.3	20.0	24.5	20.7	21.7
10	IET 28403	23.9	19.9	17.4	17.9	19.8	18.0	30.5	18.7	20.7	18.5	17.0	14.5	15.7	20.3	17.3	29.2	15.3	18.5
11	Gontra Bidhan-3	25.9	19.0	19.5	18.9	29.6	16.7	22.1	19.7	21.4	22.5	17.2	17.5	14.3	19.5	17.3	20.4	17.3	18.3
12	IET 28407	19.1	17.0	15.1	16.2	20.0	18.7	21.3	18.0	18.2	14.7	13.3	12.6	14.6	24.0	16.0	18.7	13.3	15.9
13	IET 28408	19.1	17.7	17.0	16.9	20.5	17.7	27.7	19.2	19.5	19.3	17.1	14.3	14.4	19.5	31.3	22.7	15.3	19.2
14	IET 28409	23.3	20.8	24.0	22.6	25.7	19.3	31.7	23.7	23.9	19.8	19.3	19.2	20.3	24.8	19.7	28.5	24.0	21.9
15	IET 28411	26.4	22.1	25.0	23.0	22.1	23.7	25.7	23.8	24.0	22.4	18.7	19.5	16.9	25.0	16.0	24.1	21.0	20.5
16	IET 28412	22.6	21.7	20.6	21.5	28.7	21.0	25.3	21.7	22.9	23.7	21.2	19.5	16.6	30.3	19.0	23.7	19.0	21.6
17	IET 28417	22.7	23.0	23.1	21.7	22.3	22.0	28.0	22.7	23.2	21.1	20.9	18.2	17.5	30.4	21.0	25.4	21.0	21.9
18	IET 28422	35.5	22.8	23.1	23.1	22.6	24.0	32.0	24.5	26.0	22.9	21.0	19.2	15.3	29.5	19.0	30.6	22.0	22.4
19	IET 28423	22.6	19.8	19.3	18.9	24.8	15.0	22.3	26.3	21.1	23.1	17.4	18.9	16.7	32.0	20.7	19.7	24.0	21.6
20	IET 28425	32.7	28.4	22.1	28.4	28.8	23.0	24.5	30.3	27.3	28.2	23.9	19.4	23.5	32.0	24.7	23.3	32.0	25.9
21	IET 28427	25.5	22.6	23.2	22.2	27.7	19.7	26.3	27.3	24.3	25.2	19.2	20.2	16.1	24.7	20.0	19.6	23.0	21.0
22	IET 28429	31.6	16.4	15.3	14.9	20.2	14.7	24.6	19.7	19.7	21.4	14.0	13.3	18.5	29.5	13.0	19.5	15.0	18.0
23	IET 28432	21.1	27.0	24.5	25.9	20.6	18.0	26.3	24.3	23.5	29.4	23.2	19.8	19.0	19.5	20.0	25.6	27.0	23.0
24	IET 27908	27.6	19.6	16.7	20.5	20.0	20.7	30.0	23.7	22.3	20.8	17.6	13.4	18.5	20.9	18.0	29.2	21.0	19.9
25	IET 27876	34.7	31.8	20.4	30.1	20.1	30.0	28.4	27.5	27.9	32.9	30.7	17.5	21.9	33.0	23.0	26.2	26.0	26.4
26	IET 25713	25.5	24.5	22.0	25.8	20.0	20.0	26.7	30.8	24.4	25.0	22.5	19.2	18.4	24.2	27.3	24.1	26.0	23.3
27	IET 26468	33.1	24.2	21.1	24.8	26.1	23.7	23.9	28.3	25.6	27.3	22.1	18.6	18.5	32.8	21.0	21.4	22.0	23.0
28	IET 26780	25.7	22.5	22.4	20.9	27.5	19.3	25.0	24.7	23.5	19.7	19.0	19.0	16.8	28.4	21.3	21.7	18.0	20.5
29	N-22	28.8	22.8	23.9	22.9	29.2	21.0	26.5	21.8	24.6	23.1	22.3	19.6	18.3	26.0	20.0	22.3	20.0	21.5
30	Vandana	25.7	25.4	22.1	26.7	24.6	19.7	20.7	24.7	23.7	24.8	22.1	18.0	21.8	27.3	29.3	18.8	22.0	23.0
	Mean	26.2	22.9	21.2	22.3	24.6	20.3	26.9	23.7	23.5	23.7	20.5	17.9	17.8	25.6	20.6	23.9	21.0	21.4
	LSD (Treatment)					0.173*					LSD (Treatment x Genotype)						ns		
	LSD (Location x Treatment)					0.642**					LSD (Location x Treatment x Genotype)						ns		
	LSD (Genotype)					0.879**					CV (%)						7.4		
	LSD (Location x Genotype)					2.487**													

Table 6.3.19 Influence of Heat Stress on Harvest Index (%) at different AICRIP locations Kharif 2019

S.No.	Genotypes	Control								Grand Mean	Treated								Grand Mean
		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB		CHN	IIRR	MTU	NRRI	PNR	PTB	REWA	TTB	
1	IET 28384	51.7	50.4	50.0	0.3	27.9	2.5	41.4	39.5	33.0	43.3	42.2	48.8	0.3	21.0	23.4	26.2	20.1	28.2
2	IET 28386	59.4	52.9	52.1	0.3	30.4	7.2	41.3	41.0	35.6	53.5	45.4	48.0	0.3	24.3	31.1	21.1	24.9	31.1
3	IET 28387	54.7	53.6	50.2	0.3	38.9	6.4	40.1	40.1	35.5	47.6	49.2	48.7	0.2	33.3	26.8	44.3	29.5	34.9
4	IET 28390	51.2	50.2	50.4	0.4	32.5	10.9	31.1	39.3	33.2	49.0	45.8	48.2	0.2	28.1	19.2	29.7	25.9	30.8
5	IET 27668	56.6	53.6	50.2	0.4	32.7	11.5	39.9	42.2	35.9	47.1	52.6	46.0	0.3	26.6	19.3	17.0	36.0	30.6
6	IET 28393	56.6	54.9	50.0	0.4	29.2	17.6	37.8	38.1	35.6	57.5	54.8	45.0	0.2	25.3	18.1	32.8	33.0	33.3
7	IET 28397	50.9	43.8	51.3	0.4	32.3	24.8	26.7	40.1	33.8	46.1	37.6	49.2	0.2	26.3	27.5	22.2	33.3	30.3
8	IET 28400	49.3	49.8	52.0	0.4	39.8	26.8	47.9	40.9	38.4	39.8	42.5	49.4	0.2	32.9	21.6	39.1	34.1	32.4
9	IET 28402	53.2	52.2	50.9	0.3	30.6	29.7	35.4	40.6	36.6	46.2	43.0	49.0	0.2	23.0	16.2	25.1	32.1	29.3
10	IET 28403	59.2	54.9	51.2	0.4	33.4	24.3	41.4	35.6	37.5	55.8	49.0	48.7	0.3	30.2	27.3	27.1	25.6	33.0
11	Gontra Bidhan-3	64.0	52.6	51.0	0.4	40.0	22.6	39.8	30.1	37.6	62.0	51.4	50.6	0.3	24.7	13.7	27.9	24.6	31.9
12	IET 28407	45.3	45.5	50.6	0.3	32.6	33.1	43.9	37.5	36.1	42.3	37.8	49.3	0.0	20.2	21.7	23.4	27.1	27.7
13	IET 28408	52.8	53.7	51.3	0.4	36.1	27.0	44.8	42.6	38.6	47.9	45.1	48.4	0.1	26.2	30.1	38.1	27.8	33.0
14	IET 28409	52.1	46.5	52.8	0.4	34.7	11.6	43.1	46.0	35.9	47.9	37.6	44.0	0.2	28.4	24.5	19.2	28.5	28.8
15	IET 28411	55.7	49.6	50.0	0.4	26.9	27.3	38.4	41.8	36.3	51.4	42.6	49.0	0.1	19.1	23.2	42.6	23.4	31.4
16	IET 28412	59.0	52.9	51.4	0.4	30.1	16.3	38.1	39.3	36.0	50.0	46.0	50.0	0.2	20.6	21.0	28.1	23.6	29.9
17	IET 28417	53.2	44.4	51.3	0.4	25.6	29.8	34.3	31.7	33.8	47.2	30.1	49.2	0.2	15.9	16.8	20.2	28.2	26.0
18	IET 28422	45.9	47.9	50.3	0.3	42.0	20.7	30.6	35.0	34.1	41.9	39.8	49.7	0.0	31.3	24.9	24.8	27.9	30.1
19	IET 28423	41.3	46.3	50.2	0.3	29.1	5.4	34.7	41.7	31.1	42.9	26.0	48.3	0.1	20.9	14.0	30.3	28.8	26.4
20	IET 28425	57.4	55.7	49.7	0.4	27.4	30.3	28.9	42.5	36.5	56.4	40.6	49.8	0.3	18.8	22.4	18.7	35.6	30.3
21	IET 28427	55.0	48.7	49.7	0.4	33.8	12.6	24.5	40.5	33.1	54.0	35.5	48.5	0.2	27.2	19.6	15.3	34.0	29.3
22	IET 28429	51.2	51.9	47.2	0.2	28.9	29.5	35.1	42.3	35.8	49.5	24.3	48.5	0.1	21.6	17.7	25.1	37.2	28.0
23	IET 28432	58.8	43.0	51.2	0.4	27.6	8.6	27.8	40.2	32.2	55.0	26.7	49.5	0.3	20.2	16.6	26.6	35.3	28.8
24	IET 27908	51.1	46.6	47.2	0.4	33.2	11.6	31.1	44.1	33.1	50.0	35.4	48.5	0.0	27.0	14.0	28.0	35.0	29.7
25	IET 27876	52.5	54.7	52.4	0.4	30.6	15.8	36.3	36.4	34.9	47.5	39.8	49.0	0.2	22.1	21.8	22.4	28.3	28.9
26	IET 25713	53.7	49.3	51.4	0.4	29.6	35.7	26.4	31.7	34.8	53.0	31.9	50.3	0.3	22.4	30.4	26.5	28.9	30.5
27	IET 26468	53.9	45.7	50.3	0.4	27.2	28.7	33.6	35.8	34.4	45.8	28.3	48.4	0.2	19.3	16.7	36.2	37.3	29.0
28	IET 26780	57.9	52.5	50.6	0.3	29.2	33.0	36.4	33.6	36.7	55.5	45.7	48.0	0.2	22.6	7.2	21.5	31.1	29.0
29	N-22	53.3	53.9	50.8	0.4	30.5	22.6	37.5	29.6	34.8	49.2	39.4	48.6	0.3	21.7	12.9	18.4	30.8	27.7
30	Vandana	50.6	51.0	50.3	0.3	24.2	22.3	31.3	25.6	32.0	49.8	18.7	48.5	0.3	18.0	11.3	29.3	26.8	25.3
	Mean	**53.6**	**50.3**	**50.6**	**0.4**	**31.6**	**20.2**	**36.0**	**38.2**	**35.1**	**49.5**	**39.5**	**48.6**	**0.2**	**24.0**	**20.4**	**26.9**	**29.8**	**29.9**
	LSD (Treatment)					0.508*					LSD (Treatment x Genotype)						ns		
	LSD (Location x Treatment)					1.432**					LSD (Location x Treatment x Genotype)						ns		
	LSD (Genotype)					1.493*					CV (%)						11		
	LSD (Location x Genotype)					5.55**													

Table 6.3.20 Heat tolerance indices of different rice genotypes. The indices are computed based on grain obtained under control (Yp) and elevated temperature conditions. Each value represents the mean of 8 locations during Kharif-2019

S.No.	Genotypes	Yp	Ys	HSI	RHI	HTI	GMP	TOL	MPI	SSI	YSI	HI	STI	HM	K1STI	K2STI	Rank Sum	Mean Rank	Sem
1	IET 28384	535.7	367.0	0.898	1.055	0.685	443	169	451	0.953	0.685	0.653	0.557	436	0.813	0.909	195	14.7	1.7
2	IET 28386	644.1	377.5	1.174	0.905	0.586	493	267	511	0.981	0.586	0.575	0.689	476	1.176	0.962	173	13.4	1.6
3	IET 28387	655.3	446.5	0.904	1.943	0.681	541	209	551	1.160	0.681	0.790	0.829	531	1.217	1.345	265	20.0	2.0
4	IET 28390	640.3	450.4	0.842	2.005	0.703	537	190	545	1.170	0.703	0.823	0.817	529	1.162	1.368	271	20.5	2.0
5	IET 27668	622.7	405.5	0.990	1.857	0.651	503	217	514	1.053	0.651	0.686	0.716	491	1.099	1.109	222	17.1	1.2
6	IET 28393	642.8	452.5	0.840	1.087	0.704	539	190	548	1.175	0.704	0.827	0.824	531	1.171	1.381	271	20.6	2.0
7	IET 28397	643.9	461.6	0.804	1.107	0.717	545	182	553	1.199	0.717	0.859	0.842	538	1.175	1.437	293	22.3	2.4
8	IET 28400	627.1	431.6	0.885	1.063	0.688	520	196	529	1.121	0.688	0.772	0.767	511	1.115	1.257	256	19.7	1.3
9	IET 28402	599.2	396.1	0.962	1.021	0.661	487	203	498	1.029	0.661	0.680	0.673	477	1.018	1.059	203	15.7	0.5
10	IET 28403	635.5	472.2	0.729	1.147	0.743	548	163	554	1.226	0.743	0.911	0.850	542	1.145	1.504	296	22.4	2.7
11	Gontra Bidhan-3	654.0	449.9	0.886	1.062	0.688	542	204	552	1.169	0.688	0.804	0.834	533	1.212	1.366	269	20.6	1.9
12	IET 28407	548.2	296.6	1.302	0.836	0.541	403	252	422	0.770	0.541	0.417	0.461	385	0.852	0.594	92	6.7	2.6
13	IET 28408	607.4	395.0	0.992	1.004	0.650	490	212	501	1.026	0.650	0.667	0.680	479	1.046	1.053	193	14.9	0.3
14	IET 28409	706.0	415.6	1.167	0.909	0.589	542	290	561	1.080	0.589	0.636	0.832	523	1.413	1.166	210	16.2	2.4
15	IET 28411	572.8	328.5	1.210	0.886	0.574	434	244	451	0.853	0.574	0.489	0.533	418	0.930	0.728	122	9.2	1.9
16	IET 28412	634.4	397.4	1.060	0.967	0.626	502	237	516	1.032	0.626	0.647	0.715	489	1.141	1.065	197	15.4	1.2
17	IET 28417	469.4	270.9	1.200	0.891	0.577	357	199	370	0.704	0.577	0.406	0.360	344	0.624	0.495	109	7.9	2.8
18	IET 28422	574.5	355.9	1.080	0.957	0.620	452	219	465	0.924	0.620	0.573	0.580	440	0.935	0.855	154	11.7	1.1
19	IET 28423	614.8	342.1	1.259	0.859	0.556	459	273	478	0.888	0.556	0.494	0.596	440	1.071	0.789	131	9.9	2.0
20	IET 28425	595.9	375.2	1.051	0.972	0.630	473	221	486	0.975	0.630	0.614	0.634	460	1.007	0.950	172	13.1	0.7
21	IET 28427	619.2	397.7	1.015	0.992	0.642	496	221	508	1.033	0.642	0.663	0.698	484	1.086	1.067	195	15.3	0.9
22	IET 28429	597.4	328.2	1.279	0.848	0.549	443	269	463	0.853	0.549	0.468	0.556	424	1.011	0.727	116	8.7	2.2
23	IET 28432	583.7	444.4	0.677	1.176	0.761	509	139	514	1.154	0.761	0.879	0.735	505	0.966	1.332	256	18.8	2.6
24	IET 27908	698.7	392.5	1.244	0.867	0.562	524	306	546	1.019	0.562	0.573	0.777	503	1.384	1.039	182	14.1	2.5
25	IET 27876	538.6	325.4	1.124	0.933	0.604	419	213	432	0.845	0.604	0.510	0.497	406	0.822	0.714	132	9.8	1.9
26	IET 25713	562.2	376.8	0.936	1.035	0.670	460	185	470	0.979	0.670	0.656	0.600	451	0.896	0.958	199	15.1	1.0
27	IET 26468	526.3	347.7	0.963	1.020	0.661	428	179	437	0.903	0.661	0.597	0.519	419	0.785	0.816	169	12.7	1.7
28	IET 26780	537.8	432.9	0.553	1.243	0.805	483	105	485	1.124	0.805	0.905	0.660	480	0.820	1.264	240	17.9	2.7
29	N-22	473.7	314.6	0.953	1.025	0.664	386	159	394	0.817	0.664	0.543	0.422	378	0.636	0.668	169	12.4	2.6
30	Vandana	434.5	306.9	0.833	1.091	0.706	365	128	371	0.797	0.706	0.563	0.378	360	0.535	0.636	194	14.1	3.3
	Mean	**593.2**	**385.2**	**0.994**	**1.092**	**0.650**	**477**	**208**	**489**	**1.000**	**0.650**	**0.656**	**0.654**	**466**	**1.009**	**1.020**	**198**	**15.0**	**1.9**

HIS = Heat Stress Index; RHI = Relative Heat Stress Index; GMP= Geometric Mean of Productivity; TOL = Tolerance; SSI= Stress Susceptibility Index; YSI= Yield Stability Index; STI= Stress Tolerance Index; MPI = Mean Productivity Index

Table 6.3.21 Correlation between Heat Tolerance Indices and mean grain yield recorded under control (Yp) and elevated temperature (Ys) conditions

	Yp	**Ys**	**HSI**	**RHI**	**HTI**	**GMP**	**TOL**	**MPI**	**SSI**	**YSI**	**HI**	**STI**	**HM**	**K1STI**	**K2STI**
Yp	**1.00**	0.70	0.08	0.19	-0.08	0.90	0.56	0.94	0.70	-0.08	0.41	0.89	0.86	1.00	0.69
Ys	**0.70**	**1.00**	-0.65	0.49	0.65	0.94	-0.20	0.91	1.00	0.65	0.94	0.95	0.97	0.70	1.00
HSI	0.08	**-0.65**	**1.00**	-0.47	-1.00	-0.36	0.87	-0.27	-0.65	-1.00	-0.87	-0.37	-0.43	0.09	-0.66
RHI	0.19	**0.49**	-0.47	**1.00**	0.47	0.39	-0.31	0.36	0.49	0.47	0.53	0.40	0.42	0.19	0.50
HTI	-0.08	**0.65**	-1.00	0.47	**1.00**	0.36	-0.87	0.27	0.65	1.00	0.87	0.37	0.43	-0.09	0.66
GMP	**0.90**	**0.94**	-0.36	0.39	0.36	**1.00**	0.14	1.00	0.94	0.36	0.76	1.00	1.00	0.89	0.93
TOL	**0.56**	-0.20	0.87	-0.31	-0.87	0.14	**1.00**	0.23	-0.20	-0.87	-0.53	0.13	0.06	0.56	-0.22
MPI	0.94	**0.91**	-0.27	0.36	0.27	1.00	0.23	**1.00**	0.91	0.27	0.70	0.99	0.98	0.93	0.90
SSI	**0.70**	**1.00**	-0.65	0.49	0.65	0.94	-0.20	0.91	**1.00**	0.65	0.94	0.95	0.97	0.70	1.00
YSI	-0.08	**0.65**	-1.00	0.47	1.00	0.36	-0.87	0.27	0.65	**1.00**	0.87	0.37	0.43	-0.09	0.66
HI	**0.41**	**0.94**	-0.87	0.53	0.87	0.76	-0.53	0.70	0.94	0.87	**1.00**	0.77	0.81	0.40	0.94
STI	**0.89**	**0.95**	-0.37	0.40	0.37	1.00	0.13	0.99	0.95	0.37	0.77	**1.00**	1.00	0.89	0.94
HM	**0.86**	**0.97**	-0.43	0.42	0.43	1.00	0.06	0.98	0.97	0.43	0.81	1.00	**1.00**	0.86	0.96
K1STI	**1.00**	**0.70**	0.09	0.19	-0.09	0.89	0.56	0.93	0.70	-0.09	0.40	0.89	0.86	**1.00**	0.68
K2STI	**0.69**	**1.00**	-0.66	0.50	0.66	0.93	-0.22	0.90	1.00	0.66	0.94	0.94	0.96	0.68	**1.00**

HIS = Heat Stress Index; RHI = Relative Heat Stress Index; GMP= Geometric Mean of Productivity; TOL = Tolerance; SSI= Stress Susceptibility Index; YSI= Yield Stability Index; STI= Stress Tolerance Index; MPI = Mean Productivity Index

6.4 Physiological characterization of selected rice genotypes for multiple abiotic stress Tolerance

Locations: CBT, IIRR, KJT, KRK, MTU, NRRI, PTB, REWA, RANCHI, PNR and TTB

Abiotic stress is the main factor negatively affecting crop growth and productivity worldwide. About 90% of rice (Oryza sativa L.) is produced and consumed in Asia, where the demand for rice is on the increase due to increasing population. Rice is a semi-aquatic plant and grown well under lowland flooded anaerobic conditions but to sustain production and productivity of rice under changing climate specially abiotic stresses is big challenge in coming years. As a staple food for nearly half of the world's population, and in light of projected population growth, improving and increasing rice yield is imperative. This book presents current research on abiotic stresses including extreme temperature variance, drought, hypoxia, salinity, heavy metal, nutrient deficiency and toxicity stresses. Going further, it identifies a variety of approaches to alleviate the damaging effects and improving the stress tolerance of rice. In view of the importance of the abiotic stresses in rice production and productivity a trial was formulated to assess tolerance to multiple abiotic stresses under AICRIP Plant physiology Programme.

During kharif-2029 season this trial was conducted in 11 centres with 23 rice genotype taken from AVT-1-IME set and some genotypes were taken from the submergence tolerance set obtained from NRRI. Under this experiment, only laboratory experiments were conducted to screen the above genotypes with the following. 1. Anaerobic germination: In this situation, the genotypes were imposed to the stress by allowing to germinate in water at a depth of 15 cm (Submergence stress). 2. Water stress: Seeds were allowed to germinate under 1% and 2% mannitol solutions. 3. Salinity stress: Sodium chloride of concentration 200mM (Water potential: -1.26, PF: 4.11) was used for germinating the seeds. In case of control situations, seedlings were grown in Hoagland's solution and the following observations were recorded in each of these stresses and control grown situations. Seed germination in percentage, shoot, root lengths in cms and seedling vigour were recorded. Root, shoot length, germination percentage and seedling vigour (Gupta 1998) were recorded during experimental period. Location wise data is presented in *(Tables 6.4.1 to 6.4.16).*

Salinity stress: Screening for salinity tolerance was done at CBT, KJT, KRK, MTU, PNR, PTB, REWA and NRRI centres. Salinity treatment significantly reduced the mean (average of all locations) root and shoot dry weight *(Fig.6.4.1).* The mean root dry weight for all genotypes was reduced by >55% in comparison with control and the inhibition in mean dry weight is >60%. Significant variation was observed amongst the genotypes. The reduction in mean dry weight varied from 73% (IET 27772) to >39% (IET 27757, IET27758, Brahmana Nakhi). Similarly, the reduction in mean shoot weight varied from >67% (IET 27762) to >36% (IET 27758) with a mean of -60% for all the tested genotypes *(Fig.6.4.1)*

Root length and shoot length is another important seedling trait which show significant reduction under salinity treatment in all the tested genotypes. The reduction in mean root length (mean of all locations) varied from >51% (IET 27773) followed by AC3577, IET 27772 (>50% reduction) to 16% reduction (IET 27737) with a mean (Mean of all genotypes and locations) of >39% reduction in comparison with control treatment *(Fig.6.4.2)*. Similarly, mean shoot length (mean of all genotypes and locations) was reduced by >37% in comparison with control treatment. The reduction in shoot length varied from >50% (Mahulatha) followed by IET 27772 (>46% reduction) to 9.4% (IET 27737). In all other genotypes the reduction in shoot length is >30%, in fact only 9 genotypes recorded less reduction in shoot length than the mean reduction for all genotypes.

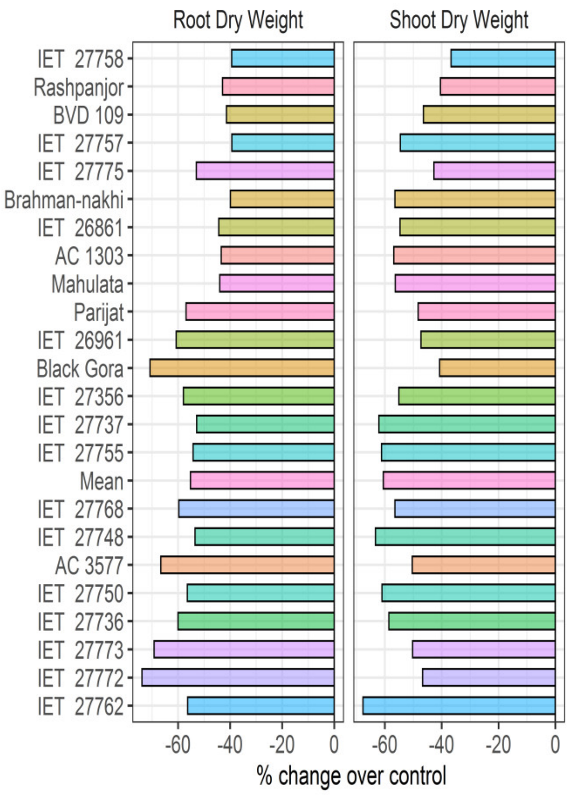


Fig 6.4.1: Influence of salinity stress on root and shoot dry weight of different rice genotypes. Each bar represents the mean of all locations.

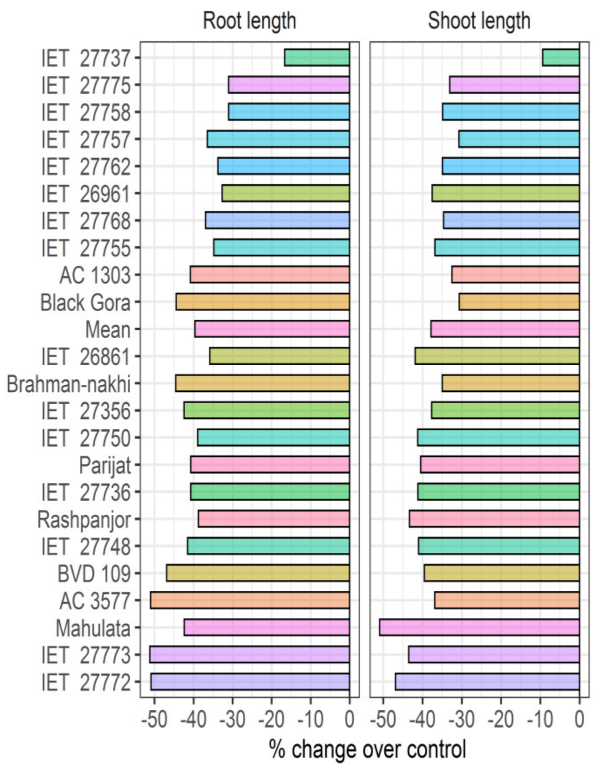


Fig 6.4.2: Influence of salinity stress on root and shoot length of different rice genotypes. Each bar represents the mean of all locations.

Leaf chlorophyll content was measured under both salinity and control treatments. The data revealed that leaf chlorophyll content was reduced significantly under salinity treatment. The mean (mean of all genotypes and all locations) was reduced by >34% in salinity stress in comparison with control treatment (*Fig.6.4.3)*. With the exception of 7 entries, all other genotypes recorded reduction in chlorophyll content from a minimum of 2% reduction (IET27737) to a maximum reduction of >87% (IET27356) followed by IET 27758 and IET 27758 (>70% reduction over control). No significant change in chlorophyll content was observed in IET 27755. Germination % under saline conditions is one of the important criteria for screening for salinity tolerance. The reduction in mean % germination under salinity treatment varied from >79% (IET 27737) followed by IET 27758(>57% reduction) and IET 27775 (>44% reduction over control). The reduction in % germination was lower in IET 27762 (<7% reduction) followed by IET 26861 (9.3% reduction over control). Mahulata, IET 27768, Rashpanjor and IET 27768 are the other genotypes which performed well under salinity treatment with <15% reduction in % germination in comparison with control treatment. These entries may be considered as relatively tolerant genotypes.

Seedling vigour was significantly inhibited by the salinity stress. The mean seedling vigour was reduced by >96% under salinity stress in comparison with control. The % reduction in seedling vigour was non-significant amongst the genotypes. The % reduction in seedling vigour varied from maximum of 99% (IET 27737) followed by IET 27758 (98% reduction over control) to 93% (Mahulata), 94% (IET 27773 and IET 27762 and Parijat) (*Fig.6.4.4)*.

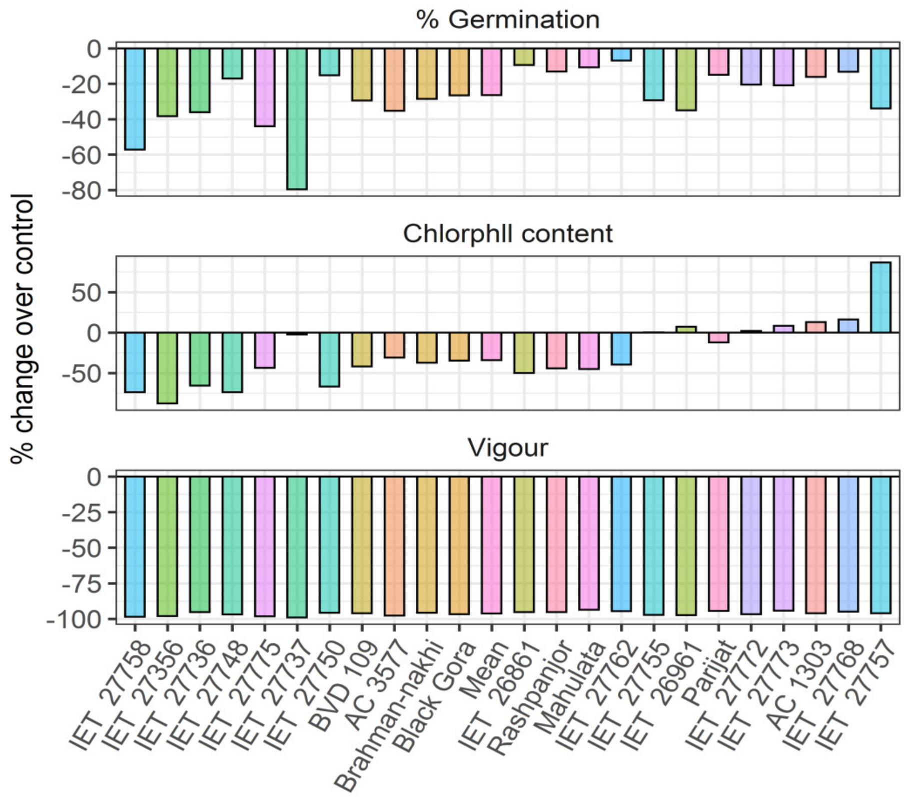


Fig.6.4.3 Influence of salinity stress on % Germination, seedling vigour and total chlorophyll content in different rice genotypes. Each bar represents the mean of all locations and the data was expressed as % change in comparison to control treatment.

Water Stress: Screening for tolerance to water stress was conducted at CBT, KJT, KRK, MTU, PNR, PTB, REWA, TTB and NRRI centers. Water stress was imposed using Mannitol (1% and 2%). Water stress caused reduction in root dry weight (*Fig.6.4.4*). Exposure to Mannitol (1%) resulted in moderate reduction in mean (mean of all genotypes and locations) by >2.6% reduction in comparison to control treatment. Maximum inhibition in root dry weight was observed in IET 27773 followed by IET 27736 to 0.58% reduction (IET 26861). Root dry weight was significantly higher in Mahalata followed by IET 27757 and IET 27758. In fact, as many as 7 genotypes recorded higher root dry weight under water stress (1% Mannitol) treatment (*Fig.6.4.4*).

Exposure to 2% mannitol solution (severe water stress) resulted in significant (>21% reduction in mean root dry weight (mean of all genotypes and locations) comparison to control (*Fig.6.4.4*). Significant variation was noticed amongst the genotypes in their response to imposed water stress. In IET 27737, IET 27773 and Black Gora the reduction in root dry weight is >40% under severe water stress in comparison with control treatment. The reduction is minimum (<5% over control) in Mahulata, IET 27757, IET 27775 and BVD 109. A significant increase in root dry weight was observed in IET 27758 (*Fig. 6.4.4)*.

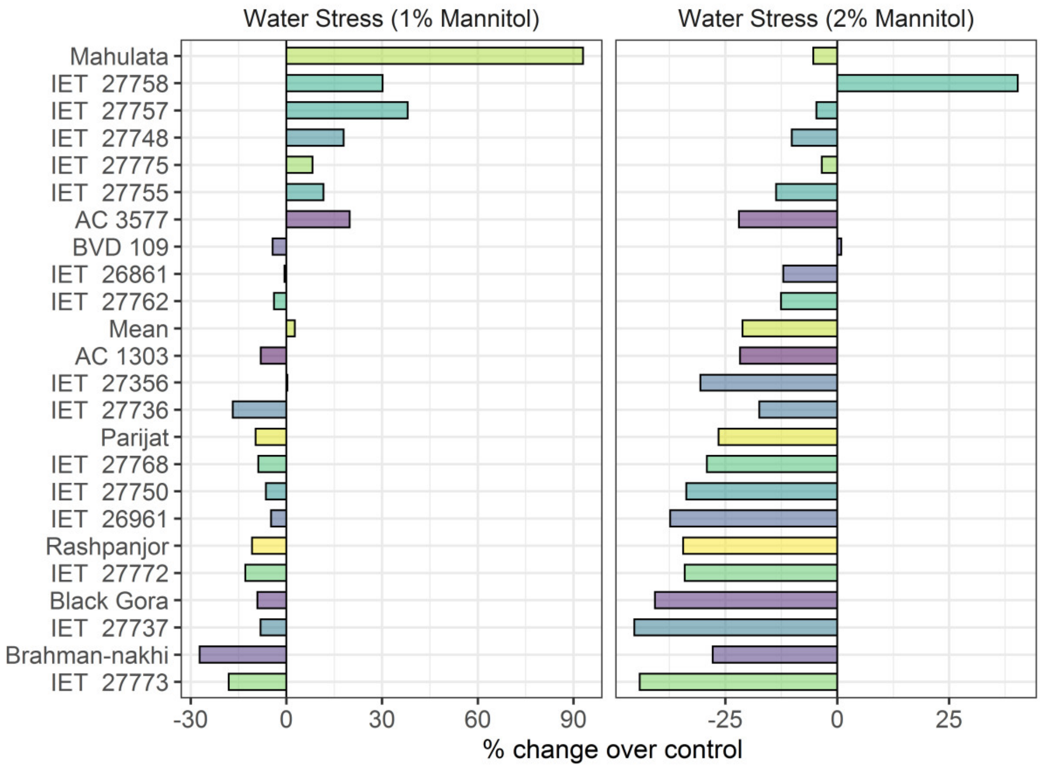


Fig. 6.4.4: Influence of Water stress (1% and 2% Mannitol) on root dry weight in different rice genotypes. Each bar represents the mean of all locations. The data was presented as % change under water stress in comparison with control.

Water stress significantly affected the shoot weight in rice genotypes *(Fig.6.4.5)*. The mean shoot weight (mean of all genotypes and locations) was reduced by >15% under moderate water stress (1% mannitol) in comparison with control. Significant differences were observed amongst the genotypes. The % reduction in shoot dry weight is highest in IET 27748 followed by IET 27736 and minimum reduction is observed in IET 26861 (<1% reduction). IET 27737, IET 27768 and IET 27758 are the other entries which show <5% reduction shoot weight under water stress condition in comparison with control treatment (*Fig.6.4.5).* Similarly, the shoot weight was significantly reduced under severe water stress (2% mannitol) treatment. The mean shoot dry weight was reduced by >39% under severe water stress treatment. Significant differences were noticed between the genotypes in their response to the imposed stress. Maximum reduction in shoot dry weight was observed in IET 27768 followed by IET 27773. Minimum reduction in shoot weight was observed in BVD

109 (>19% reduction). In all other genotypes the reduction in shoot weight under imposed water stress is >30% in comparison with control treatment (*Fig.6.4.5)*.

Root length was significantly affected by water stress. Under moderate stress (1% mannitol) the mean root length (mean of all genotypes and locations) was reduced by >15%. Significant differences were observed amongst the genotypes in their response to water stress. The reduction in root length ranged from 29% (BVD 19) to 2% (IET 27758). In fact, in Parijat, IET 27736, IET 26861 and IET 27755 an increase in root length was observed *(Fig.6.4.6*). Exposure to 2% mannitol (severe water stress) had resulted in >27% reduction in mean root length (mean of all genotypes and locations significant differences were observed amongst the genotypes in their response to imposed stress. The reduction root length show significant variation amongst the genotypes which varied from 42% (AC 3577) followed by iET 27737 (41% reduction over control) to 5.4% (IET 27755). IET 27762, IET 27775 and IET 27768 are the other entries in which the reduction in root length was <20% and based on this trait these genotypes are relatively tolerant to severe water stress (*Fig.6.4.6).*

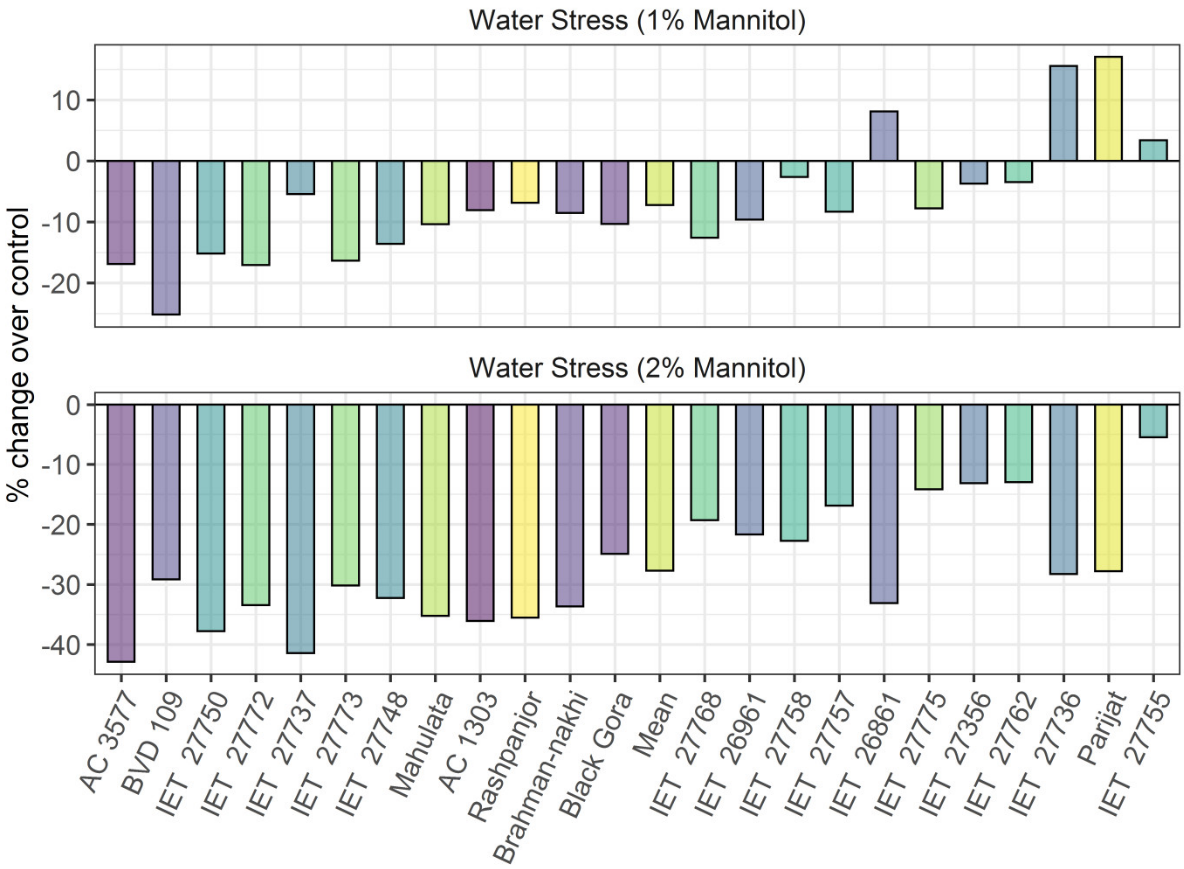


Fig. 6.4.6 : Influence of water stress (1% and 2% mannitol) on root length of different rice genotypes. Each bar represents the mean of all locations. The data was expressed as % change under water stress treatment in comparison to control.

Similarly, shoot length was also significantly influenced by water stress treatment. The mean shoot length (mean of all genotypes and locations) was reduced by 25.7% in comparison with control treatment under 1% mannitol induced water stress. Significant differences were observed amongst the genotypes in their response to imposed stress which varied from >40% (Mahulata) to 8.8% (IET 27750). IET 27750, IET 27356, IET 26861, IET 27775 and IET 27768 are the other genotypes in which the reduction in mean shoot length is <20% under water stress in comparison with control treatment. Furthermore, the reduction in mean shoot length under 2% mannitol induced water stress is >42% in comparison to control *(Fig.6.4.7)*. Significant differences were observed amongst the genotypes for their response to imposed water stress (2% mannitol) which varied from >60% (IET 27737) to 32% (IET 27755) followed by BVD 109 and IET 27768 (<35% reduction) these entries may be considered relatively tolerant to imposed stress based on this trait.

The chlorophyll content show significant reduction under water stress treatment. Water stress resulted in >19 and 26% reduction in mean chlorophyll content under 1 and 2% mannitol induced water stress treatment in comparison with control treatment, respectively. Significant variation was observed amongst the genotypes in their response to imposed water stress. Under 1% mannitol induced water stress the reduction in mean chlorophyll content varied from 75% over control (IET 27356) to <1% in IET 27773. IET 27736, Brahman-Nakhi, AC1303 and IET 27755 are the other genotypes showing <10% reduction in chlorophyll content., Parijat, Mhulata, IET 27757, AC3577, IET 27772, Black Gora and IET 26861 show higher mean chlorophyll content under water stress condition in comparison with control treatment (Fig.6.4.8). Similarly, significant differences were noticed amongst the genotypes in % reduction in mean chlorophyll content under 2% mannitol induced water stress. It ranged from 79% (IET 27356) to >3% (IET 27773). The entries IET 27755, IET 26861 and IET 27762 show <15% reduction in mean chlorophyll content. The entries IET 27737, Parijat, Black Gora, IET 27757 and Brahman-Nakhi show an increase in mean chlorophyll content under water stress *(Fig.6.4.8)*.

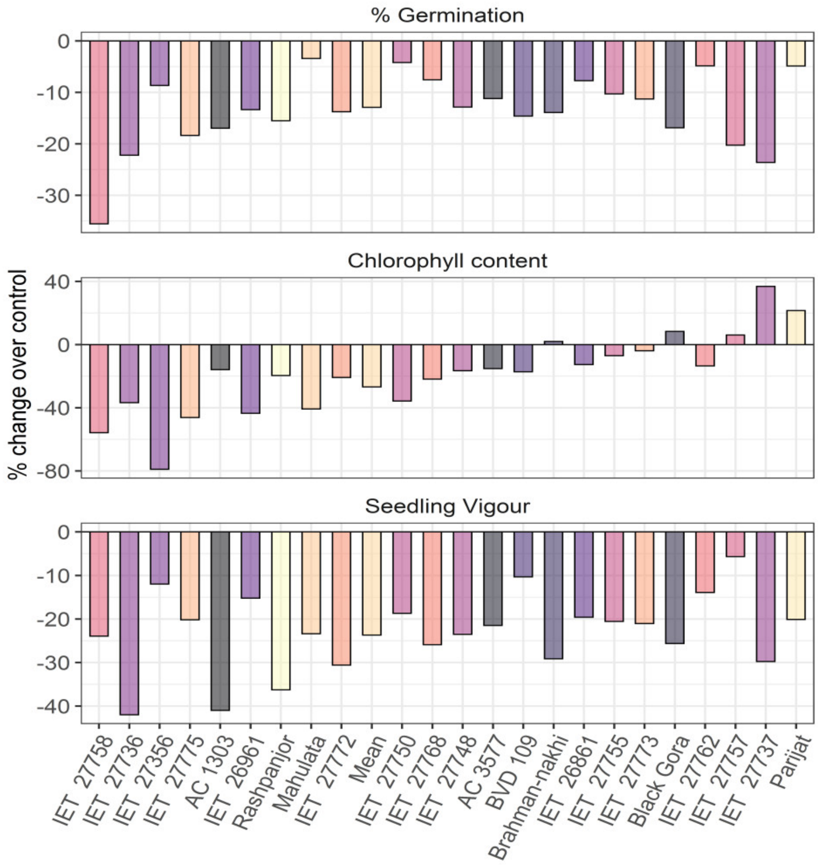


Fig. 6.4.7: Influence of 1% mannitol induced water stress on leaf chlorophyll content, % Germination and Seedling Vigour in different rice genotypes. Each bar represents the mean of all locations. The data was presented as % change in comparison with control treatment.

Germination was significantly affected by water stress treatment. The mean (mean of all genotypes and locations) was reduced by 13% under 1% mannitol induced stress. Significant variation was observed between the genotypes in their response to water stress (Fig.6.4.7). The % reduction in germination ranged from 35% (IET 27758) to 3.4% (Mhulata). The reduction in germination is <5% in IET 27750 , IET 27762 and Prarijat and between 5-10% in IET 27768, IET 26861 and IET 27356. These genotypes with <10% reduction in % germination under moderate water stress may be considered relatively tolerant to water stress. Seedling vigour is another important parameter which was calculated to delineate water stress tolerant genotypes. The mean seedling vigour (mean of all genotypes and locations) was reduced by 23% under water stress Significant differences were noticed amongst the genotypes. The reduction in seedling vigour ranged from 42% (IET 27736) followed by AC 1303 (41%) to 5.6% (IET 27757). The reduction in seedling vigour is <15% in BVD 109, IET 27356 and IET 27762. These entries with lower reduction in seedling vigour may be considered as tolerant genotypes under moderate stress. *(Fig.6.4.7).*

Germination % was significantly affected by the water stress (2% mannitol). The mean (mean of all genotypes and locations) was reduced by 18% in comparison to control treatment. Significant variation was observed amongst the genotypes in their response to imposed stress. The % reduction in germination varied from 35% (IET 27758) to 8.6% (Parijat). In genotypes Mahulata, IET 27768, BVD 109, IET 27762 and IET 27750 the reduction in germination % is <15%. These genotypes could be considered relatively tolerant to water stress. The seedling vigour was reduced under water stress induced by 2% mannitol by 9% in comparison with control. Significant variation was found amongst the genotypes in their response to imposed stress. The reduction in seedling vigour ranged from 40% (Rashpanjar) to 0.15% (Brahman-Nakhi). The genotype BVD 109, IET 27758, Mahulata, IET 27757 show increase in seedling vigour under water stress treatment *(Fig.6.4.8)*. These entries may be considered as relatively water stress tolerant.

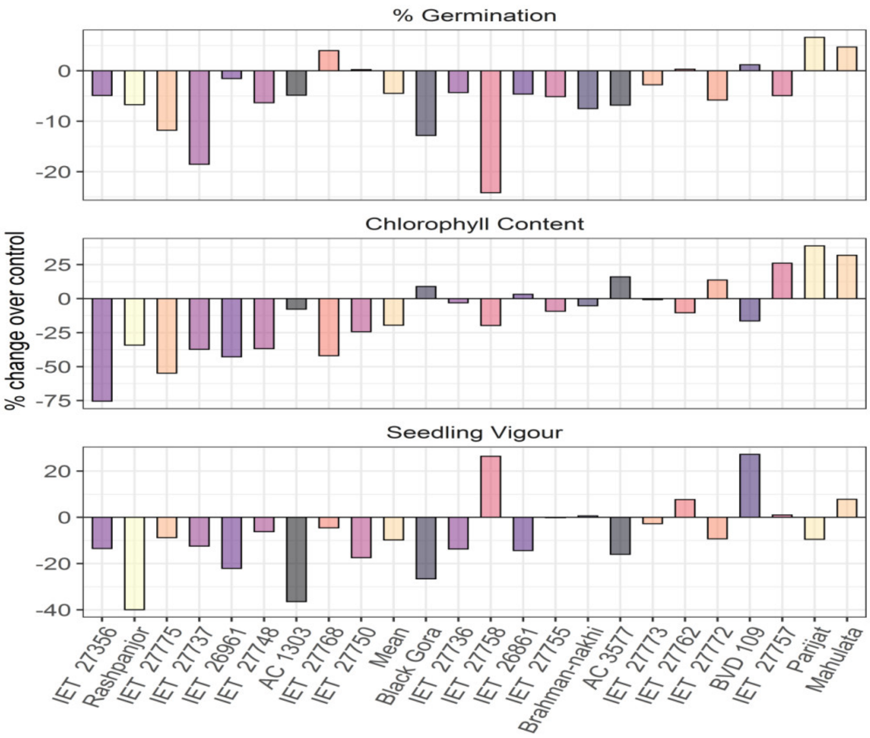


Fig.6.4.8 Influence of 2% mannitol induced water stress on % Germination, seedling vigour and total chlorophyll content in different rice genotypes. Each bar represents the mean of all locations and the data was expressed as % change in comparison to control treatment.

Anaerobic germination: Anaerobic germination (AG) is an important trait for direct-seeded rice (DSR) to be successful. Rice usually has low germination under anaerobic conditions, which leads to a poor crop stand in DSR when rain occurs after seeding. The ability of rice to germinate under water reduces the risk of poor crop stand. Twenty three rice genotypes were tested for their ability to germinate under anerobic germination. Root length was significantly reduced under anerobic condition. The mean root length was reduced by 65% under anaerobic condition in comparison with control (Fig.6.4.9). Significant differences were noticed amongst the tested entries. The reduction in root length ranged from >89% (Parijat) followed by Brahman-nakhi (84% over control) to 37% (IET 26961) and IET 27756 (39% over control). Similarly shoot length was also significantly reduced under anaerobic condition. The mean shoot length was reduced by 26% over control treatment. Significant differences were observed between the tested entries for their response to anaerobic treatment. The reduction in shoot length ranged from >71% (Parijat) to 3.9% (IET 26961). A minor increase (3% over control) was noticed in IET 27755 *(Fig.6.4.8).*

Mean root dry weight (mean of all genotype and locations) was reduced by 54% under anaerobic condition in comparison with control. Significant differences were observed amongst the genotypes. The reduction in root dry weight ranged from 100% (Parijat), IET 27731 followed by IET 27772 (97% reduction over control) to 24% (IET 26961). IET 27755 and IET 27757 are the other entries showing <30% reduction under anaerobic condition (Fig. 6.4.10). Similarly, the shoot dry weight also show significant reduction. The mean shoot weight was reduced by 44% under anaerobic condition in comparison with control. The reduction in shoot weight ranged from a maximum of 100% (Parijat, IET 27737) followed by IET 27736 (88% reduction) to 15% IET 26961 followed by Black Gora, IET 27366 and IET 27775 (<20% reduction over control).

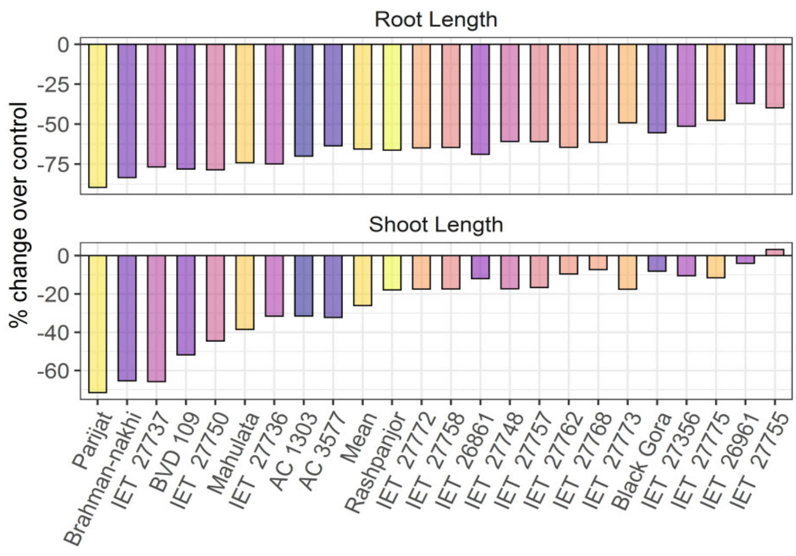


Fig.6.4.9: Influence anaerobic stress on root and shoot length of different rice genotypes. Each bar represent the mean of all locations. Data was presented as % change under anaerobic condition in comparison with control.

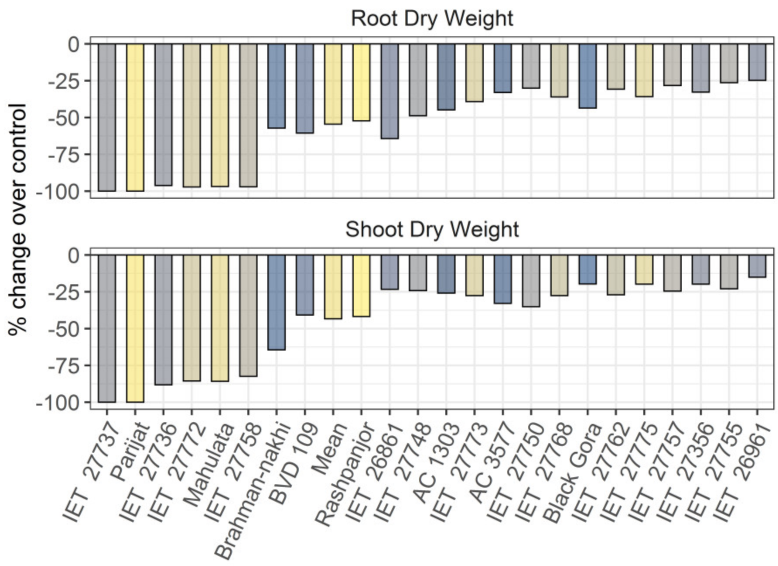


Fig.6.4.10: Influence anaerobic stress on root and shoot weight of different rice genotypes. Each bar represent the mean of all locations. Data was presented as % change under anaerobic condition in comparison with control.

Seed germination was significantly inhibited under anaerobic condition. The mean (mean of all genotypes and locations) was reduced >66% under anaerobic condition. Significant reduction in % germination was observed in all genotypes. The reduction varied from 92% (IET 27737) followed by Brahman-nakhi (83% reduction over control) to AC 3677(46%) followed by IET 27762 and Rashpanjor are the other genotypes in which the reduction in germination % is <50% in comparison to control treatment (Fig.6.4.11). These genotypes showing <50% reduction in germination % may be considered as relatively tolerant to anaerobic condition. The mean Seedling vigour was reduced by 38% under anaerobic condition. Significant differences were observed between the genotypes in their response to anaerobic treatment. The reduction in vigour ranged from 78% (IET 27736) to 2.4% (IET 27768). Rashpanjor, Mahulata, and IET 27356 are the other genotypes showing <20% reduction in vigour under anaerobic condition. These genotypes may be considered as tolerant to anaerobic stress.

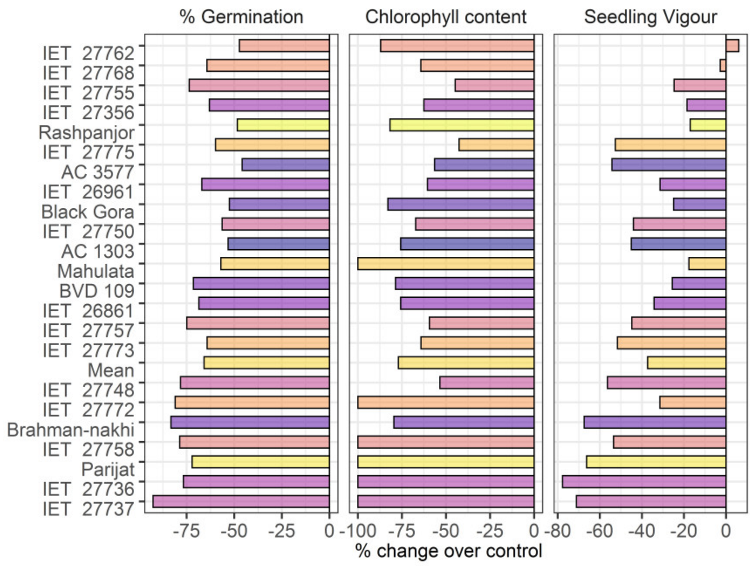


Fig. 6.4.11: Influence of anaerobic stress on % germination, seedling vigour and chlorophyll content in different rice genotypes. Each bar represents the mean of all locations. Data was expressed as % change over control treatment.

Summary & Conclusion

Screening for multiple abiotic stress tolerance was conducted at 11 AICRIP centres for salinity, water stress (1% and 2%) and anaerobic stress. Germination % under saline conditions is one of the important criteria for screening for salinity tolerance. Based on their performance under salinity stress, IET 27762, IET 26861, Mahulata, IET 27768, Rashpanjor and IET 27768 performed well and may be considered as relatively tolerant genotypes. The entries IET 27750 , IET 27762, Parijat, IET 27768, IET 26861 and IET 27356 performed well under moderate water stress (1% mannitol) where as under 2% mannitol induced stress, Mahulata, IET 27768, BVD 109, IET 27762 IET 27750, Brahman-Nakhi), IET 27758 and IET 27757 can be identified as relatively tolerant. Under anaerobic stress, all the tested entries suffered reduction in important physiological trait. However, IET 27768, Rashpanjor, Mahulata, and IET 27356 could be identified as relatively suitable for anaerobic conditions. Entries like IET 27762 show tolerance to salinity and water stress, IET 27768 and Mahulata performed well under salinity, water stress and anaerobic stress, IET 27356 show relative tolerance to water stress and anaerobic stress. These entries could be identified as possessing tolerance to multiple abiotic stresses.

Table 6.4.1 Physiological characterization of selected rice multiple abiotic stress tolerance at *Coimbatore* Kharif 2019

S.No.	Entries	Root Dry weight (g)				Grand Mean	Shoot dry weight (g)				Grand Mean
		Control	Salinity	WS (1% Mon)	WS (2% Mon.)		Control	Salinity	WS (1% Mon)	WS (2% Mon.)	
1	AC 1303	0.094	0.038	0.075	0.094	0.075	0.132	0.038	0.094	0.108	0.093
2	Rashpanjor	0.075	0.028	0.042	0.056	0.050	0.113	0.047	0.099	0.085	0.086
3	Black Gora	0.113	0.028	0.085	0.080	0.076	0.099	0.075	0.104	0.108	0.097
4	Parijat	0.099	0.058	0.075	0.085	0.079	0.104	0.066	0.066	0.104	0.085
5	Brahman-nakhi	0.056	0.036	0.030	0.056	0.045	0.066	0.044	0.052	0.094	0.064
6	AC 3577	0.088	0.014	0.092	0.089	0.071	0.080	0.033	0.080	0.075	0.067
7	Mahulata	0.085	0.056	0.293	0.160	0.148	0.075	0.056	0.075	0.104	0.078
8	BVD 109	0.052	0.052	0.075	0.104	0.071	0.061	0.038	0.080	0.113	0.073
9	IET 27736	0.132	0.042	0.089	0.141	0.101	0.146	0.056	0.078	0.104	0.096
10	IET 26861	0.034	0.031	0.024	0.066	0.039	0.099	0.047	0.094	0.094	0.084
11	IET 27750	0.099	0.024	0.071	0.071	0.066	0.052	0.037	0.052	0.075	0.054
12	IET 27773	0.160	0.047	0.104	0.104	0.104	0.099	0.064	0.099	0.113	0.094
13	IET 27772	0.122	0.015	0.068	0.089	0.074	0.089	0.040	0.082	0.094	0.076
14	IET 27768	0.089	0.038	0.052	0.066	0.061	0.066	0.047	0.069	0.104	0.071
15	IET 27762	0.136	0.040	0.124	0.165	0.116	0.099	0.046	0.080	0.122	0.087
16	IET 27758	0.028	0.028	0.066	0.141	1.979	0.075	0.022	0.094	0.094	0.071
17	IET 27737	0.075	0.014	0.078	0.047	0.054	0.085	0.028	0.103	0.113	0.082
18	IET 27775	0.077	0.019	0.099	0.127	0.080	0.106	0.028	0.075	0.080	0.072
19	IET 27356	0.113	0.020	0.094	0.092	0.080	0.071	0.015	0.085	0.080	0.062
20	IET 27757	0.038	0.033	0.098	0.056	0.056	0.089	0.047	0.094	0.104	0.084
21	IET 26961	0.108	0.028	0.084	0.052	0.068	0.071	0.038	0.089	0.085	0.071
22	IET 27755	0.028	0.014	0.033	0.056	0.033	0.085	0.033	0.080	0.122	0.080
23	IET 27748	0.023	0.014	0.042	0.072	0.038	0.061	0.042	0.056	0.061	0.055
	Mean	**0.084**	**0.031**	**0.082**	**0.090**	**0.155**	**0.088**	**0.043**	**0.082**	**0.097**	**0.077**
	LSD (Treatments)			NS					0.00056**		
	LSD (Variety)			NS					0.00021**		
	Treatments x Variety			NS					0.00025**		
	CV (%)			NS					12.36		

Table 6.4.2 Physiological characterization of selected rice multiple abiotic stress tolerance at Coimbatore Kharif 2019

S.No.	Entries	Total Chlorophyll content				Grand Mean	% Germination				Grand Mean
		Control	Salinity	WS (1% Mon,)	WS (2% Mon.)		Control	Salinity	WS (1% Mon)	WS (2% Mon.)	
1	AC 1303	2.38	0.95	1.90	2.38	1.91	100	70	100	100	93
2	Rashpanjor	1.90	0.72	1.07	1.43	1.28	100	85	100	100	96
3	Black Gora	2.86	0.71	2.14	2.02	1.93	100	60	100	96	89
4	Parijat	2.50	1.48	1.90	2.14	2.00	100	85	100	100	96
5	Brahman-nakhi	1.43	0.90	0.76	1.43	1.13	100	80	100	100	95
6	AC 3577	2.21	0.36	2.33	2.26	1.79	98	75	92	98	91
7	Mahulata	2.14	1.43	1.79	4.05	2.35	100	100	100	100	100
8	BVD 109	1.31	1.29	1.90	2.62	1.78	92	70	90	100	88
9	IET 27736	3.33	1.07	2.26	3.57	2.56	100	80	75	100	89
10	IET 26861	0.83	0.95	0.59	1.67	1.01	100	90	98	90	95
11	IET 27750	2.50	0.59	1.79	1.79	1.67	100	90	92	100	96
12	IET 27773	4.05	1.19	2.62	2.62	2.62	98	70	92	100	90
13	IET 27772	3.10	0.12	1.72	2.26	1.80	100	70	100	85	89
14	IET 27768	2.26	0.95	1.31	2.00	1.63	100	96	98	100	99
15	IET 27762	3.46	1.03	3.14	4.16	2.95	100	100	100	100	100
16	IET 27758	0.72	0.59	1.67	3.57	1.64	70	40	45	60	54
17	IET 27737	1.90	0.36	1.97	1.19	1.36	75	10	65	80	58
18	IET 27775	1.95	0.48	2.50	3.21	2.04	80	35	90	80	71
19	IET 27356	2.86	0.50	2.38	2.33	2.02	100	25	100	96	80
20	IET 27757	0.95	0.83	2.50	1.43	1.43	100	60	96	100	89
21	IET 26961	2.74	0.71	2.12	1.31	1.72	100	45	100	100	86
22	IET 27755	0.71	0.36	0.83	1.43	0.83	100	90	100	100	98
23	IET 27748	0.59	0.35	1.07	1.83	0.96	100	100	100	96	99
	Mean	**2.12**	**0.78**	**1.84**	**2.29**	**1.76**	**96**	**71**	**93**	**95**	**89**
	LSD (Treatments)			0.035**							
	LSD (Variety)			0.078**							
	Treatments x Variety			0.156**							
	CV (%)			4.18							

Table 6.4.3 Physiological characterization of selected rice multiple abiotic stress tolerance at Coimbatore Kharif 2019

S.No.	Entries	Seedling Vigour				Grand Mean	Tolerance				Grand Mean
		Control	Salinity	WS (1% Mon)	WS (2% Mon.)		Control	Salinity	WS (1% Mon)	WS (2% Mon.)	
1	AC 1303	2454	573	1841	2198	1766	0.00	7.00	3.00	3.00	3.25
2	Rashpanjor	2045	695	1534	1534	1452	0.00	9.00	5.00	5.00	4.75
3	Black Gora	2301	675	2045	1963	1746	0.00	5.00	0.00	5.00	2.50
4	Parijat	2198	1147	1534	2045	1731	0.00	7.00	5.00	5.00	4.25
5	Brahman-nakhi	1329	695	890	1636	1138	0.00	9.00	9.00	9.00	6.75
6	AC 3577	1784	383	1722	1754	1411	0.00	9.00	5.00	5.00	4.75
7	Mahulata	1738	1227	1585	2863	1853	0.00	7.00	5.00	0.00	3.00
8	BVD 109	1129	680	1518	2352	1420	0.00	3.00	5.00	1.00	2.25
9	IET 27736	3017	859	1365	2659	1975	0.00	9.00	5.00	3.00	4.25
10	IET 26861	1432	828	1253	1565	1269	7.00	9.00	7.00	7.00	7.50
11	IET 27750	1636	598	1223	1585	1261	0.00	7.00	7.00	7.00	5.25
12	IET 27773	2756	859	2023	2352	1997	0.00	5.00	1.00	1.00	1.75
13	IET 27772	2301	344	1626	1695	1491	0.00	3.00	5.00	5.00	3.25
14	IET 27768	1687	883	1283	1841	1424	0.00	7.00	7.00	7.00	5.25
15	IET 27762	2556	951	2219	3119	2211	0.00	9.00	0.00	0.00	2.25
16	IET 27758	787	196	782	1534	825	0.00	9.00	9.00	9.00	6.75
17	IET 27737	1304	46	1283	1391	1006	0.00	7.00	7.00	7.00	5.25
18	IET 27775	1595	179	1703	1800	1319	0.00	3.00	3.00	5.00	2.75
19	IET 27356	1994	92	1943	1796	1456	0.00	7.00	1.00	5.00	3.25
20	IET 27757	1380	522	2012	1738	1413	0.00	9.00	1.00	5.00	3.75
21	IET 26961	1943	322	1882	1483	1407	0.00	5.00	1.00	7.00	3.25
22	IET 27755	1227	460	1227	1943	1214	0.00	3.00	7.00	5.00	3.75
23	IET 27748	920	614	1074	1394	1000	5.00	3.00	9.00	9.00	6.50
	Mean	**1805**	**601**	**1546**	**1923**	**1469**	**0.52**	**6.57**	**4.65**	**5.00**	**4.18**
	LSD (Treatments)			13.0**					8.58**		
	LSD (Variety)			31.2**					2.057**		
	Treatments x Variety			634**					4.115**		
	CV (%)			2.99					4.66		

Table 6.4.4 Physiological characterization of selected rice multiple abiotic stress tolerance at Karjat Kharif 2019

S.No.	Entries	Seedling Vigour					Grand Mean	Germination (%)					Grand Mean
		Anaerobic germination	Control	Saline Test	WS (1% Mon)	WS (2% Mon.)		Anaerobic germination	Control	Saline Test	WS (1% Mon)	WS (2% Mon.)	
1	AC 1303	1188.7	1665.3	106.7	1350.0	656.0	993.3	29.7	76.3	71.0	72.7	82.7	66.5
2	Rashpanjor	1954.0	1723.3	99.7	1697.3	1198.3	1334.5	47.0	83.7	78.7	92.0	84.0	77.1
3	Black Gora	1302.3	1399.3	98.7	1176.0	618.3	918.9	47.7	77.0	61.0	80.3	71.3	67.5
4	Parijat	761.3	1194.0	150.7	1336.7	877.0	863.9	32.3	78.0	71.3	78.0	75.0	66.9
5	Brahman-nakhi	226.0	708.3	100.3	776.0	637.0	489.5	13.0	63.3	55.7	67.0	76.0	55.0
6	AC 3577	774.7	1580.7	97.0	1079.7	1032.0	912.8	26.3	74.0	61.7	65.3	63.0	58.1
7	Mahulata	2361.0	1938.3	90.7	1277.7	1394.0	1412.3	59.7	88.0	74.0	80.3	81.7	76.7
8	BVD 109	1036.3	970.0	133.3	972.3	1123.7	847.1	39.7	68.3	74.7	68.7	81.7	66.6
9	IET 27736	450.7	1147.3	95.0	653.0	739.3	617.1	15.3	64.7	42.7	48.7	59.3	46.1
10	IET 26861	928.7	1072.3	73.3	665.3	761.0	700.1	28.0	82.3	51.0	54.0	66.3	56.3
11	IET 27750	853.7	1298.7	118.7	1261.7	728.7	852.3	31.0	84.3	79.0	83.3	73.3	70.2
12	IET 27773	771.7	1313.3	99.0	1146.0	1155.3	897.1	22.0	74.3	70.0	66.7	76.3	61.9
13	IET 27772	1458.3	1070.0	54.3	792.7	1239.0	922.9	35.3	75.0	48.3	52.0	73.7	56.9
14	IET 27768	1688.3	1149.3	145.7	1001.7	964.7	989.9	50.0	86.3	83.3	73.7	83.7	75.4
15	IET 27762	1960.0	1294.3	176.0	1238.0	1056.7	1145.0	57.0	89.0	77.7	71.3	71.3	73.3
16	IET 27758	295.0	408.3	46.0	227.7	274.3	250.3	11.7	47.0	31.7	28.3	29.0	29.5
17	IET 27737	376.0	945.7	170.0	568.7	386.0	489.3	13.0	61.0	73.3	35.0	46.7	45.8
18	IET 27775	610.0	1035.7	78.7	719.0	923.7	673.4	18.3	66.7	58.0	53.3	76.7	54.6
19	IET 27356	1208.7	908.0	51.0	1073.0	833.0	814.7	36.7	68.3	50.3	68.3	64.7	57.7
20	IET 27757	807.3	822.0	87.0	817.7	1230.0	752.8	24.3	53.7	51.3	58.7	76.7	52.9
21	IET 26961	766.3	467.3	65.7	629.3	626.7	511.1	24.7	48.3	53.3	53.0	60.0	47.9
22	IET 27755	1346.7	993.0	83.3	777.7	924.3	825.0	40.3	74.0	52.3	66.7	69.3	60.5
23	IET 27748	854.0	1517.7	174.3	1141.3	1003.7	938.2	25.7	85.3	74.3	69.7	69.7	64.9
	Mean	**1042.6**	**1157.5**	**104.1**	**973.0**	**886.2**	**832.7**	**31.7**	**72.6**	**62.8**	**64.7**	**70.1**	**60.4**
	LSD (Treatments)			35.57**							2.14**		
	LSD (Variety)			76.30**							4.59**		
	Treatments x Variety			170.62**							10.27**		
	CV (%)			9.66							8.01		

Table 6.4.5 Physiological characterization of selected rice multiple abiotic stress tolerance on at Karjat Kharif 2019

S.No.	Entries	Root Length (cm)					Grand Mean	Shoot Length (cm)					Grand Mean
		Anaerobic germination	Control	Saline Test	WS (1% Mon)	WS (2% Mon.)		Anaerobic germination	Control	Saline Test	WS (1% Mon)	WS (2% Mon.)	
1	AC 1303	5.93	8.67	0.23	8.31	1.17	4.86	34.37	12.06	1.28	10.27	6.73	12.94
2	Rashpanjor	6.91	8.35	0.14	7.78	6.59	5.95	34.86	11.49	1.13	10.71	7.68	13.17
3	Black Gora	6.38	6.67	0.11	5.72	1.87	4.15	21.05	10.01	1.52	8.91	6.80	9.66
4	Parijat	3.85	8.33	0.51	8.41	4.81	5.18	19.87	7.97	1.60	8.75	6.86	9.01
5	Brahman-nakhi	2.73	6.11	0.23	5.99	2.88	3.59	14.53	5.49	1.57	5.59	5.50	6.54
6	AC 3577	5.78	10.57	0.23	9.14	7.38	6.62	23.91	7.98	1.34	7.39	9.02	9.93
7	Mahulata	8.00	8.84	0.37	7.61	7.71	6.51	31.61	10.47	0.85	8.30	9.35	12.12
8	BVD 109	3.85	7.55	0.45	7.59	6.97	5.28	22.30	7.42	1.34	6.55	6.81	8.88
9	IET 27736	5.17	8.12	0.27	7.01	6.17	5.35	24.36	7.49	1.96	6.50	6.44	9.35
10	IET 26861	5.39	5.72	0.22	5.97	4.47	4.35	27.79	7.31	1.35	6.35	6.98	9.96
11	IET 27750	5.19	9.09	0.34	9.62	4.89	5.83	22.37	6.27	1.15	5.53	5.15	8.09
12	IET 27773	8.25	8.88	0.23	9.04	6.52	6.58	26.78	8.14	1.18	8.15	8.61	10.57
13	IET 27772	8.50	7.98	0.25	8.59	8.62	6.79	32.71	6.93	0.87	6.59	8.19	11.06
14	IET 27768	6.44	6.58	0.63	7.01	5.32	5.20	27.30	5.65	1.12	6.61	6.23	9.38
15	IET 27762	5.72	7.87	0.57	9.18	8.18	6.30	28.67	7.13	1.70	8.17	6.63	10.46
16	IET 27758	5.96	2.81	0.39	2.64	4.37	3.23	19.26	4.95	1.07	5.37	5.07	7.15
17	IET 27737	7.18	7.73	0.54	7.80	3.75	5.40	21.60	8.57	1.78	8.46	4.50	8.98
18	IET 27775	5.93	5.06	0.37	4.45	4.67	4.10	27.19	8.53	0.98	9.00	7.37	10.61
19	IET 27356	7.17	7.13	0.15	7.89	6.43	5.75	25.75	7.31	0.87	7.80	6.43	9.63
20	IET 27757	6.06	7.05	0.34	6.95	7.44	5.57	27.03	8.28	1.30	7.11	8.60	10.46
21	IET 26961	7.94	4.33	0.29	4.75	4.29	4.32	23.10	5.08	0.95	7.14	6.15	8.48
22	IET 27755	6.98	5.67	0.16	6.03	6.77	5.12	26.37	7.52	1.44	5.60	6.65	9.51
23	IET 27748	7.67	8.33	0.55	8.49	8.04	6.62	25.57	9.15	1.79	7.91	6.39	10.16
	Mean	**6.22**	**7.28**	**0.33**	**7.22**	**5.62**	**5.33**	**25.58**	**7.88**	**1.31**	**7.51**	**6.88**	**9.83**
	LSD (Treatments)				0.35**						0.478**		
	LSD (Variety)				0.76**						1.06**		
	Treatments x Variety				1.68**						2.291**		
	CV (%)				14.85						11.01		

Table 6.4.6 Physiological characterization of selected rice multiple abiotic stress tolerance on at Karikal Kharif 2019

S.No.	Entries	Root (cm)					Grand Mean	Shoot length (cm)					Grand Mean	Germination (%)					Grand Mean
		Anaerobic germination	Control	Salinity	WS (1% M)	WS (2% M)		Anaerobic germination	Control	Salinity	WS (1% M)	WS (2% M)		Anaerobic germination	Control	Salinity	WS (1% M)	WS (2% M)	
1	AC 1303	0.27	11.63	9.70	13.40	14.23	9.85	0.07	52.17	26.00	13.43	10.83	20.50	11.3	100.0	87.3	100.0	100.0	79.7
2	Rashpanjor	0.20	12.43	8.97	15.87	11.83	9.86	0.03	44.37	23.30	14.83	9.07	18.32	57.3	100.0	88.7	98.0	100.0	88.8
3	Black Gora	0.17	12.43	9.73	7.33	9.00	7.73	0.17	41.40	21.10	13.03	9.70	17.08	43.3	88.7	73.3	100.0	100.0	81.1
4	Parijat	0.30	12.47	8.07	11.90	9.33	8.41	0.23	36.47	8.53	9.63	9.40	12.85	70.7	100.0	90.0	97.3	100.0	91.6
5	Brahman-nakhi	0.30	14.33	8.07	8.07	10.43	8.24	0.10	36.50	7.40	8.73	8.33	12.21	4.7	97.3	82.0	100.0	100.0	76.8
6	AC 3577	0.17	16.37	9.83	8.70	9.90	8.99	0.10	46.37	10.77	10.53	9.23	15.40	88.0	94.7	28.7	100.0	96.7	81.6
7	Mahulata	0.13	11.47	15.33	9.40	11.20	9.51	0.07	45.90	16.00	11.63	12.47	17.21	76.0	99.3	81.3	100.0	97.3	90.8
8	BVD 109	0.23	11.17	9.70	7.03	7.73	7.17	0.07	29.87	12.47	7.93	8.57	11.78	11.3	100.0	80.0	92.0	100.0	76.7
9	IET 27736	0.30	13.40	8.80	10.23	10.33	8.61	0.13	28.63	11.93	8.50	8.43	11.53	24.7	100.0	62.0	83.3	87.3	71.5
10	IET 26861	0.30	11.30	9.60	10.13	9.20	8.11	0.10	26.13	14.33	10.50	11.37	12.49	6.0	95.3	97.3	96.0	100.0	78.9
11	IET 27750	0.17	12.17	6.60	8.53	7.10	6.91	0.10	20.70	8.20	7.03	7.50	8.71	74.0	98.0	71.3	100.0	100.0	88.7
12	IET 27773	0.47	11.27	6.60	9.00	11.37	7.74	0.10	35.00	12.13	12.03	9.57	13.77	28.0	100.0	100.0	100.0	100.0	85.6
13	IET 27772	0.23	13.80	10.07	7.93	6.10	7.63	0.10	32.43	19.43	9.37	5.93	13.45	6.0	100.0	97.3	92.0	98.0	78.7
14	IET 27768	0.20	14.53	13.40	8.73	8.10	8.99	0.10	33.47	19.53	7.23	6.97	13.46	6.7	98.0	88.0	100.0	100.0	78.5
15	IET 27762	0.13	10.50	8.33	10.40	9.63	7.80	0.17	35.33	20.33	10.90	9.43	15.23	7.3	97.3	100.0	100.0	100.0	80.9
16	IET 27758	0.13	11.27	9.27	7.00	4.97	6.53	0.10	26.93	12.90	9.03	7.63	11.32	4.0	32.0	27.3	23.3	32.7	23.9
17	IET 27737	0.10	7.23	11.53	4.97	9.80	6.73	0.10	28.87	23.03	10.73	9.27	14.40	4.7	44.0	3.3	56.0	28.7	27.3
18	IET 27775	0.10	7.47	11.13	6.03	13.77	7.70	0.10	33.97	25.03	9.17	11.87	16.03	40.7	100.0	73.3	76.7	95.3	77.2
19	IET 27356	0.17	10.00	9.60	11.60	9.87	8.25	0.07	33.57	18.27	7.87	8.97	13.75	18.0	88.0	74.7	92.0	98.0	74.1
20	IET 27757	0.13	9.63	8.47	8.93	10.23	7.48	0.10	31.90	20.67	12.47	12.40	15.51	4.7	86.7	84.7	88.0	98.7	72.5
21	IET 26961	0.20	6.73	9.67	7.97	8.53	6.62	0.10	30.83	19.63	7.43	6.37	12.87	4.0	92.0	90.0	87.3	99.3	74.5
22	IET 27755	0.23	7.57	7.67	9.60	8.77	6.77	0.20	25.63	16.30	10.83	12.17	13.03	2.7	98.7	64.0	100.0	100.0	73.1
23	IET 27748	0.30	12.40	10.00	9.30	9.07	8.21	0.20	31.27	16.23	7.60	7.93	12.65	4.0	100.0	89.3	91.3	100.0	76.9
	Mean	**0.21**	**11.37**	**9.57**	**9.22**	**9.59**	**7.99**	**0.11**	**34.25**	**16.68**	**10.02**	**9.28**	**14.07**	**26.0**	**91.7**	**75.4**	**90.1**	**92.7**	**75.2**
	LSD (Treatments)			1.27**								1.024**					1.69**		
	LSD (Variety)			2.75**								2.195**					3.63**		
	Treatments x Variety			6.12**								4.914**					8.12**		
	CV (%)			20.85								28.37					5.09		

Table 6.4.7 Physiological characterization of selected rice multiple abiotic stress tolerance on at Maruteru Kharif 2019

S.No.	Entries	Root length (cm)				Grand Mean	Shoot Length (cm)				Grand Mean
		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	4.18	1.73	2.58	2.22	2.68	8.08	3.98	4.58	4.20	5.21
2	Rashpanjor	7.42	3.98	2.60	1.28	3.82	8.08	3.62	5.42	3.73	5.21
3	Black Gora	2.75	1.13	1.63	1.85	1.84	5.33	1.42	3.50	3.33	3.40
4	Parijat	4.33	1.92	2.93	2.07	2.81	6.68	3.02	4.47	3.58	4.44
5	Brahman-nakhi	5.33	2.77	3.32	2.93	3.59	5.62	4.42	5.37	5.20	5.15
6	AC 3577	5.45	1.37	4.33	2.37	3.38	7.35	1.45	5.20	4.07	4.52
7	Mahulata	7.82	4.32	5.20	4.73	5.52	8.35	3.08	5.75	3.70	5.22
8	BVD 109	4.97	1.95	3.37	2.75	3.26	6.92	2.42	4.98	2.62	4.23
9	IET 27736	6.98	3.73	5.73	3.93	5.10	6.00	3.52	4.17	3.27	4.24
10	IET 26861	5.07	2.63	4.20	2.75	3.66	6.33	3.60	5.85	4.33	5.03
11	IET 27750	4.75	2.70	4.27	2.83	3.64	5.62	3.25	4.38	3.63	4.22
12	IET 27773	5.77	4.42	5.28	4.57	5.01	7.45	4.68	5.58	5.28	5.75
13	IET 27772	6.07	2.87	3.13	3.52	3.90	5.83	3.55	5.60	3.98	4.74
14	IET 27768	5.72	3.27	4.00	3.50	4.12	6.88	2.67	5.67	4.93	5.04
15	IET 27762	3.85	2.95	3.32	3.20	3.33	7.25	3.42	5.68	5.33	5.42
16	IET 27758	4.65	4.18	4.53	3.42	4.20	6.05	4.32	4.70	4.42	4.87
17	IET 27737	4.47	2.17	1.43	3.77	2.96	5.37	1.75	4.02	3.87	3.75
18	IET 27775	4.40	3.02	3.60	3.37	3.60	6.88	2.80	4.98	3.27	4.48
19	IET 27356	5.22	2.68	3.68	3.43	3.75	6.07	2.72	4.62	4.15	4.39
20	IET 27757	5.47	4.32	4.82	4.60	4.80	4.97	3.27	4.63	3.78	4.16
21	IET 26961	5.00	3.17	4.43	3.87	4.12	6.27	3.17	4.57	4.47	4.62
22	IET 27755	6.87	4.10	4.68	4.25	4.98	5.78	2.58	5.13	3.85	4.34
23	IET 27748	5.45	1.77	4.83	4.47	4.13	5.42	1.20	5.33	4.98	4.23
	Mean	**5.30**	**2.92**	**3.82**	**3.29**	**3.83**	**6.46**	**3.04**	**4.96**	**4.09**	**4.64**
	LSD (Treatments)			0.388**					0.303**		
	LSD (Variety)			0.922**					0.727**		
	Treatments x Variety			1.840**					1.456**		
	CV (%)			22.5					14.76		

Table 6.4.8 Physiological characterization of selected rice multiple abiotic stress tolerance on at Maruteru Kharif 2019

S.No.	Entries	Germination (%)				Grand Mean	Seedling Vigour				Grand Mean
		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	99.7	91.7	20.0	12.3	55.9	1222	524	144	81	493
2	Rashpanjor	97.3	81.0	12.0	6.3	49.2	1509	615	96	32	563
3	Black Gora	83.7	73.7	17.0	6.0	45.1	677	188	89	31	246
4	Parijat	100.0	81.0	90.0	84.0	88.8	1102	400	666	475	661
5	Brahman-nakhi	88.7	69.3	84.7	72.0	78.7	973	500	734	586	698
6	AC 3577	99.3	81.3	93.3	84.0	89.5	1269	229	891	542	733
7	Mahulata	97.0	79.7	91.0	84.3	88.0	1569	590	995	712	967
8	BVD 109	99.3	83.7	90.0	86.3	89.8	1180	367	752	463	690
9	IET 27736	99.3	64.3	91.0	89.7	86.1	1289	467	900	644	825
10	IET 26861	100.0	82.0	96.0	94.7	93.2	1140	512	964	670	821
11	IET 27750	99.0	90.3	96.3	91.0	94.2	1026	539	835	588	747
12	IET 27773	99.3	86.3	98.0	91.7	93.8	1313	787	1065	903	1017
13	IET 27772	95.3	88.0	91.7	88.7	90.9	1132	563	800	667	791
14	IET 27768	99.3	84.0	91.0	88.0	90.6	1252	496	879	746	843
15	IET 27762	99.3	80.7	94.0	83.3	89.3	1103	514	848	711	794
16	IET 27758	99.3	22.3	82.0	77.3	70.3	1062	191	753	605	653
17	IET 27737	96.7	14.3	87.0	84.0	70.5	951	55	474	642	530
18	IET 27775	100.0	45.0	68.0	44.0	64.3	1128	268	583	294	568
19	IET 27356	99.3	82.7	91.0	86.7	89.9	1121	448	756	657	745
20	IET 27757	91.0	76.3	65.3	55.3	72.0	950	579	616	466	653
21	IET 26961	99.3	61.7	72.3	63.0	74.1	1119	390	657	526	673
22	IET 27755	99.7	45.3	66.3	50.7	65.5	1261	301	652	411	656
23	IET 27748	99.3	56.7	65.0	58.7	69.9	1080	167	662	555	616
	Mean	**97.4**	**70.5**	**76.2**	**68.8**	**78.2**	**1149**	**421**	**687**	**522**	**695**
	LSD (Treatments)			1.17**					45.41**		
	LSD (Variety)			2.809**					108.89**		
	Treatments x Variety			5.619**					217.78**		
	CV (%)			4.55					14.74		

Table 6.4.9 Physiological characterization of selected rice multiple abiotic stress tolerance on at Pantnagar Kharif 2019

S.No.	Entries	Root Length (cm)					Grand Mean	Shoot Length (cm)					Grand Mean
		Anaerobic germination	Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Anaerobic germination	Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	4.13	9.87	2.77	7.03	4.13	5.59	14.30	19.93	17.40	9.87	8.00	13.90
2	Rashpanjor	3.23	9.60	3.00	8.27	2.33	5.29	13.30	14.33	11.27	9.67	5.03	10.72
3	Black Gora	2.90	7.93	5.27	4.50	2.80	4.68	10.67	11.07	10.27	8.23	6.90	9.43
4	Parijat	0.00	9.00	2.40	7.67	4.17	4.65	0.00	11.03	9.63	9.37	6.73	7.35
5	Brahman-nakhi	2.10	5.30	2.23	3.00	2.27	2.98	6.23	8.07	6.33	3.90	3.50	5.61
6	AC 3577	4.37	5.80	2.40	4.00	2.67	3.85	5.57	7.57	6.23	6.50	3.20	5.81
7	Mahulata	0.00	8.90	0.00	7.10	3.17	3.83	0.00	9.43	0.00	8.87	3.67	4.39
8	BVD 109	4.60	9.97	4.17	6.30	2.93	5.59	9.40	11.50	9.27	7.43	5.77	8.67
9	IET 27736	0.00	7.37	3.27	6.33	3.07	4.01	0.00	9.23	8.27	8.70	3.80	6.00
10	IET 26861	2.47	8.07	5.23	6.33	3.43	5.11	11.17	13.23	11.20	11.13	4.20	10.19
11	IET 27750	3.50	7.27	6.37	5.20	2.60	4.99	6.00	8.70	7.40	6.07	3.10	6.25
12	IET 27773	4.50	8.23	3.17	6.30	3.07	5.05	6.43	10.33	9.63	9.07	6.60	8.41
13	IET 27772	0.00	9.83	5.10	6.93	3.30	5.03	0.00	11.97	10.70	7.40	5.53	7.12
14	IET 27768	4.10	9.87	3.30	5.53	3.70	5.30	9.30	11.63	10.27	7.27	4.83	8.66
15	IET 27762	3.23	6.20	3.23	4.90	2.57	4.03	8.23	10.27	8.33	8.13	3.07	7.61
16	IET 27758	0.00	7.13	0.00	3.90	2.37	2.68	0.00	7.53	0.00	5.03	3.90	3.29
17	IET 27737	0.00	5.40	5.10	4.20	2.03	3.35	0.00	8.27	6.20	4.77	2.47	4.34
18	IET 27775	5.07	9.20	4.20	4.27	2.90	5.13	8.93	11.33	9.63	9.17	5.67	8.95
19	IET 27356	4.50	8.17	2.63	3.37	3.50	4.43	12.07	13.17	11.27	9.43	5.03	10.19
20	IET 27757	4.17	10.27	2.07	7.63	2.50	5.33	12.27	14.17	12.20	9.97	3.10	10.34
21	IET 26961	4.13	11.13	0.00	6.23	3.53	5.01	10.37	13.27	0.00	9.80	4.20	7.53
22	IET 27755	3.90	9.13	2.17	8.27	3.17	5.33	9.07	12.17	10.53	11.13	6.20	9.82
23	IET 27748	4.23	8.63	2.23	5.23	2.23	4.51	8.00	10.53	8.70	6.30	4.93	7.69
	Mean	**2.83**	**8.36**	**3.06**	**5.76**	**2.98**	**4.60**	**7.01**	**11.25**	**8.47**	**8.14**	**4.76**	**7.93**
	LSD (Treatments)				0.12**						0.074**		
	LSD (Variety)				0.266**						0.158**		
	Treatments x Variety				0.596**						0.353**		
	CV (%)				6.114						2.11		

Table 6.4.10 Physiological characterization of selected rice multiple abiotic stress tolerance on at Pantnagar Kharif 2019

S.No.	Entries	Root Dry Weight (mg)					Grand Mean	Shoot Dry Weight (mg)					Grand Mean
		Anaerobic germination	Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Anaerobic germination	Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	30.33	51.67	5.23	37.00	18.00	28.45	51.00	72.00	13.33	56.00	43.33	47.13
2	Rashpanjor	26.00	53.33	2.93	43.33	6.00	26.32	44.00	86.33	13.00	54.00	36.00	46.67
3	Black Gora	21.33	39.00	4.73	26.00	14.00	21.01	41.33	64.00	10.67	45.00	34.00	39.00
4	Parijat	0.00	42.33	4.30	21.33	14.33	16.46	0.00	53.00	9.33	44.67	29.00	27.20
5	Brahman-nakhi	16.67	37.33	3.53	18.00	14.33	17.97	24.00	63.33	7.33	32.00	21.00	29.53
6	AC 3577	22.33	32.67	5.33	25.67	19.33	21.07	31.67	54.00	9.67	32.33	28.00	31.13
7	Mahulata	0.00	36.00	0.00	24.33	17.67	15.60	0.00	53.00	0.00	34.00	27.00	22.80
8	BVD 109	17.33	40.67	2.50	14.33	7.00	16.37	30.67	45.00	7.67	37.33	24.33	29.00
9	IET 27736	0.00	37.33	3.90	15.00	9.67	13.18	0.00	53.33	9.00	33.33	23.33	23.80
10	IET 26861	12.00	33.00	2.50	15.33	7.33	14.03	45.00	60.67	12.33	51.00	41.67	42.13
11	IET 27750	33.00	43.33	5.67	33.33	22.33	27.53	46.00	64.67	13.00	50.33	45.00	43.80
12	IET 27773	26.33	44.00	5.67	27.33	19.33	24.53	41.00	62.67	10.00	52.00	31.67	39.47
13	IET 27772	0.00	51.67	4.33	39.67	30.00	25.13	0.00	55.00	10.33	52.67	34.00	30.40
14	IET 27768	34.67	54.00	5.00	45.00	31.00	33.93	40.33	62.33	10.67	54.00	35.33	40.53
15	IET 27762	31.00	42.67	7.50	33.67	26.00	28.17	46.67	71.00	14.67	54.33	46.00	46.53
16	IET 27758	0.00	37.67	0.00	24.00	19.00	16.13	0.00	47.00	0.00	33.33	23.33	20.73
17	IET 27737	0.00	57.00	6.00	46.33	31.00	28.07	0.00	60.67	12.00	54.00	38.67	33.07
18	IET 27775	36.00	55.67	8.03	37.00	28.33	33.01	45.00	62.00	10.00	51.33	35.00	40.67
19	IET 27356	23.33	34.33	5.47	25.00	17.00	21.03	47.00	64.00	11.33	54.00	41.00	43.47
20	IET 27757	45.67	62.67	6.67	54.00	36.67	41.13	51.00	71.00	13.33	57.00	44.00	47.27
21	IET 26961	40.33	54.00	0.00	43.67	32.00	34.00	46.00	60.67	0.00	47.00	36.67	38.07
22	IET 27755	38.33	52.67	4.33	44.33	28.00	33.53	41.67	61.00	9.00	52.00	33.00	39.33
23	IET 27748	28.00	53.33	6.00	34.67	22.67	28.93	45.00	64.00	11.33	56.33	36.00	42.53
	Mean	**20.99**	**45.49**	**4.33**	**31.67**	**20.48**	**24.59**	**31.19**	**61.33**	**9.48**	**47.30**	**34.23**	**36.71**
	LSD (Treatments)				0.756**						0.559**		
	LSD (Variety)				1.62**						1.199**		
	Treatments x Variety				3.625**						2.68**		
	CV (%)				6.9						3.44		

Table 6.4.11 Physiological characterization of selected rice multiple abiotic stress tolerance on at Pantnagar Kharif 2019

S.No.	Entries	Total chlorophyll					Grand Mean	Germination %					Grand Mean	Seedling Vigour					Grand Mean
		Anaerobic germination	Control	Salinity	WS (1% M)	WS (2% M)		Anaerobic germination	Control	Salinity	WS (1% M)	WS (2% M)		Anaerobic germination	Control	Salinity	WS (1% M)	WS (2% M)	
1	AC 1303	0.42	1.73	0.55	0.66	0.54	0.78	55.0	96.7	0.0	96.7	95.0	68.7	787	1927	0	954	760	885
2	Rashpanjor	0.34	1.86	0.54	0.72	0.56	0.80	50.0	100.0	0.0	98.3	91.7	68.0	665	1433	0	950	461	702
3	Black Gora	0.28	1.64	0.40	0.52	0.38	0.64	51.7	96.7	0.0	90.0	85.0	64.7	551	1070	0	741	587	590
4	Parijat	0.00	1.73	0.52	1.03	0.83	0.82	0.0	96.7	0.0	96.7	93.3	57.3	0	1066	0	905	629	520
5	Brahman-nakhi	0.25	1.22	0.56	0.87	0.77	0.73	41.7	96.7	0.0	73.3	55.0	53.3	259	780	0	286	192	303
6	AC 3577	0.54	1.24	0.60	0.66	0.42	0.69	25.0	55.0	0.0	41.7	20.0	28.3	139	416	0	271	64	178
7	Mahulata	0.00	1.32	0.00	1.18	0.95	0.69	0.0	98.3	0.0	98.3	96.7	58.7	0	927	0	872	354	431
8	BVD 109	0.31	1.45	0.70	1.08	0.64	0.84	50.0	91.7	0.0	86.7	81.7	62.0	470	1054	0	644	471	528
9	IET 27736	0.00	1.56	0.32	0.62	0.54	0.61	16.7	95.0	0.0	86.7	86.7	57.0	0	877	0	754	329	392
10	IET 26861	0.42	1.73	0.54	0.68	0.51	0.78	56.7	98.3	0.0	98.3	93.3	69.3	633	1301	0	1094	392	684
11	IET 27750	0.41	1.25	0.61	0.78	0.75	0.76	60.0	100.0	0.0	100.0	93.3	70.7	360	870	0	607	289	425
12	IET 27773	0.43	1.20	0.75	1.07	1.02	0.89	56.7	100.0	0.0	91.7	88.3	67.3	364	1033	0	831	583	562
13	IET 27772	0.00	1.78	0.43	0.85	0.73	0.76	0.0	88.3	0.0	86.7	78.3	50.7	0	1057	0	641	433	426
14	IET 27768	0.59	1.65	0.77	0.98	0.65	0.93	58.3	98.3	0.0	98.3	91.7	69.3	542	1144	0	714	443	569
15	IET 27762	0.23	1.78	0.59	0.95	0.67	0.84	56.7	96.7	0.0	100.0	76.7	66.0	466	992	0	813	235	501
16	IET 27758	0.00	1.66	0.00	0.87	0.64	0.63	0.0	30.0	0.0	25.0	25.0	16.0	0	226	0	126	98	90
17	IET 27737	0.00	1.79	0.63	1.24	1.12	0.95	0.0	43.3	0.0	36.7	30.0	22.0	0	358	0	174	74	121
18	IET 27775	0.97	1.69	0.60	1.44	0.78	1.10	41.7	91.7	0.0	90.0	85.0	61.7	372	1039	0	825	482	544
19	IET 27356	0.54	1.44	0.86	1.17	1.06	1.01	50.0	100.0	0.0	98.3	81.7	66.0	603	1317	0	928	411	652
20	IET 27757	0.75	1.85	0.63	1.47	0.95	1.13	35.0	100.0	0.0	86.7	83.3	61.0	429	1417	0	864	258	594
21	IET 26961	0.47	1.19	0.00	0.76	0.51	0.59	43.3	98.3	0.0	95.0	90.0	65.3	449	1304	0	930	378	612
22	IET 27755	0.63	1.14	0.43	1.74	0.85	0.96	35.0	100.0	0.0	96.7	76.7	61.7	317	1217	0	1076	475	617
23	IET 27748	0.54	1.16	0.67	0.83	0.73	0.79	33.3	100.0	0.0	98.3	96.7	65.7	267	1053	0	619	477	483
	Mean	**0.35**	**1.52**	**0.51**	**0.96**	**0.72**	**0.81**	**35.5**	**90.1**	**0.0**	**85.7**	**78.0**	**57.9**	**334**	**1038**	**0**	**723**	**386**	**496**
	LSD (Treatments)				0.0058**					1.497**							6.925**		
	LSD (Variety)				0.0125**					3.212**							14.853**		
	Treatments x Variety				0.0279**					7.182**							33.21**		
	CV (%)				1.6					5.82							3.15		

Table 6.4.12 Physiological characterization of selected rice multiple abiotic stress tolerance on at Pattambi Kharif 2019

S.No.	Entries	Root Dry Weight (mg)				Grand Mean	Shoot Dry Weight (mg)				Grand Mean
		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	0.96	5.18	2.12	2.02	2.57	0.06	0.03	0.01	0.02	0.03
2	Rashpanjor	0.66	2.55	2.20	0.47	1.47	0.05	0.03	0.01	0.02	0.02
3	Black Gora	0.35	1.59	2.02	1.25	1.30	0.02	0.02	0.01	0.02	0.02
4	Parijat	0.40	1.83	2.57	2.34	1.79	0.03	0.01	0.01	0.01	0.01
5	Brahman-nakhi	0.68	1.03	2.11	0.40	1.06	0.04	0.01	0.01	0.02	0.02
6	AC 3577	2.57	2.21	2.46	2.43	2.42	0.05	0.01	0.02	0.02	0.03
7	Mahulata	1.90	1.33	0.46	1.46	1.29	0.03	0.01	0.03	0.01	0.02
8	BVD 109	1.82	1.46	1.14	1.19	1.40	0.02	0.01	0.03	0.02	0.02
9	IET 27736	1.88	1.05	0.20	1.70	1.21	0.03	0.01	0.02	0.02	0.02
10	IET 26861	2.77	1.25	2.35	3.56	2.48	0.02	0.01	0.01	0.02	0.02
11	IET 27750	1.42	0.07	0.09	0.34	0.48	0.02	0.01	0.03	0.00	0.02
12	IET 27773	1.53	6.60	1.55	2.02	2.93	0.03	0.05	0.00	0.01	0.02
13	IET 27772	1.47	7.02	1.32	4.51	3.58	0.05	0.07	0.01	0.01	0.04
14	IET 27768	2.03	6.15	1.44	0.19	2.45	0.03	0.02	0.02	0.01	0.02
15	IET 27762	1.54	2.09	0.58	1.29	1.38	0.04	0.01	0.04	0.01	0.02
16	IET 27758	5.03	0.03	0.09	0.09	1.31	0.03	0.11	0.04	0.00	0.04
17	IET 27737	0.22	1.83	2.14	0.14	1.08	0.06	0.01	0.05	0.00	0.03
18	IET 27775	10.31	7.54	3.08	1.30	5.56	0.02	0.03	0.02	0.02	0.02
19	IET 27356	17.47	0.75	0.40	0.03	4.66	0.02	0.02	0.01	0.00	0.01
20	IET 27757	1.77	10.09	2.30	3.82	4.50	0.05	0.04	0.01	0.01	0.02
21	IET 26961	3.39	8.16	0.08	1.48	3.28	0.01	0.03	0.00	0.00	0.01
22	IET 27755	2.00	3.65	1.85	0.95	2.11	0.04	0.03	0.04	0.01	0.03
23	IET 27748	3.04	0.13	4.42	0.98	2.14	0.03	0.07	0.03	0.02	0.04
	Mean	**2.84**	**3.20**	**1.61**	**1.48**	**2.28**	**0.03**	**0.03**	**0.02**	**0.01**	**0.02**
	LSD (Treatments)				0.202**				0.008**		
	LSD (Variety)				0.485**				0.019**		
	Treatments x Variety				0.971**				0.038**		
	CV (%)				20.04				28.3		

Table 6.4.13 Physiological characterization of selected rice multiple abiotic stress tolerance on at Pattambi Kharif 2019

S.No.	Entries	Root Length (cm)				Grand Mean	Shoot Length (cm)				Grand Mean	Total Chlorophyll				Grand Mean
		Control	Salinity	WS (1% M)	WS (2% M)		Control	Salinity	WS (1% M)	WS (2% M)		Control	Salinity	WS (1% M)	WS (2% M)	
1	AC 1303	16.75	12.33	13.17	3.75	11.50	32.50	24.67	32.33	15.50	26.25	0.96	5.18	2.12	2.02	2.57
2	Rashpanjor	14.33	11.00	9.83	2.33	9.38	33.50	27.67	35.50	14.00	27.67	0.66	2.55	2.20	0.47	1.47
3	Black Gora	8.17	4.67	13.00	2.67	7.13	15.33	12.50	19.03	7.67	13.63	0.35	1.59	2.02	1.25	1.30
4	Parijat	9.33	9.83	14.00	3.67	9.21	17.00	10.17	21.00	10.00	14.54	0.40	1.83	2.57	2.34	1.79
5	Brahman-nakhi	14.83	5.67	14.50	3.17	9.54	17.33	8.83	22.83	13.33	15.58	0.68	1.03	2.11	0.40	1.06
6	AC 3577	15.83	9.33	12.67	2.00	9.96	15.67	16.17	20.33	13.50	16.42	2.57	2.21	2.46	2.43	2.42
7	Mahulata	6.00	5.42	9.50	4.17	6.27	17.83	15.33	19.00	14.67	16.71	1.90	1.33	0.46	1.46	1.29
8	BVD 109	5.67	2.83	2.83	2.83	3.54	8.67	7.67	13.33	11.83	10.38	1.82	1.46	1.14	1.19	1.40
9	IET 27736	12.33	8.50	13.00	3.83	9.42	19.67	17.83	17.83	13.17	17.13	1.88	1.05	0.20	1.70	1.21
10	IET 26861	7.33	9.33	9.33	6.17	8.04	11.00	12.50	20.33	15.33	14.79	2.77	1.25	2.35	3.56	2.48
11	IET 27750	8.83	5.00	2.00	7.17	5.75	11.33	10.00	29.00	15.00	16.33	1.42	0.07	0.09	0.34	0.48
12	IET 27773	13.00	10.00	5.67	4.00	8.17	18.00	12.17	16.67	15.33	15.54	1.53	6.60	1.55	2.02	2.93
13	IET 27772	17.83	8.67	7.67	6.33	10.13	24.00	11.50	17.83	14.67	17.00	1.47	7.02	1.32	4.51	3.58
14	IET 27768	11.33	10.70	9.83	8.83	10.18	13.00	8.42	23.17	18.33	15.73	2.03	6.15	1.44	0.19	2.45
15	IET 27762	7.67	5.67	2.20	8.00	5.88	19.83	13.00	17.97	13.83	16.16	1.54	2.09	0.58	1.29	1.38
16	IET 27758	6.33	8.83	7.50	2.83	6.38	15.67	14.00	21.00	11.33	15.50	5.03	0.03	0.09	0.09	1.31
17	IET 27737	9.57	8.00	12.50	0.00	7.52	12.67	14.50	15.50	0.00	10.67	0.22	1.83	2.14	0.14	1.08
18	IET 27775	4.83	10.67	5.17	6.92	6.90	10.00	14.00	17.00	18.83	14.96	10.31	7.54	3.08	1.30	5.56
19	IET 27356	9.00	10.17	11.50	4.50	8.79	25.33	16.33	30.50	12.50	21.17	17.47	0.75	0.40	0.03	4.66
20	IET 27757	10.33	10.17	14.50	7.83	10.71	22.33	13.00	23.00	19.67	19.50	1.77	10.09	2.30	3.82	4.50
21	IET 26961	4.33	13.17	2.00	1.83	5.33	9.67	13.17	8.50	7.33	9.67	3.39	8.16	0.08	1.48	3.28
22	IET 27755	9.83	11.50	10.67	4.33	9.08	20.67	13.83	16.67	13.50	16.17	2.00	3.65	1.85	0.95	2.11
23	IET 27748	11.33	11.00	5.43	3.67	7.86	15.67	15.50	11.88	12.33	13.85	3.04	0.13	4.42	0.98	2.14
	Mean	**10.21**	**8.80**	**9.06**	**4.38**	**8.11**	**17.68**	**14.03**	**20.44**	**13.12**	**16.32**	**2.84**	**3.20**	**1.61**	**1.48**	**2.28**
	LSD (Treatments)			1.096**					1.618**					0.202**		
	LSD (Variety)			2.627**					3.88**					0.485**		
	Treatments x Variety			5.255**					7.76**					0.971**		
	CV (%)			30					22					20.1		

Table 6.4.14 Physiological characterization of selected rice multiple abiotic stress tolerance on at REWA Kharif 2019

S.No.	Entries	Root Dry Weight (g)				Grand Mean	Shoot Dry Weight (g)				Grand Mean
		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	0.054	0.040	0.051	0.042	0.047	0.060	0.023	0.033	0.018	0.034
2	Rashpanjor	0.073	0.065	0.073	0.070	0.070	0.077	0.031	0.047	0.027	0.045
3	Black Gora	0.054	0.014	0.045	0.028	0.035	0.053	0.017	0.037	0.014	0.030
4	Parijat	0.041	0.015	0.037	0.023	0.029	0.040	0.023	0.033	0.017	0.028
5	Brahman-nakhi	0.050	0.044	0.045	0.038	0.044	0.063	0.014	0.043	0.015	0.034
6	AC 3577	0.035	0.024	0.031	0.025	0.029	0.053	0.031	0.037	0.027	0.037
7	Mahulata	0.081	0.048	0.072	0.055	0.064	0.080	0.022	0.060	0.019	0.045
8	BVD 109	0.044	0.019	0.033	0.020	0.029	0.047	0.011	0.047	0.006	0.028
9	IET 27736	0.055	0.017	0.044	0.035	0.038	0.067	0.028	0.040	0.022	0.039
10	IET 26861	0.074	0.037	0.072	0.069	0.063	0.077	0.040	0.047	0.037	0.050
11	IET 27750	0.085	0.047	0.080	0.069	0.070	0.087	0.020	0.070	0.018	0.049
12	IET 27773	0.054	0.023	0.040	0.031	0.037	0.073	0.013	0.050	0.007	0.036
13	IET 27772	0.072	0.032	0.067	0.050	0.055	0.057	0.033	0.047	0.030	0.041
14	IET 27768	0.073	0.042	0.071	0.059	0.061	0.077	0.032	0.050	0.029	0.047
15	IET 27762	0.065	0.038	0.048	0.041	0.048	0.070	0.012	0.057	0.007	0.037
16	IET 27758	0.078	0.059	0.075	0.073	0.071	0.087	0.025	0.067	0.019	0.049
17	IET 27737	0.051	0.030	0.042	0.023	0.036	0.057	0.021	0.047	0.016	0.035
18	IET 27775	0.065	0.053	0.057	0.055	0.058	0.077	0.021	0.053	0.019	0.043
19	IET 27356	0.058	0.045	0.055	0.053	0.053	0.047	0.029	0.030	0.028	0.034
20	IET 27757	0.063	0.048	0.056	0.052	0.055	0.067	0.012	0.057	0.007	0.035
21	IET 26961	0.089	0.062	0.085	0.073	0.077	0.087	0.031	0.053	0.028	0.050
22	IET 27755	0.071	0.040	0.063	0.054	0.057	0.083	0.030	0.047	0.029	0.047
23	IET 27748	0.042	0.017	0.033	0.022	0.029	0.057	0.022	0.033	0.017	0.032
	Mean	0.062	0.037	0.055	0.046	0.050	0.067	0.023	0.047	0.020	0.039
	LSD (Treatments)			0.0033**					0.0052**		
	LSD (Variety)			0.008**					0.0126**		
	Treatments x Variety			0.0161**					0.025**		
	CV (%)			15.2					30.2		

Table 6.4.15 Physiological characterization of selected rice multiple abiotic stress tolerance on at REWA Kharif 2019

S.No	Entries	Root Length (cm)				Grand Mean	Shoot Length (cm)				Grand Mean
		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Control	Salinity	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	10.27	6.00	9.90	8.33	8.63	12.50	8.07	11.37	10.50	10.61
2	Rashpanjor	14.23	9.73	13.30	10.40	11.92	16.33	11.73	14.67	12.40	13.78
3	Black Gora	17.23	7.37	13.70	10.37	12.17	19.47	9.43	15.13	12.43	14.12
4	Parijat	10.57	4.30	8.30	5.17	7.08	13.17	7.17	10.23	8.03	9.65
5	Brahman-nakhi	12.03	6.90	12.00	9.20	10.03	13.70	8.43	13.07	10.73	11.48
6	AC 3577	14.60	6.93	13.20	9.53	11.07	16.07	8.17	14.10	10.77	12.28
7	Mahulata	17.67	8.07	15.20	11.50	13.11	19.57	9.77	16.40	13.20	14.73
8	BVD 109	14.30	9.70	11.03	10.33	11.34	15.57	10.73	11.80	11.37	12.37
9	IET 27736	17.33	10.17	14.63	12.40	13.63	19.57	12.33	16.10	14.57	15.64
10	IET 26861	17.20	8.27	14.00	11.53	12.75	19.50	10.47	15.50	13.73	14.80
11	IET 27750	18.70	12.33	15.93	14.80	15.44	21.23	14.70	17.57	17.17	17.67
12	IET 27773	14.37	9.27	12.27	10.00	11.48	16.40	11.23	13.60	11.97	13.30
13	IET 27772	13.33	7.97	11.47	8.37	10.28	15.50	11.33	12.87	10.40	12.53
14	IET 27768	20.27	16.90	19.33	17.97	18.62	22.23	18.63	20.57	19.70	20.28
15	IET 27762	16.40	13.40	16.33	14.23	15.09	18.60	15.40	17.73	16.23	16.99
16	IET 27758	16.70	12.53	16.77	14.73	15.18	19.47	15.07	18.53	17.27	17.58
17	IET 27737	17.63	11.37	13.27	11.90	13.54	19.27	12.83	14.30	13.37	14.94
18	IET 27775	19.17	9.93	18.40	15.00	15.63	20.80	11.50	19.47	16.57	17.08
19	IET 27356	14.47	6.60	11.70	10.40	10.79	16.43	8.43	12.97	12.23	12.52
20	IET 27757	15.63	12.20	13.10	12.93	13.47	16.90	13.23	13.87	13.97	14.49
21	IET 26961	15.53	10.30	11.80	10.73	12.09	17.63	12.20	13.13	12.63	13.90
22	IET 27755	16.27	12.87	15.43	13.20	14.44	18.43	14.80	16.80	15.13	16.29
23	IET 27748	16.73	9.93	14.80	10.23	12.93	19.37	12.50	16.53	12.80	15.30
	Mean	**15.68**	**9.70**	**13.73**	**11.45**	**12.64**	**17.73**	**11.66**	**15.06**	**13.36**	**14.45**
	LSD (Treatments)				0.569**				0.590**		
	LSD (Variety)				1.365**				1.417**		
	Treatments x Variety				2.73**				2.834**		
	CV (%)				10.16				9.2		

Table 6.4.16 Physiological characterization of selected rice multiple abiotic stress tolerance on at Titabar Kharif 2019

S.No.	Entries	Root Length (cm)				Grand Mean	Shoot Length (cm)				Grand Mean	Germination %				Grand Mean
		Anaerobic germination	Control	WS (1% M)	WS (2% M)		Anaerobic germination	Control	WS (1% M)	WS (2% M)		Anaerobic germination	Control	WS (1% M)	WS (2% M)	
1	AC 1303	4.50	19.33	17.50	4.67	11.50	31.83	33.50	31.00	24.17	30.13	77.7	98.7	85.0	76.0	84.3
2	Rashpanjor	5.50	16.67	15.17	13.83	12.79	35.17	31.33	27.50	19.33	28.33	43.3	99.3	90.0	82.0	78.7
3	Black Gora	4.83	5.00	2.17	6.67	4.67	36.83	12.33	8.83	11.17	17.29	28.3	98.0	65.0	48.3	59.9
4	Parijat	0.00	10.33	7.50	4.00	5.46	0.00	15.17	10.50	12.00	9.42	0.0	95.0	80.0	68.3	60.8
5	Brahman-nakhi	0.00	5.33	3.50	3.00	2.96	0.00	10.17	7.83	8.83	6.71	0.0	98.0	43.3	28.3	42.4
6	AC 3577	5.17	9.83	7.67	4.83	6.88	23.50	16.50	12.67	15.83	17.13	32.7	94.0	65.0	49.7	60.3
7	Mahulata	4.50	19.67	19.33	4.83	12.08	23.33	23.67	19.83	16.50	20.83	27.7	95.0	88.3	58.3	67.3
8	BVD 109	0.00	11.00	8.17	4.33	5.88	0.00	17.17	14.17	14.67	11.50	0.0	94.0	38.3	23.3	38.9
9	IET 27736	5.33	14.17	13.00	4.50	9.25	18.50	17.50	12.50	6.83	13.83	25.0	91.3	43.3	28.3	47.0
10	IET 26861	4.17	14.67	13.33	1.67	8.46	22.83	23.67	19.67	5.00	17.79	25.0	92.0	81.7	20.0	54.7
11	IET 27750	0.00	13.00	12.00	5.17	7.54	0.00	15.67	9.00	6.50	7.79	0.0	96.0	81.5	38.3	54.0
12	IET 27773	3.83	5.17	3.00	7.33	4.83	19.17	10.17	7.17	12.00	12.13	25.0	94.0	53.3	15.0	46.8
13	IET 27772	5.00	7.50	4.50	2.33	4.83	23.17	16.50	10.83	4.17	13.67	26.7	95.0	55.0	23.3	50.0
14	IET 27768	4.00	7.17	5.17	3.83	5.04	21.17	11.67	7.33	2.83	10.75	20.0	96.0	73.3	51.7	60.3
15	IET 27762	4.50	13.67	12.33	3.50	8.50	28.67	20.00	15.83	8.67	18.29	78.3	95.0	84.0	65.0	80.6
16	IET 27758	4.00	7.33	5.17	2.83	4.83	23.67	12.67	9.33	6.33	13.00	28.3	97.0	38.3	20.0	45.9
17	IET 27737	0.00	11.00	10.33	2.50	5.96	0.00	17.67	14.00	6.17	9.46	0.0	92.0	35.0	18.3	36.3
18	IET 27775	5.50	10.00	7.83	3.83	6.79	25.83	16.33	12.33	4.17	14.67	40.0	92.0	55.0	20.0	51.8
19	IET 27356	4.67	8.67	6.33	8.67	7.08	21.67	12.50	8.50	9.33	13.00	25.0	95.0	53.3	21.7	48.8
20	IET 27757	3.67	9.00	6.67	5.00	6.08	17.83	14.33	10.83	6.50	12.38	20.0	95.0	25.0	15.0	38.8
21	IET 26961	4.83	5.00	3.17	2.67	3.92	21.33	8.00	4.33	3.50	9.29	38.3	96.0	55.0	38.3	56.9
22	IET 27755	5.17	4.67	2.67	8.50	5.25	22.50	11.00	7.67	11.50	13.17	18.3	93.3	77.7	63.3	63.2
23	IET 27748	4.50	13.33	14.00	8.50	10.08	22.17	16.67	10.67	8.50	14.50	20.0	96.0	81.7	45.0	60.7
	Mean	**3.64**	**10.50**	**8.72**	**5.09**	**6.99**	**19.09**	**16.70**	**12.71**	**9.76**	**14.57**	**26.1**	**95.1**	**63.0**	**39.9**	**56.0**
	LSD (Treatments)			0.929**					1.254**					3.943**		
	LSD (Variety)			2.228**					3.009**					9.45**		
	Treatments x Variety			4.456**					6.018**					18.91**		
	CV (%)			30.1					19.04					15.84		

Table 6.4.17 Physiological characterization of selected rice multiple abiotic stress tolerance on at Titabar Kharif 2019

S.No.	Entries	Root Dry Weight (g)				Grand Mean	Shoot Dry Weight (g)				Grand Mean
		Anerobic germination	Control	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Anerobic germination	Control	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	1.33	5.74	4.77	1.23	3.27	12.13	13.23	11.43	8.27	11.27
2	Rashpanjor	1.80	4.95	4.15	2.90	3.45	13.43	12.23	10.18	6.57	10.60
3	Black Gora	1.50	1.48	1.00	1.77	1.44	13.97	4.87	3.21	3.80	6.46
4	Parijat	0.00	3.03	2.07	1.20	1.58	0.00	6.00	3.87	4.13	3.50
5	Brahman-nakhi	0.00	1.58	0.97	0.83	0.85	0.00	4.00	2.87	3.03	2.48
6	AC 3577	1.53	2.93	2.10	1.27	1.96	8.90	6.45	4.70	5.47	6.38
7	Mahulata	1.33	5.87	5.23	1.27	3.43	8.90	9.33	7.33	5.67	7.81
8	BVD 109	0.00	3.30	2.23	1.10	1.66	0.00	6.80	5.27	5.05	4.28
9	IET 27736	1.60	4.20	3.53	1.23	2.64	7.13	6.90	4.57	2.33	5.23
10	IET 26861	1.33	4.37	3.63	0.77	2.53	8.70	9.33	7.27	1.73	6.76
11	IET 27750	0.00	3.87	3.28	1.35	2.12	0.00	6.20	3.33	2.20	2.93
12	IET 27773	1.33	1.53	1.00	1.90	1.44	7.27	4.03	2.67	4.13	4.53
13	IET 27772	1.53	2.23	1.37	0.70	1.46	8.90	6.53	4.00	1.43	5.22
14	IET 27768	1.23	2.13	1.37	1.17	1.47	8.10	4.60	2.72	1.07	4.12
15	IET 27762	1.37	4.10	3.37	0.97	2.45	10.93	7.90	5.83	2.97	6.91
16	IET 27758	1.20	2.20	1.43	0.77	1.40	9.17	5.00	3.47	2.17	4.95
17	IET 27737	0.00	3.20	2.85	0.80	1.71	0.00	6.93	5.17	2.13	3.56
18	IET 27775	1.63	2.93	2.10	0.99	1.92	9.87	6.47	4.53	1.53	5.60
19	IET 27356	1.50	2.63	1.77	2.23	2.03	8.30	4.93	3.17	3.19	4.90
20	IET 27757	1.17	2.65	1.80	1.30	1.73	6.80	5.60	4.00	2.23	4.66
21	IET 26961	1.43	1.50	1.00	0.77	1.18	8.17	3.13	1.63	1.30	3.56
22	IET 27755	1.53	1.43	1.00	2.20	1.54	8.60	4.27	2.85	3.93	4.91
23	IET 27748	1.37	3.99	3.80	1.90	2.76	8.47	6.57	3.92	2.83	5.45
	Mean	**1.12**	**3.12**	**2.43**	**1.33**	**2.00**	**7.29**	**6.58**	**4.69**	**3.36**	**5.48**
	LSD (Treatments)			0.253**					0.463**		
	LSD (Variety)			0.608**					1.111**		
	Treatments x Variety			1.217**					2.222**		
	CV (%)			28.6					19.08		

Table 6.4.18 Physiological characterization of selected rice multiple abiotic stress tolerance on at NRRI Kharif 2019

S.No.	Entries	Root Length (cm)				Grand Mean	Shoot Length (cm)				Grand Mean
		Control	Saline Test	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)		Control	Saline Test	Water Stress (1% Mannitol)	Water Stress (2% Mannitol)	
1	AC 1303	14.67	9.00	10.49	18.77	13.23	21.57	39.17	15.50	27.67	25.98
2	Rashpanjor	13.77	8.63	11.40	9.70	10.88	36.30	30.33	33.53	23.63	30.95
3	Black Gora	6.33	9.33	7.07	10.93	8.42	20.37	30.00	26.63	21.73	24.68
4	Parijat	8.47	9.33	14.00	12.87	11.17	28.53	27.67	30.87	22.27	27.33
5	Brahman-nakhi	6.93	9.67	10.90	10.57	9.52	23.57	25.00	22.93	21.50	23.25
6	AC 3577	16.00	10.33	17.60	14.43	14.59	35.03	33.67	31.90	18.93	29.88
7	Mahulata	16.43	11.67	5.43	9.60	10.78	43.87	36.33	16.43	20.93	29.39
8	BVD 109	11.03	7.00	6.27	11.93	9.06	28.27	26.33	15.33	20.90	22.71
9	IET 27736	11.20	7.00	26.57	15.67	15.11	32.57	22.00	28.73	16.53	24.96
10	IET 26861	11.03	5.33	17.57	10.80	11.18	30.97	26.00	22.70	15.00	23.67
11	IET 27750	14.37	7.67	14.03	7.97	11.01	27.27	20.00	27.87	12.40	21.88
12	IET 27773	18.53	6.00	17.60	10.03	13.04	33.17	19.67	26.43	15.97	23.81
13	IET 27772	15.53	9.00	17.83	16.03	14.60	28.40	20.00	26.97	17.40	23.19
14	IET 27768	15.10	8.00	14.53	17.17	13.70	26.50	22.67	27.00	21.77	24.48
15	IET 27762	16.03	9.33	17.80	19.63	15.70	29.87	31.67	27.83	19.67	27.26
16	IET 27758	14.60	10.00	14.50	13.67	13.19	25.00	25.00	25.37	19.80	23.79
17	IET 27737	0.00	9.00	0.00	0.00	2.25	0.00	28.00	0.00	0.00	7.00
18	IET 27775	17.43	12.33	17.97	12.57	15.08	27.07	28.67	28.20	19.27	25.80
19	IET 27356	15.47	10.67	15.63	17.87	14.91	25.50	26.67	32.33	22.47	26.74
20	IET 27757	17.40	12.00	9.53	14.87	13.45	26.83	31.67	28.43	21.80	27.18
21	IET 26961	14.73	10.33	13.67	11.37	12.53	26.80	24.67	26.20	19.43	24.28
22	IET 27755	14.73	10.33	14.50	16.70	14.07	30.77	24.00	24.07	20.00	24.71
23	IET 27748	17.37	8.00	14.97	14.20	13.63	35.10	26.33	30.90	22.83	28.79
	Mean	**13.36**	**9.13**	**13.47**	**12.93**	**12.22**	**27.97**	**27.20**	**25.05**	**19.21**	**24.86**
	LSD (Treatments)			0.778**					1.272**		
	LSD (Variety)			1.867**					3.050**		
	Treatments x Variety			3.735**					6.10**		
	CV (%)			14.37					11.54		

Table 6.4.19 Physiological characterization of selected rice multiple abiotic stress tolerance on at NRRI Kharif 2019

S.No.	Entries	Root Dry weight (g)				Grand Mean	Shoot Dry weight (g)				Grand Mean	Total Chlorophyll				Grand Mean
		Control	Saline Test	WS (1% M)	WS (2% M)		Control	Saline Test	WS (1% M)	WS (2% M)		Control	Saline Test	WS (1% M)	WS (2% M)	
1	AC 1303	0.02	25.86	0.02	0.02	6.48	21.57	39.17	15.50	27.67	25.98	2.65	2.05	1.81	2.18	2.17
2	Rashpanjor	0.03	22.91	0.02	0.02	5.75	0.038	93.14	0.048	0.042	23.316	4.61	1.22	3.27	3.48	3.14
3	Black Gora	0.02	13.76	0.03	0.01	3.46	0.082	65.57	0.062	0.036	16.437	2.69	2.23	3.49	4.56	3.24
4	Parijat	0.04	10.81	0.03	0.04	2.73	0.051	34.79	0.067	0.018	8.732	2.00	1.99	2.56	3.89	2.61
5	Brahman-nakhi	0.02	14.46	0.01	0.01	3.63	0.060	50.88	0.076	0.053	12.766	2.76	1.33	2.47	3.17	2.43
6	AC 3577	0.04	10.81	0.04	0.02	2.73	0.031	47.87	0.036	0.016	11.989	1.86	2.27	1.23	4.03	2.35
7	Mahulata	0.06	23.36	0.01	0.02	5.86	0.087	50.75	0.079	0.019	12.735	2.31	1.45	1.11	3.65	2.13
8	BVD 109	0.02	15.42	0.01	0.03	3.87	0.068	60.77	0.025	0.031	15.222	3.54	1.27	2.60	2.34	2.44
9	IET 27736	0.01	12.33	0.04	0.01	3.10	0.030	30.46	0.018	0.059	7.641	2.95	0.90	3.06	3.61	2.63
10	IET 26861	0.03	12.68	0.03	0.01	3.19	0.064	33.08	0.074	0.011	8.307	2.73	1.28	3.42	2.58	2.50
11	IET 27750	0.03	19.63	0.03	0.01	4.92	0.088	40.57	0.058	0.027	10.185	2.86	1.40	2.50	3.19	2.49
12	IET 27773	0.04	10.80	0.04	0.01	2.72	0.091	39.37	0.075	0.010	9.886	1.95	0.93	3.15	3.00	2.26
13	IET 27772	0.03	12.87	0.04	0.01	3.24	0.105	35.80	0.063	0.014	8.995	1.90	0.85	2.64	1.88	1.82
14	IET 27768	0.03	9.02	0.03	0.02	2.27	0.072	23.41	0.075	0.024	5.894	2.11	1.48	2.56	1.83	2.00
15	IET 27762	0.03	18.28	0.03	0.01	4.59	0.089	33.30	0.074	0.039	8.376	2.18	1.69	3.08	1.91	2.22
16	IET 27758	0.03	17.33	0.03	0.02	4.35	0.089	50.30	0.065	0.034	12.622	2.13	1.88	1.59	3.35	2.24
17	IET 27737	0.00	22.87	0.00	0.00	5.72	0.050	44.91	0.054	0.026	11.259	0.00	1.00	0.00	0.00	0.25
18	IET 27775	0.03	19.87	0.03	0.02	4.99	0.000	61.86	0.000	0.000	15.464	3.02	0.94	2.11	2.38	2.11
19	IET 27356	0.04	26.09	0.05	0.02	6.55	0.092	55.78	0.082	0.038	13.998	2.40	0.86	1.13	2.52	1.73
20	IET 27757	0.01	15.85	0.02	0.02	3.98	0.057	37.99	0.088	0.037	9.544	2.49	1.63	1.22	2.70	2.01
21	IET 26961	0.03	16.43	0.03	0.02	4.12	0.029	36.81	0.047	0.031	9.230	2.02	1.15	2.31	2.04	1.88
22	IET 27755	0.02	16.84	0.03	0.01	4.23	0.094	37.83	0.054	0.025	9.500	2.51	1.93	1.49	2.54	2.12
23	IET 27748	0.03	12.57	0.03	0.02	3.16	0.278	33.05	0.056	0.023	8.352	3.85	1.12	0.89	1.92	1.95
	Mean	**0.03**	**16.56**	**0.03**	**0.02**	**4.16**	**0.104**	**30.63**	**0.069**	**0.046**	**7.713**	**2.50**	**1.43**	**2.16**	**2.73**	**2.20**
	LSD (Treatments)			0.126**					0.686**					0.0312**		
	LSD (Variety)			0.302**					1.647**					0.0746**		
	Treatments x Variety			0.603**					3.294**					0.149**		
	CV (%)			6.88					13.9					3.185		

Table 6.4.20 Physiological characterization of selected rice multiple abiotic stress tolerance on at Faizabad Kharif 2019

S.No.	Entries	% Germination after 7 Days		Grand Mean	% Germination after 14 Days		Grand Mean	Plant Height after 60 DAS		Grand Mean	Plant Dry Weight after 60 DAS		Grand Mean
		Anaerobic germination	Control		Anaerobic germination	Control		Anaerobic germination	Control		Anaerobic germination	Control	
1	AC 1303	19.17	58.33	38.75	41.67	89.17	65.42	38.83	35.67	37.25	60.26	49.73	55.00
2	Rashpanjor	21.67	68.33	45.00	40.00	81.67	60.83	44.00	37.00	40.50	66.45	44.78	55.62
3	Black Gora	15.00	23.33	19.17	20.00	56.67	38.33	39.33	30.83	35.08	42.36	36.44	39.40
4	Parijat	20.00	64.17	42.08	53.33	90.00	71.67	32.50	29.67	31.08	51.38	39.24	45.31
5	Brahman-nakhi	0.00	0.00	0.00	10.83	0.00	5.42	33.83	0.00	16.92	0.00	0.00	0.00
6	AC 3577	0.00	20.83	10.42	15.83	64.17	40.00	33.33	29.50	31.42	46.10	33.01	39.56
7	Mahulata	15.83	45.00	30.42	38.33	90.83	64.58	39.00	32.83	35.92	55.29	47.14	51.21
8	BVD 109	0.00	34.17	17.08	17.50	66.67	42.08	33.00	24.00	28.50	59.48	31.82	45.65
9	IET 27736	18.33	30.00	24.17	21.67	62.50	42.08	35.17	26.33	30.75	53.54	29.51	41.53
10	IET 26861	19.17	61.67	40.42	24.17	93.33	58.75	33.83	27.00	30.42	52.55	41.26	46.90
11	IET 27750	0.00	31.67	15.83	22.50	65.00	43.75	31.83	23.50	27.67	55.89	28.53	42.21
12	IET 27773	18.33	49.17	33.75	30.00	90.00	60.00	33.33	26.00	29.67	57.37	37.61	47.49
13	IET 27772	19.17	34.17	26.67	28.33	57.50	42.92	29.83	24.67	27.25	77.59	39.47	58.53
14	IET 27768	15.83	78.33	47.08	42.50	100.00	71.25	34.83	26.00	30.42	51.60	41.22	46.41
15	IET 27762	17.50	60.83	39.17	32.50	78.33	55.42	33.00	24.83	28.92	102.83	41.24	72.04
16	IET 27758	0.00	14.17	7.08	0.00	14.17	7.08	0.00	23.17	11.58	0.00	21.89	10.94
17	IET 27737	0.00	16.67	8.33	0.00	26.67	13.33	0.00	26.83	13.42	0.00	23.89	11.95
18	IET 27775	0.00	38.33	19.17	14.17	79.17	46.67	37.33	30.17	33.75	87.42	62.22	74.82
19	IET 27356	17.50	75.00	46.25	50.00	93.33	71.67	38.83	31.00	34.92	79.39	58.74	69.07
20	IET 27757	0.00	14.17	7.08	10.83	14.17	12.50	32.83	30.33	31.58	124.97	53.69	89.33
21	IET 26961	12.50	40.00	26.25	21.67	70.00	45.83	31.83	30.50	31.17	43.08	57.45	50.27
22	IET 27755	20.00	60.00	40.00	35.00	98.33	66.67	32.17	33.67	32.92	115.31	64.76	90.04
23	IET 27748	16.67	61.67	39.17	25.83	90.00	57.92	34.83	31.83	33.33	121.30	64.92	93.11
	Mean	**11.59**	**42.61**	**27.10**	**25.94**	**68.33**	**47.14**	**31.89**	**27.62**	**29.76**	**61.05**	**41.24**	**51.15**
	LSD (Treatments)		4.43**			4.523**			1.00**			0.602**	
	LSD (Variety)		15.01**			15.341**			3.423**			2.044**	
	Treatments x Variety		21.23**			21.695**			4.84**			2.890**	
	CV (%)		36.4			21.56			7.5			2.63	

6.5. Screening for submergence tolerance in Rice

Locations: NRRI, CBT, TTB and FZB

Waterlogging and floods cause substantial yield losses in cereal crops worldwide, aggravating poverty and food insecurity in developing countries. Climate change scenarios are predicting increases in future incidences and intensities of floods, especially in the tropics and subtropics Most dryland cereals, such as maize, wheat, and barley, are sensitive to water logging, causing up to 20% yield losses in irrigated areas, and even greater losses in rainfed ecos systems exceeding 40%. Water logging hampers root growth and function because of oxygen shortages that restrict root respiration. Climate change scenarios are predicting increases in future incidences and intensities of floods, especially in the tropics and subtropics. Complete submergence during seedling stage due to flooding can affect rice growth and yield in more than 16 million ha of deep-water rice areas throughout the world resulting in substantial economic losses to the farmers. Cultivars such as FR13A, are highly tolerant and survive up to two weeks of complete submergence owing to a major quantitative trait locus designated *Submergence 1* (*Sub1).* Keeping this in view, during Kharif 2019, a trial was formulated to evaluate promising rice genotypes for submergence tolerance.

At CBT centre the survival of rice seedlings were studied after 14 days of total submergence. The plant height was measured before and after submergence and % elongation was estimated. The results on % elongation was presented (Fig.6.5.1). The mean % elongation for all the tested genotypes is 10.6%. Significant variation was observed in % elongation amongst the genotypes. Maximum elongation was observed in AC38675 followed by PAU 9, Sabita and Rahaman Nakhi.

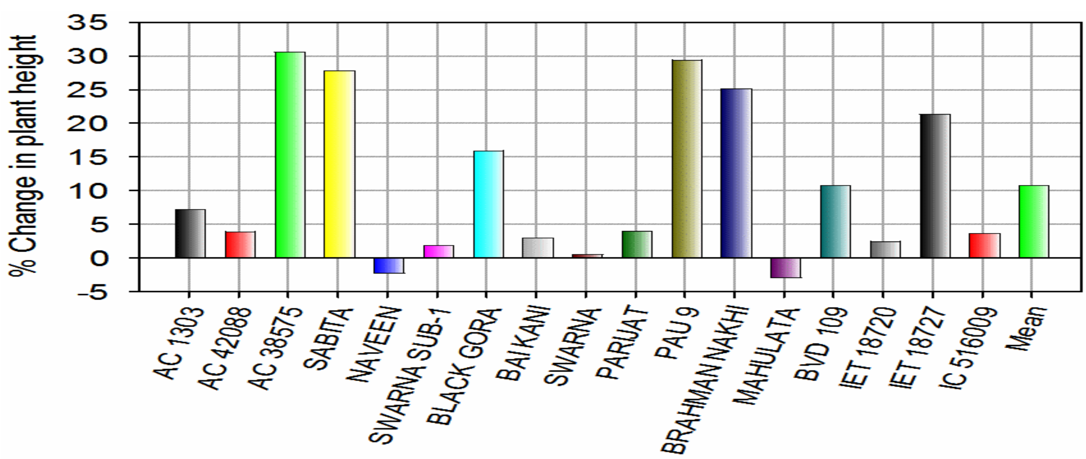


Fig. 6.5.1: Influence of submergence on the % elongation in plant height in different rice genotypes during Kharif-2019.

Elongation was minimum in geotypes AC 1303, AC 42088,Naveen, Swarna-sub1, Bakani, Swapna, PARUAT, IET 18720 and IET 18727. Survival percentage of plants after submergence was measured. The data revealed that the mean survival % for all the tested genotypes is 55.7% and the survival % varied from a maximum of 91% (IC516009) to 31% (BVD 109) followed by IET18720 (Fig. 6.5.2).

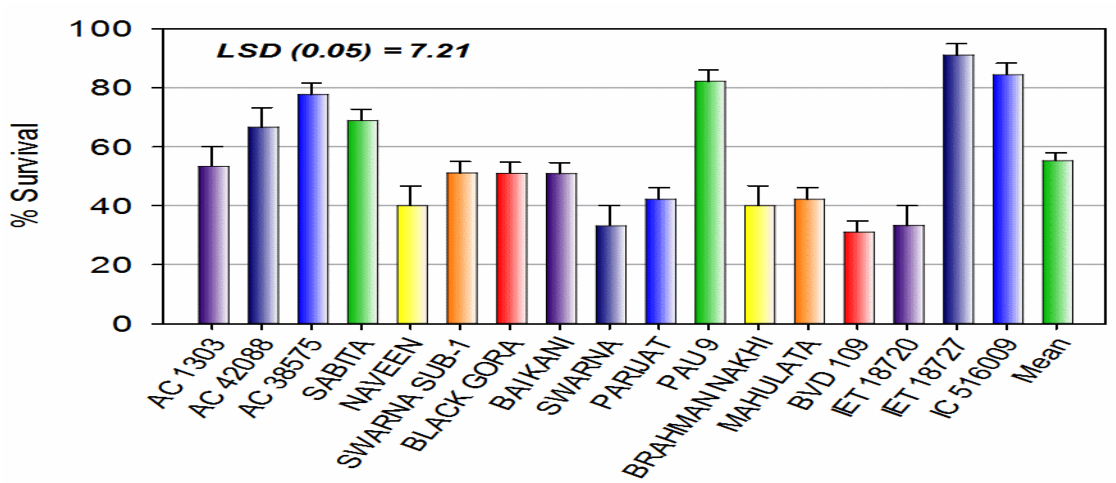


Fig.6.5.2: Influence of total submergence on the plant survival in different rice genotypes. Each bar represents the mean of 3 replications.

Total starch content was estimated in the leaves and the data revealed that significant differences were noticed amongst the rice genotypes,. The starch content varies between 6.58 mg/g (PAU9) to 2.49 mg/g (BVD 109) followed by IET 18720 and Swarna (Fig. 6.5.3) with a mean value of 4.42 mg/g.

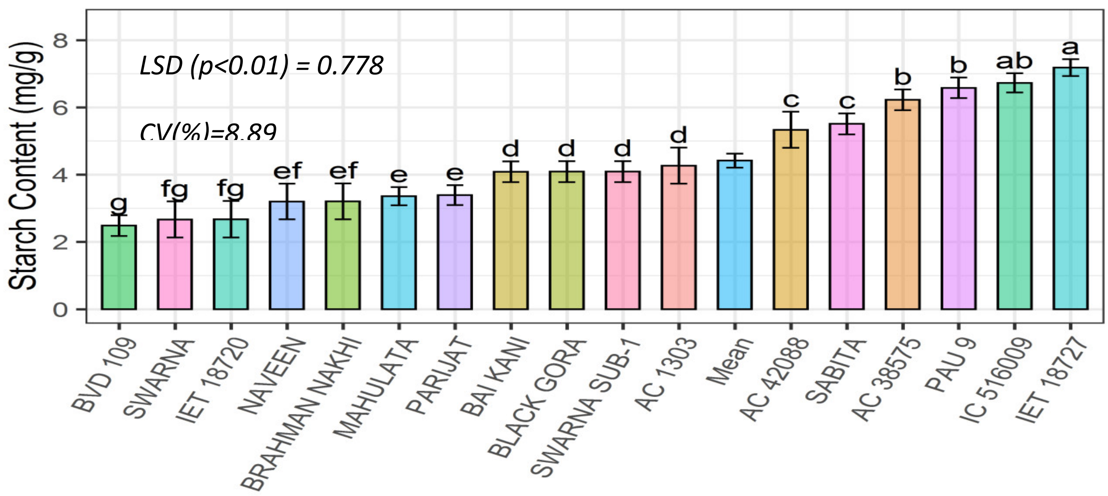


Fig.6.5.3 Influence of submergence on leaf starch content in different rice genotypes. Each bar represents the mean of three replications ±SDev. Bars with same letter are statistically not different.

At PTB centre plant height was measured before and after submergence and the elongation % was calculated. The mean (mean of all genotypes) % elongation was >37%. Significant ($p<0.05$) differences were observed in the % elongation between the tested genotypes. The % elongation ranged from 56% (SBITA) and Brahman Nakhi (54%) to a minimum of 21.2% (Mahulata) and BVD 109 (22.6%) (Fig.6.5.4)

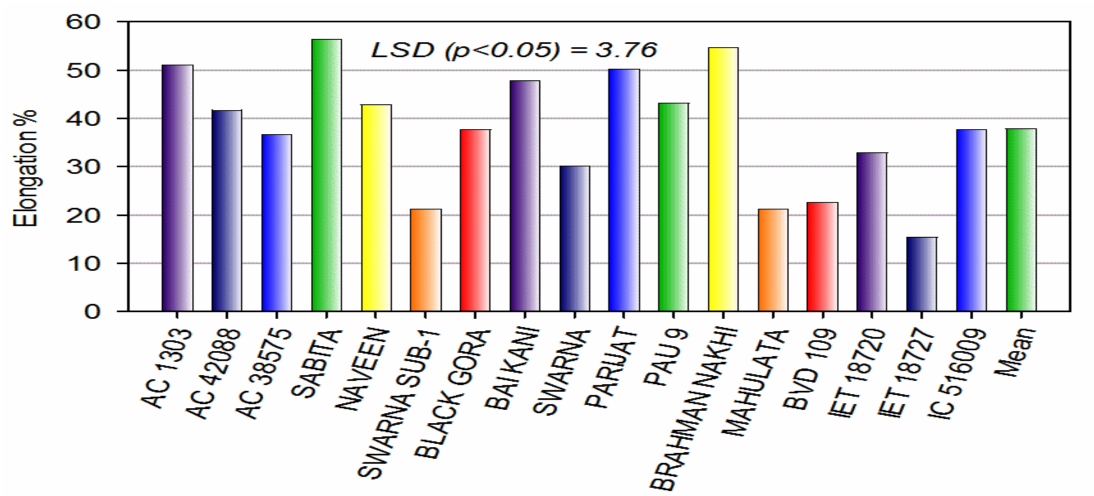


Fig.6.5.4: Influence of submergence on the % elongation in seedlings of different rice genotypes during kharif-2019 season at PTB centre

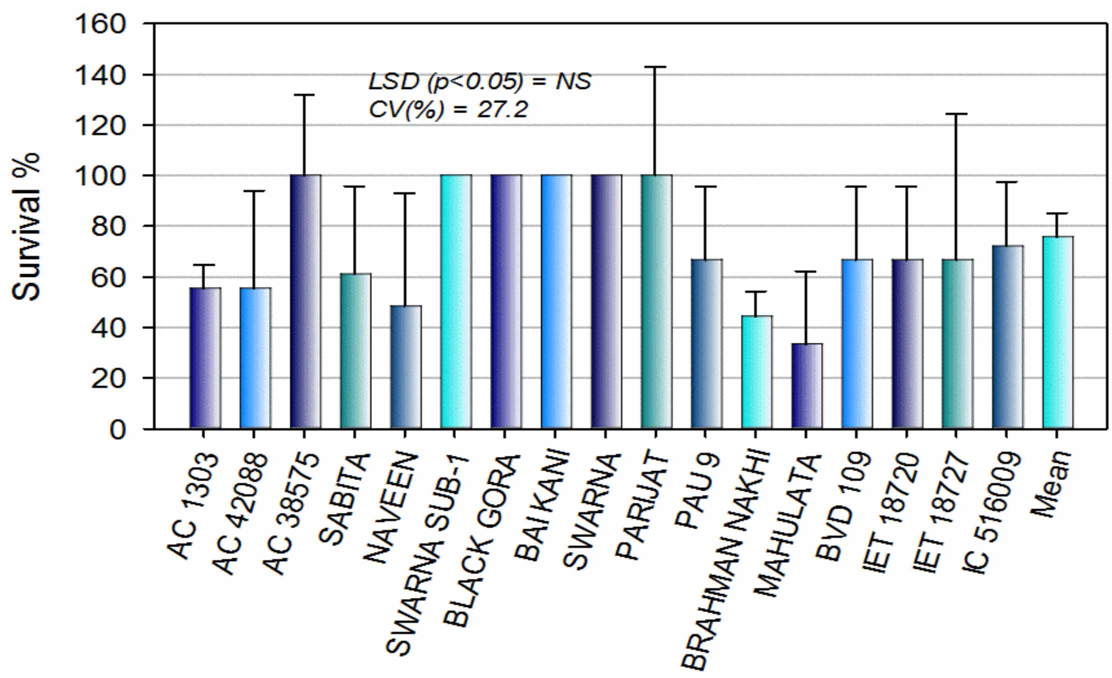


Fig.6.5.4: influence of submergence on seedling survival in different rice genotypes at PTB centre during kharif-2019. Each bar represents the mean of 3 replications ± Stdev.

Seedling survival after submergence stress was measured. The mean seedling survival % was 75%. However, the differences between the genotypes was statistically non-significant. Swarna sub-1, Black Gora, Bakani, Swarna, AC38575 and Pariji did not suffered any seedling mortality. The seedling survival is lowest in Mahulata, Pau-9 and Brahman Nakhi which is >50% *(Fig.6.5.4).*

At FZB centre none of the plants survived after submergence. Hence no data was available regarding elongation rate or seedling survival.

At TTB centre seedling survival was measured after submergence. The data revealed that the mean (mean of all genotypes) was >35% and the differences between the genotypes was found to be significant ($p<0.01$). The percent survival of the seedlings was highest in AC Sabita followed by AC38575, AC42088 and Madhulata, these show better survival percentage than the Swarna sub1. The survival percentage is lowest in swarna, BVD 19, PAU-9 and Naveen *(Fig.6.5.5).*

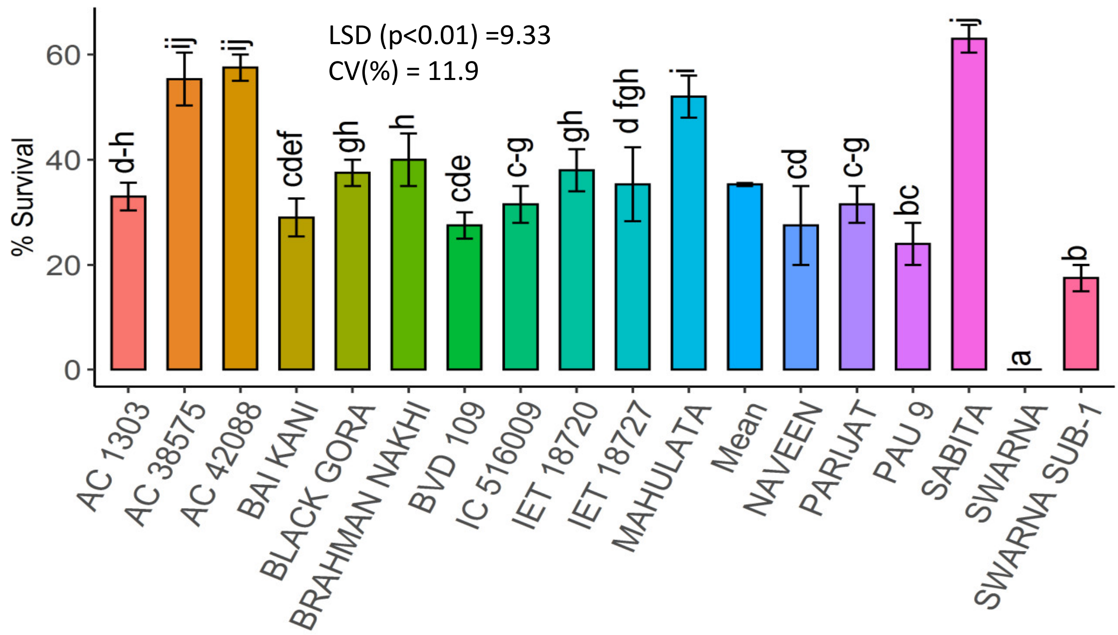


Fig.6.5.5: Influence of submergence on seedling survival percent in different rice varieties. Each bar represents the mean of 3 replications ± SDdev. Bars with similar letters are statistically non-significant.

At NRRI centre seedling survival after submergence was measured and the data was presented in Fig.6.5.6A. The data revealed that the mean % survival is 23.7% for all the tested genotypes. Significant ($p<0.01$) genotypic differences were observed between the genotypes. AC42088 show maximum survival percentage (98%) followed by Sabita (61%) Swarna Sub-1 (61%) andIC516009 (<58%). As many as 7 genotypes did not survived the submergence treatment *(Fig.6.5.7A).*

Starch content was estimated and the data was depicted in *Fig.6.5.7.B*. The starch content for all the genotypes was 38 mg/g dry weight. Significant variation was observed amongst the genotypes for starch content. Maximum starch content was observed in IC42088 (94.7 mg/g) followed by AC1303(60.8 mg/g). Lowest starch content was recorded in BVD 109 (13 mg/g) Parijat (14 mg/g), Brahman Nakhi (14 mg/g), Black Gora (16 mg/g). In fact as many as 7 genotypes recorded lower starch content than the mean starch content of all the genotypes.

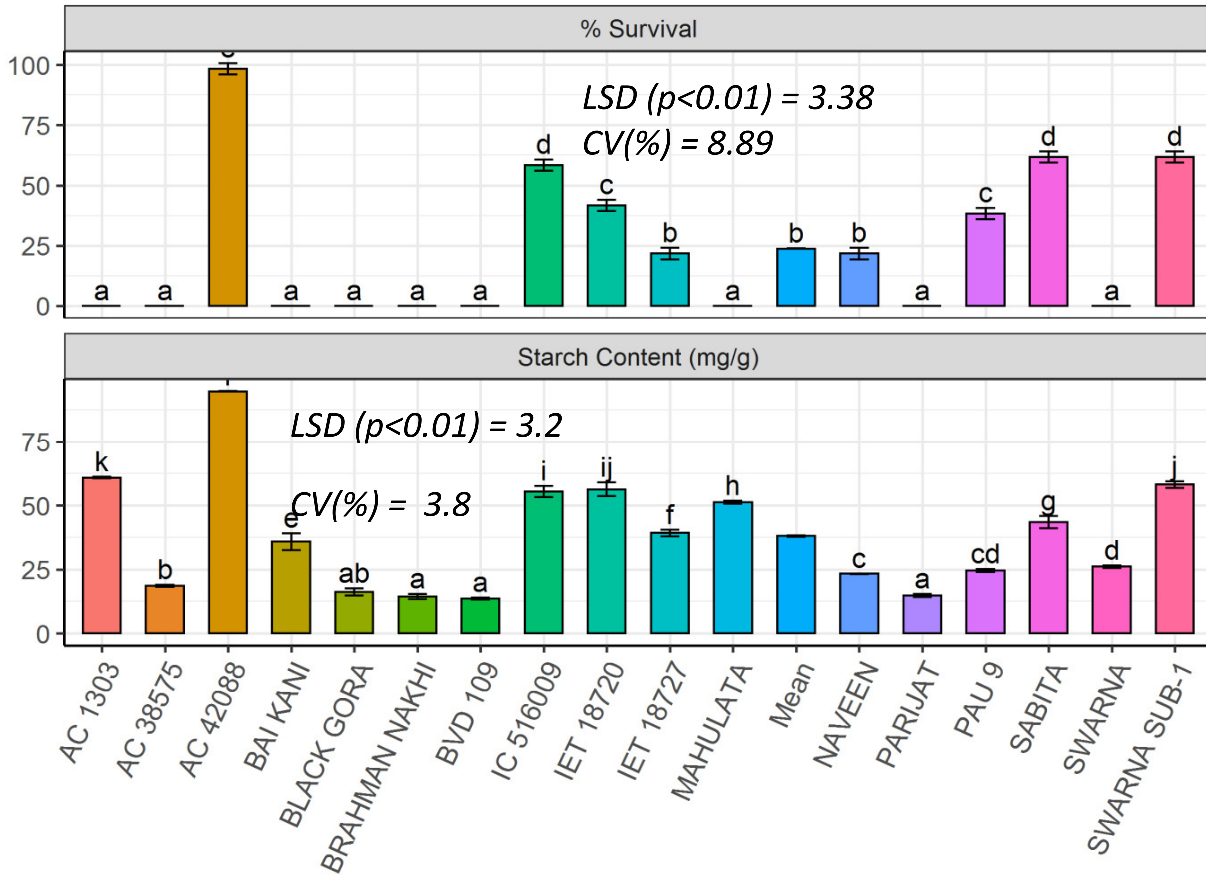


Fig.6.5.6: influence of submergence on seedling survival % and starch content (mg/g) in different rice genotypes. Each bar represents the mean of 3 replications±Stdev. Bars with same letter are statistically not different.

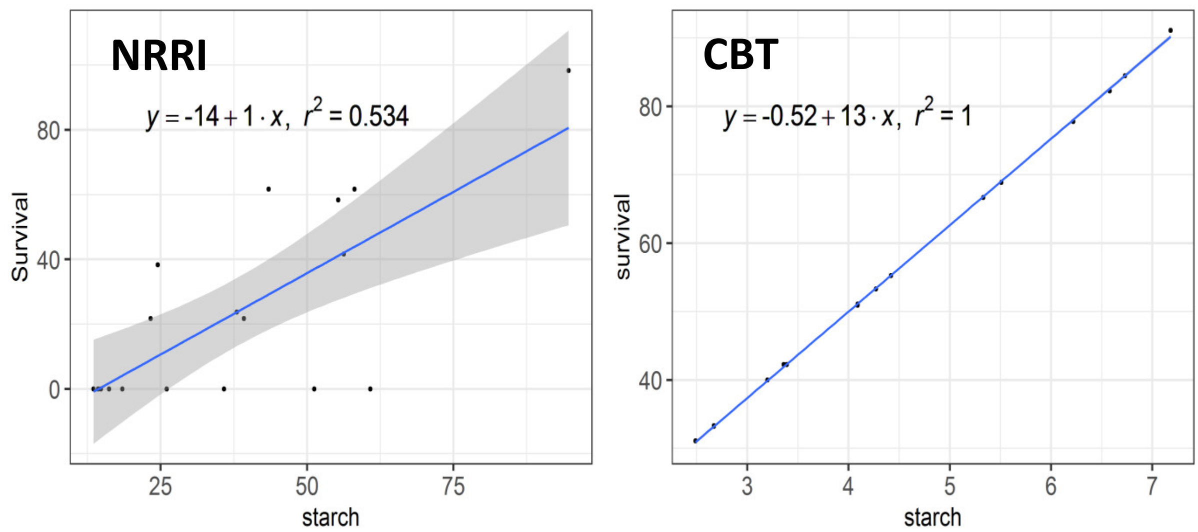


Fig.6.5.7: Relationship between leaf starch content before submergence and seedling survival percent in different rice genotypes. Mean of all genotypes were used to compute the relationship between the two traits.

Leaf starch content show highly significant relation with seedling survival percentage after submerance. The relationship was highly significant at both NRRI and CBT centres. The data indicate that seedling survival dependent on leaf starch content.

Summary & Conclusion

During Kharif 2019, a trial was formulated to evaluate promising rice genotypes for submergence tolerance. Seventeen different rice genotypes were included in the trial which was conducted at four AICRIP centres (NRRI, PTB, FZ B and TTB). Submergence tolerance was estimated by survival percentage of the seedlings subjected to complete submergence. The survival percentage was relatively higher in AC42088 Sabita followed by AC38575, AC42088 and Madhulata, these show better survival percentage than the Swarna sub1 at TTB centre. Similarly, at NRRI AC42088 show maximum survival percentage (98%) followed by Sabita (61%) Swarna Sub-1 (61%) andIC516009 (<58%). As many as 7 genotypes did not survived the submergence treatment. Significant differences were noticed in starch content among the genotypes. A significant positive association was observed between the leaf starch content and % survival indicating that leaf starch content is very important in seedling survival during submergence.

6.6 Screening of elite rice germplasm for low light stress tolerance

Locations: IIRR, CHN, KJT, NRRI, MTU, PNR and RPR

It was considered that low light intensity during monsoon season was an important constraint for higher productivity since yields as low as 3.2 to 4.4 tons/ha were recorded with varieties which yielded 8 to 10 tons/ha under high light intensity conditions as in rabi. The yield of field-grown rice mainly depends on the solar radiation throughout the growth period, especially during the reproductive and/or grain filling stages. Low irradiance (LI) during the reproductive and/or ripening stages has an adverse effect on potential yield because the photosynthetic activity in the leaves of rice cultivars decreases In addition, rice plants in low irradiance environments have shown physiological responses such as: changes in chlorophyll and rubisco content . In view of the importance of low light tolerance in rice crop a new trial was proposed during 51st ACRIP meeting at Raipur and is being continued since then. During Kharif 2019 season the trial was conducted at 7 AICRIP centres with 18 genotypes including 16 taken from IVT-SDW trial. Swarnaprabha was included as tolerant check and IR-8 was taken as susceptible check. Low light treatments were imposed immediately after transplanting by enclosing the plots in shade-net (50% transmittance). The shade net was supported by metal/bamboo poles. The trial was conducted using Factorial RBD design with light treatment as first factor and genotypes as second factor with three replications.

Low-light stress does not significantly alter the days to flowering (DF) and days to physiological maturity (DM). The mean DF (mean of genotypes and locations) under ambient control is 110 days which became 112 days under low-light condition *(Table 6.6.1).* The mean DF was maximum at IRR followed by PNR. The mean DF was lowest at RPR and the difference between ambient control and low-light treatment was discernable at TTB centre. Similarly, the days to maturity show no significant differences between the treatment. The mean DM was 131 days under control and 127 days under low-light stress treatment. The crop at IIRR took maximum number of days to attain physiological maturity where as at RPR the crop took minimum number of days (*Fig. 6.6.1*). Significant differences were observed amongst the genotypes for both DF and DM.

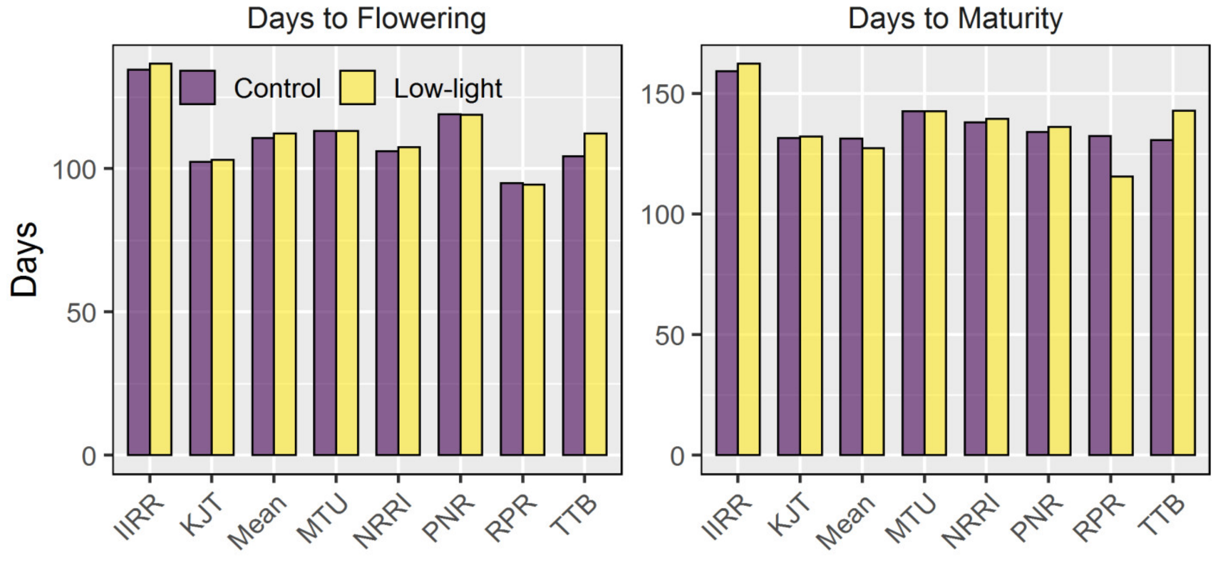


Fig.6.6.1: Influence of Low-light stress on Days to flowering and Days to maturity in different rice genotypes during kharif-2019 at different AICRIP locations. Each bar represents the mean of all genotypes & 3 replications.

The mean DF (mean of treatments & locations) varied between a maximum of 117 days (IET 27572) followed by IR-8 (116 days) to a minimum of 86 days (IET 26687). Similarly, the mean DM varied between a maximum of 147 days (IET 27588) to a minimum of 121 days(IET 27597 and IET 27572) *(Fig. 6.6.1).*

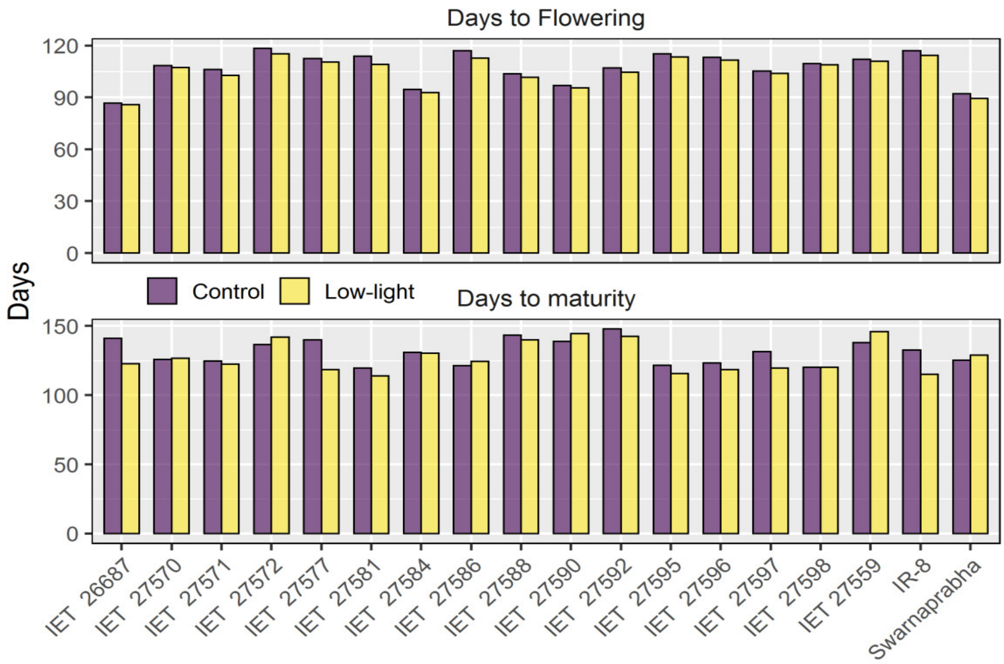


Fig.6.6.2: Influence of Low-light stress on Days to flowering and Days to maturity in different rice genotypes during kharif-2019 at different AICRIP locations. Each bar represents the mean of all locations & 3 replications

The mean (mean of all genotypes and locations)Plant height was not significantly influenced by the light treatments.(*Table 6.6.3).* However, a significant ($p<0.01$) interaction between Genotype x Location was observed implying that the genotypes behaved differently at different locations. Furthermore, the interaction between Genotype x Treatment was also found to be significant, indicating that the genotypes behaved differently under different treatments (Table 6.6.3). The plant height was marginally increased under low-light condition. Maximum increase in plant height under low-light treatment was observed at PNR centre which is very significant. The increase in mean plant height was <8% at all other centres. In fact, a non-significant increase in mean plant height was observed at MTU and RPR centres and at TTB no change was noticed in mean plant height under low-light condition. (*Fig. 6.6.3A*). Significant differences were observed amongst the genotypes. The mean (mean of all locations) show maximum increase in case of IET 27559 and IET 27590 and in case of IET 26687 non change was noticed in mean plant height. In IET 27581 and IR-8 a marginal reduction in plant height was observed *(Fig.6.6.3B).*

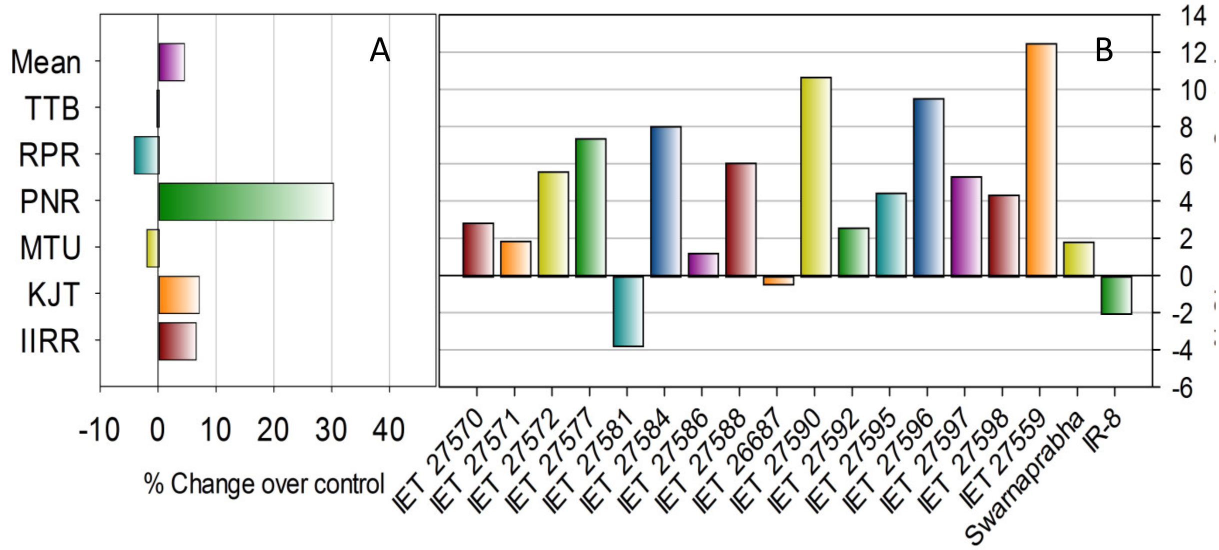


Fig. 6.6.3 : Influence of low-light on plant height in different rice genotypes at different AICRIP centres. (A) mean of all genotypes (B) mean lf all genotypes.

The data on stem weight at flowering stage was presented in *Table 6.6.5.* The data revealed that low light stress show significant effect on mean (mean of all locations and genotypes). The stem weight was reduced by > 32% under low-light in comparison with ambient control (Fig. 6.6.4). The interaction between Genotype x Location was found to be significant ($p<0.01$) indicating that the genotypes behaved differently across the locations. The reduction in mean stem weight is maximum at RPR centre followed by NRRI and PNR centres. Minimum reduction was observed at KJT and TTB centers (*Fig.6.6.4A)*. Significant differences were observed between the genotypes as revealed by highly significant interaction between Treatment x Genotype. Maximum reduction in mean stem weight was observed in case of swarnaprabha followed by IET 26687 and IET 27570. Minimum reduction was noticed in IET 27572, IET 27571 and IET 27596 (*Fig.6.6.4B)*

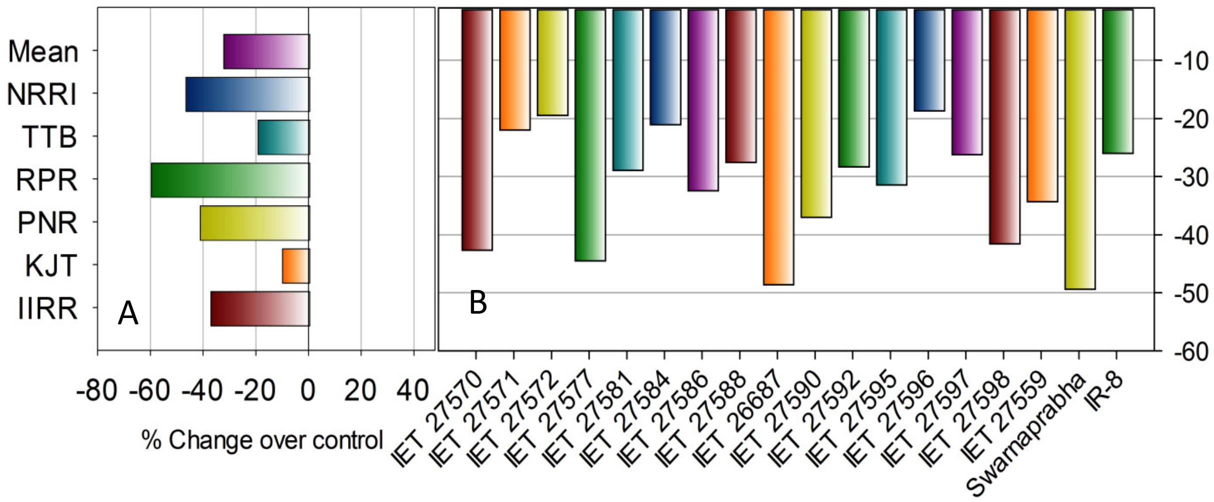


Fig. 6.6.4 : Influence of low-light on stem weight of different rice genotypes at different AICRIP centres. (A) mean of all genotypes (B) mean lf all genotypes.

Leaf chlorophyll content was estimated with the help of SPAD meter. The data indicated that light regimes had significant ($p<0.01$) effect on SPAD readings *(Fig.6.6.5)*. The mean Chlorophyll (SPAD) content was increased under low-light treatment by >11% in comparison with ambient control. Significant ($p<0.01$) differences were observed in mean SPAD amongst the genotypes. Maximum content SPAD reading was observed in Swarnaprabha followed by IET 27597, IET 27595, IET 27590 and IET 27584. Significant interaction was observed between Genotype x Treatment implying that the significant differences existed amongst the genotypes in their response to low-light treatment.

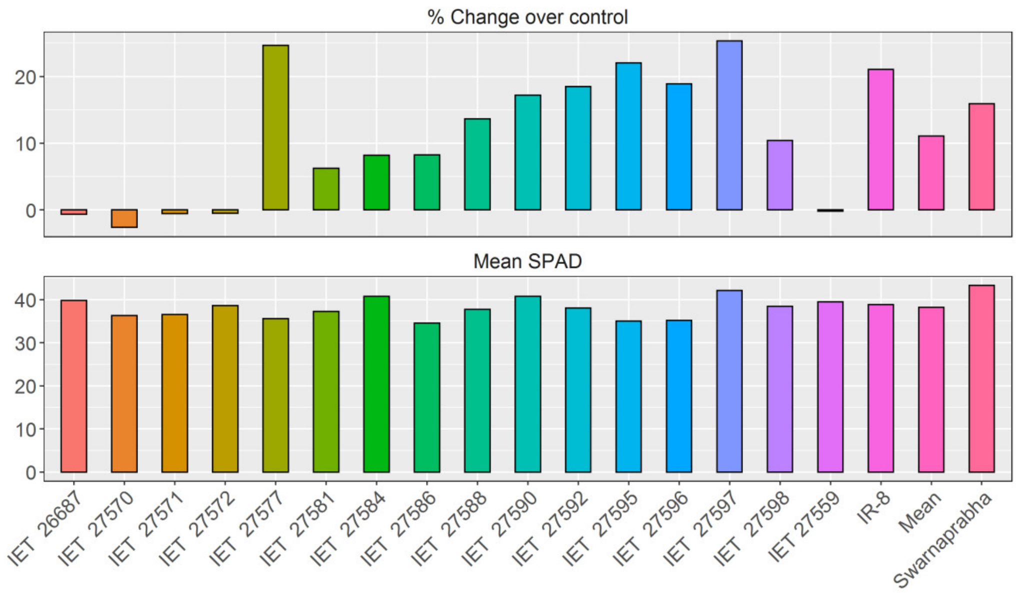


Fig.6.6.5 Influence of low-light stress on leaf chlorophyll (SPAD) content in different rice genotypes during kharif-2019 season. (A) % Change under Low-light stress in comparison with control (B) Mean chlorophyll (SPAD) content (mean of all treatments).

At NRRI, PNR and TTB centres leaf chlorophyll content was measured at panicle initiation stage and again at flowering stage. The total chlorophyll content was significantly affected by low-light treatment at both the stages *(Table 6.6.6 & 6.6.7)*. Low-light treatment increased the leaf chlorophyll content by >14% and >9% , respectively in comparison with control treatment. At PI and flowering stages the differences amongst the genotypes was non-significant for mean chlorophyll content. Moreover, the interaction between Location x treatment was found to be non-significant for both the stages (Table 6.6.6). Similarly, the interaction between Location x Genotype was also non-significant, implying that the treatment effect on chlorophyll content did not differed among the locations. However, a strong interaction was observed between Genotype x Treatment (Table 6.6.6). In all genotypes chlorophyll content increased under low-light stress. However, in some entries like IET 27577 a significant reduction in chlorophyll content was noticed. In IET 27581 and IET 27592 the reduction in chlorophyll was negligible at PI stage. Maximum increase in chlorophyll content was recorded in IET 27597 in both the stages studied (*Fig.6.6.6)* followed by IET27550.

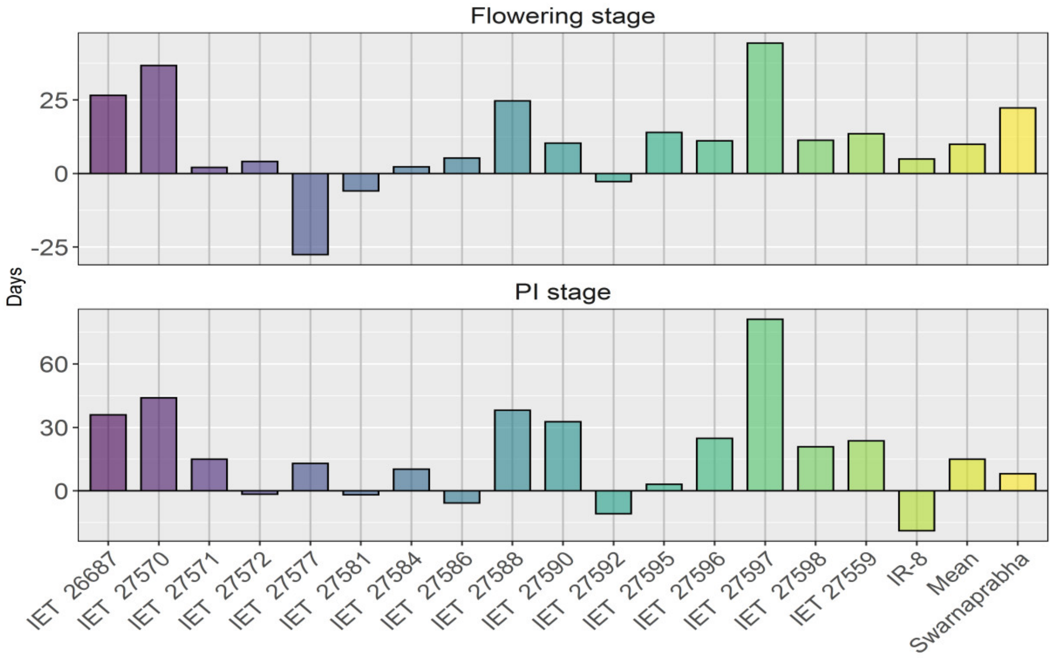


Fig. 6.6.6: Influence of Low-light stress on leaf total chlorophyll content indifferent rice genotypes. Each bar represent % change in chlorophyll content under Low-light in comparison with ambient control condition.

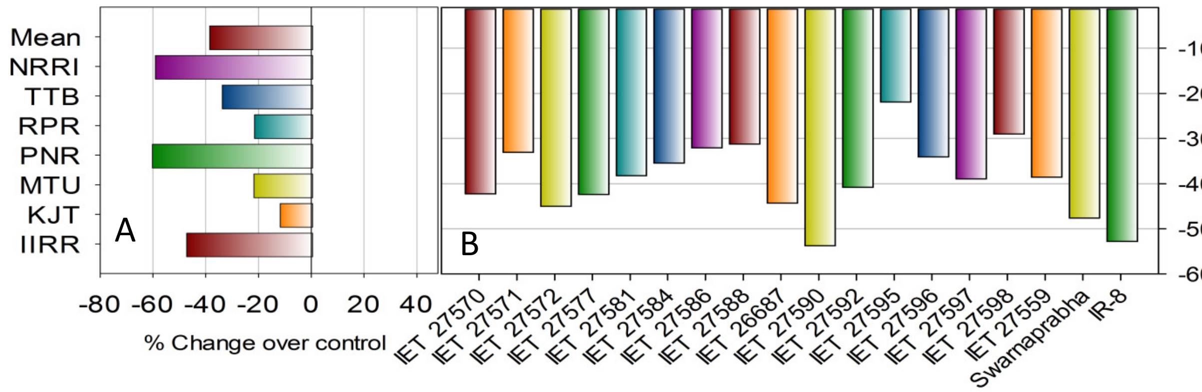


Fig. 6.6.7 : Influence of low-light on Panicle weight m^{-2} of different rice genotypes at different AICRIP centres. (A) mean of all genotypes (B) mean lf all genotypes.

Panicle weight m^{-2} recorded at maturity is an important yield contributing trait which was significantly affected by the light regime (*Table 6.6.11)*. The mean (mean of all genotypes and locations) show significant ($p<0.05$) reduction (>38% over control) under low-light condition. The interaction between Treatment x Location was found to be highly significant ($p<0.01$) indicating that the treatment effect differs across locations. Maximum reduction under low-light was observed at PNR and NRRI centres followed by IIRR which is higher than the over all mean for all locations *(Fig.6.6.7A).* The reduction is less in case of KJT, MTU and RPR centres. Significant differences were observed between the genotypes and in their response to different light regimes as indicated by highly significant interaction between Treatment x Genotype *(Table 6.6.11).* Low-light reduced the panicle weight in all the genotypes. Maximum reduction was observed in IET 27590 and IR-8. The reduction is lowest in IET 27595, IET 27571, IET 27598 *(Fig.6.6.7B).*

Number of grain per panicle is one of the important yield attribute which was measured after harvest. Low-light stress treatment had resulted in >32% reduction in Grain No. Panicle^{-1} (GNo) in comparison with control treatment (Fig. 6.6.8A). Results of ANOVA indicated that a significant interaction between Location x Treatment was found to be highly significant (p<0.01), implying that the treatment effect is not uniform across the locations (*Table 6.6.12).* Maximum reduction in grain number was observed at

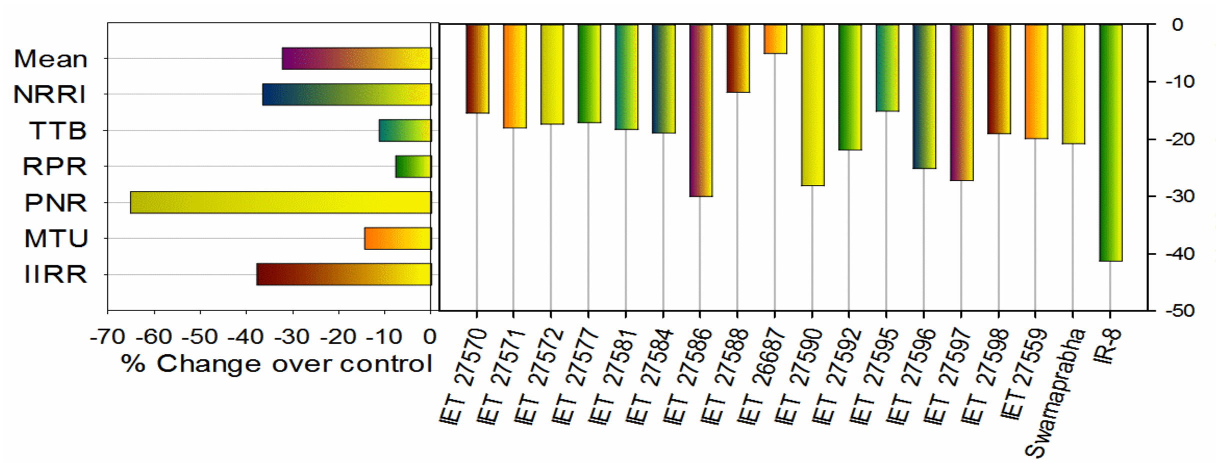
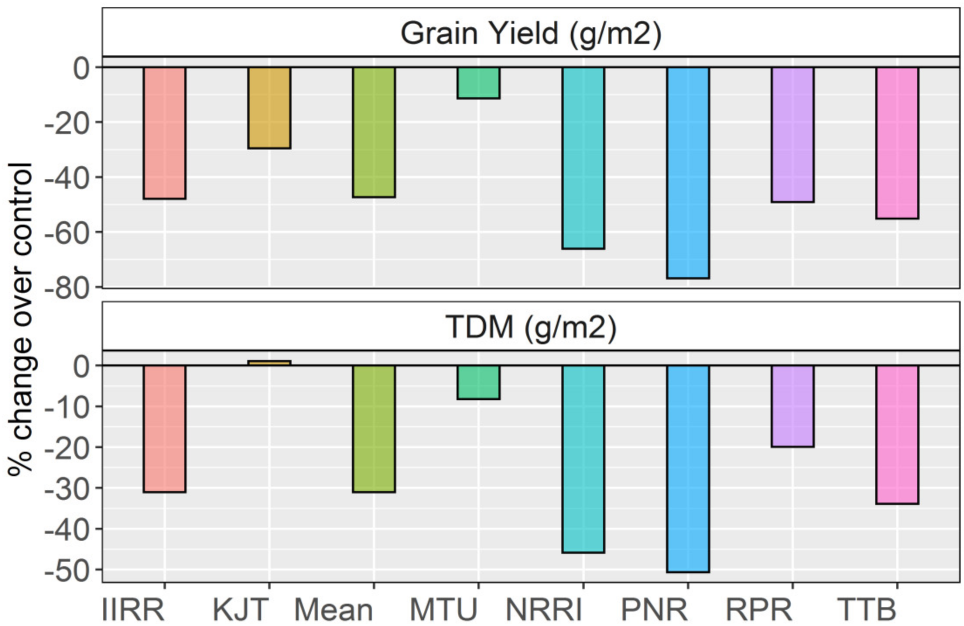


Fig.6.6.8: Influence of low-light stress on grain No.Panicle^{-2} in different rice genotypes at different AICRIP locations. (A) Mean of all genotypes (B) Mean of all locations.

PNR centre followed by IIRR. Minimum reduction in grain number per panicle in RPR and TTB centres. The differences amongst the genotypes was non-significant. Maximum reduction in number of grains was observed in iR-8 (>38%). Minimum reduction in grain number was observed in IET26687 followed by IET 27588 and IET 27570 which is less than the reduction in Swarnaprabha, which is low-light tolerant.*(Fig.6.6.8B).*

Table *6.6.13* presents the data on effect of low light stress on spikelet No per panicle. The data revealed that the mean spikelet number was not significantly influenced by the low light treatment. However, the interaction between location x treatment was found to be significant. Maximum reduction in spikelet number was observed at IIRR followed by NRRI and minimum change was observed at PNR centre. The interaction between Location x Genotype was found to be significant ($p<0.01$). With the exception of Swarnaprabha, IET 27596, IET 27592 and IET 27598, all other tested entries recorded reduction in spikelet number under low light. Maximum reduction was observed in IET 27595 followed by IET 27577 and IR-8 (*Table 6.6.13).*

Low-light treatment resulted in significant reduction in the 1000 grain weight (test weight). The mean test weight (mean of all locations and genotypes) recorded >20% reduction under low-light in comparison with control treatment (*Table 6.6.18).* significant interaction ($p<0.01$) was observed between Location x Treatment implying that the effect of imposed treatment varied from location to location. Maximum reduction in test weight as observed at PNR followed by RPR centers. The reduction is relatively lower at NRRI and IIRR centres. The differences in mean test weight amongst the varieties is non-significant. However, highly significant ($p<0.01$) interaction between Location x Genotype was observed indicating that the genotypes behaved differently at different locations. With the exception of IET 26687, all other tested entries recorded reduction in test weight (*Table 6.6.18).*



6.6.9: Influence of low-light stress on TDM and Grain Yield at different locations during kharif 2019 season. Each bar represent % change in mean TDM in comparison with control treatment.

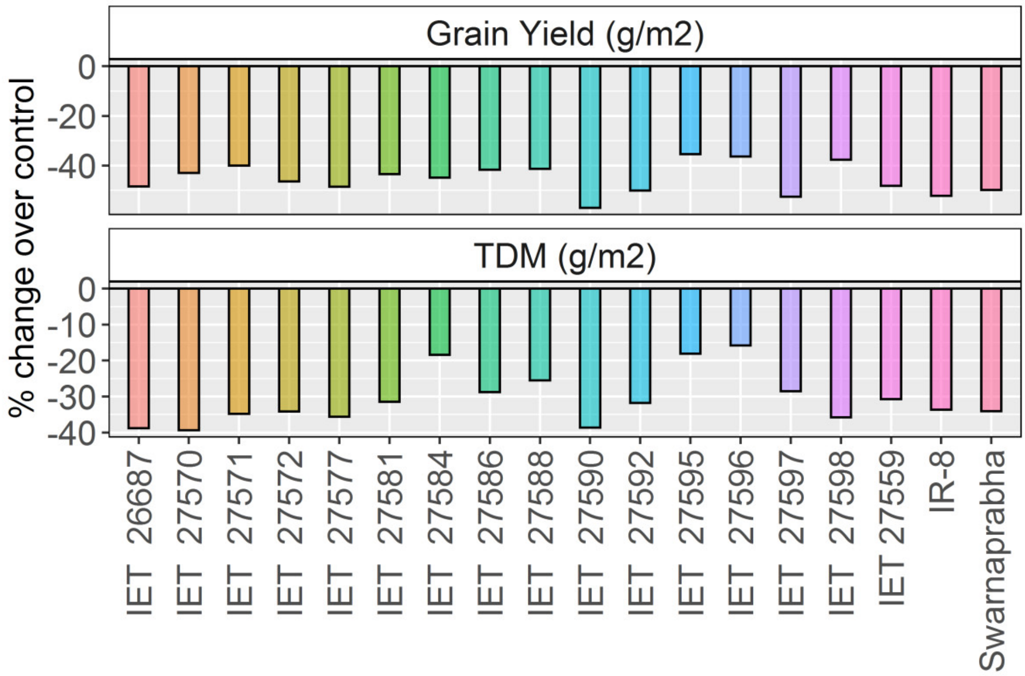


Fig.6.6.10: Influence of low-light stress on TDM and Grain yield in different rice varieties. Each bar represents the % change in comparison with control and mean of all locations.

The mean TDM (mean of all locations and genotypes) was significantly ($p<0.01$) reduced by low-light treatment. The mean TDM was reduced by >31% under low-light condition in comparison with control condition *(Fig. 6.6.10*). Similarly, grain yield was also significantly affected by low-light treatment. The mean grain yield (mean of all genotypes and locations) was reduced by >47% in comparison with control treatment. Significant differences were observed amongst the locations for mean TDM. Maximum reduction in mean TDM was observed at PNR followed by NRRI. Minimum reduction in mean TDM was observed at KJT centre. Similarly, significant differences were observed amongst the locations for mean grain yield Maximum reduction in mean grain yield. Maximum reduction was observed at PNR centre followed by NRRI and minimum reduction in grain yield was observed at MTU centre *(Fig. 6.6.10)*.

Low-light conditions reduced the TDM and grain yield in all the genotypes. The interaction between Treatment x Genotype was found to be non-significant for both TDM and grain yield. All the genotypes including the tolerant check Swarnaprabha recorded significant reduction in both TDM and grain yield. Maximum reduction is observed in IET 27570 (39% reduction) followed by IET27577. Similarly, The reduction in grain yield was highest in IET27590 followed by IET27597 and IET27592. The reduction is >40% in all the remaining entries with the exception of IET27595, IET275995 and IET27596 in which the reduction is <40%. These entries may be considered as relatively tolerant to low-light as the yield loss in these entries is less than the tolerant check swarnaprabha.

Data pertaining to the effect of low-light on harvest index (HI) was presented in *Table 6.6.19*. The data revealed that low-light stress significantly reduced the mean HI (mean of all genotypes and locations) by >20% in comparison with control treatment . The reduction in HI varied amongst the locations. Maximum reduction was observed at TTB followed by NRRI and minimum reduction was observed at KJT and MTU centres. The reduction in mean HI under low-light stress was maximum in IET 27584 and relatively lower reduction in observed in IET 27571 and IET 27598 (*Table 6.6.19).*

Summary & Conclusion

A trial was conducted at 7 AICRIP centres with 18 genotypes including 16 taken from IVT-SDW trial. Swarnaprabha was included as tolerant check and IR-8 was taken as susceptible check. Low light treatments were imposed immediately after transplanting by enclosing the plots in shade-net (50% transmittance). The shade net was supported by metal/bamboo poles. Low-light stress did not significantly influenced the days to flowering and days to maturity. Significant increase in leaf chlorophyll content was observed in all genotypes under low-light. Low-light treatment significantly influenced many yield contributing traits and reduced grain yield substantially. The reduction in grain yield was highest in IET27590 followed by IET27597 and IET27592. The reduction is >40% in all the remaining entries with the exception of IET27595, IET275995 and IET27596 in which the reduction is <40%. These entries may be considered as relatively tolerant to low-light as the yield loss in these entries is less than the tolerant check swarnaprabha.

Table 6.6.1 Influence of Low-Light Stress on Days to flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	145	114	121	138	109	123	100	121	146	114	121	124	103	130	99	120
2	IET 27571	143	114	121	137	98	121	100	119	144	114	118	121	98	129	100	118
3	IET 27572	128	105	106	111	91	90	108	106	130	108	104	111	91	98	117	109
4	IET 27577	137	93	121	110	97	103	113	111	139	93	122	113	97	110	115	113
5	IET 27581	143	90	116	114	105	117	100	112	144	90	118	118	103	125	100	114
6	IET 27584	119	90	116	92	80	81	87	95	120	90	116	106	80	89	87	98
7	IET 27586	137	90	116	139	98	115	119	116	139	92	116	130	98	122	118	116
8	IET 27588	136	105	110	116	98	113	119	114	138	108	111	113	98	121	117	115
9	IET 26687	137	105	110	114	98	103	115	112	139	107	109	130	98	112	113	115
10	IET 27590	137	104	116	123	98	84	115	111	139	108	115	133	98	93	117	115
11	IET 27592	137	114	117	135	105	113	119	120	139	114	119	119	98	122	119	119
12	IET 27595	136	105	98	122	95	113	119	113	138	105	99	117	98	123	116	114
13	IET 27596	136	114	118	138	98	116	100	117	138	114	121	132	98	125	100	118
14	IET 27597	118	90	117	104	80	90	99	100	127	90	119	117	80	96	113	106
15	IET 27598	145	114	116	138	105	123	99	120	145	114	118	125	106	130	99	120
16	IET 27559	137	105	112	114	95	91	109	109	139	105	112	114	97	99	117	112
17	Swarnaprabha	116	90	100	91	73	90	87	92	118	90	98	98	73	99	93	96
18	IR-8	133	100	104	104	85	90	103	103	134	100	103	115	85	98	93	104
	Mean	**134**	**102**	**113**	**119**	**95**	**104**	**106**	**111**	**137**	**103**	**113**	**119**	**94**	**112**	**107**	**112**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					NS		
	LSD (Location x Treatment)				1.46**					LSD (Location x Treatment x Genotype)					NS		
	LSD (Genotype)				1.781**					CV (%)					2.63		
	LSD (Location x Genotype)				4.40**												

Table 6.6.2 Influence of Low-Light Stress on Days to maturity in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	161	143	150	0	143	148	135	126	165	143	150	0	144	155	130	127
2	IET 27571	161	144	150	0	137	149	132	125	164	144	147	0	113	157	132	122
3	IET 27572	158	136	136	141	126	119	140	137	160	139	134	152	131	128	150	142
4	IET 27577	158	123	150	142	131	131	145	140	161	123	151	0	107	140	148	118
5	IET 27581	161	118	146	0	137	144	131	120	163	118	147	0	82	157	131	114
6	IET 27584	158	117	145	126	142	109	119	131	162	117	146	129	116	124	119	130
7	IET 27586	160	118	146	0	133	142	150	121	165	120	145	0	137	154	150	124
8	IET 27588	160	134	140	142	136	141	150	143	163	137	142	152	82	153	150	140
9	IET 26687	158	135	139	145	131	131	149	141	161	137	138	0	137	140	145	123
10	IET 27590	158	133	145	145	131	113	148	139	163	137	144	155	137	126	150	145
11	IET 27592	161	142	146	157	137	142	150	148	165	142	148	157	82	153	150	142
12	IET 27595	161	134	128	0	136	142	150	121	165	134	128	0	82	154	148	116
13	IET 27596	160	144	148	0	136	143	132	123	166	144	150	0	82	155	132	119
14	IET 27597	158	118	146	129	123	117	130	132	159	118	149	0	139	127	145	120
15	IET 27598	160	143	145	0	142	120	131	120	158	143	148	0	132	129	131	120
16	IET 27559	158	135	142	145	126	120	140	138	161	135	141	145	131	158	150	146
17	Swarnaprabha	158	120	129	126	107	119	118	125	159	120	127	131	112	129	125	129
18	IR-8	158	128	134	128	126	120	135	133	159	128	132	0	131	132	125	115
	Mean	**159**	**131**	**143**	**85**	**132**	**131**	**138**	**131**	**162**	**132**	**143**	**57**	**115**	**143**	**139**	**127**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					NS		
	LSD (Location x Treatment)				0.682**					LSD (Location x Treatment x Genotype)					NS		
	LSD (Genotype)				NS					CV (%)					1.07		
	LSD (Location x Genotype)				2.04**												

Table 6.6.3 Influence of Low-Light Stress on Plant height (cm) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control						Grand Mean	Treated (Low light)						Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB		IIRR	KJT	MTU	PNR	RPR	TTB	
1	IET 27570	130.8	159.7	233.0	101.3	140.2	134.3	149.9	134.8	168.7	212.5	136.1	121.4	151.7	154.2
2	IET 27571	118.0	128.3	124.0	83.2	144.2	121.3	119.8	126.0	136.3	137.0	99.8	122.5	111.0	122.1
3	IET 27572	141.5	129.7	214.5	82.3	182.3	118.0	144.7	137.0	143.7	220.5	119.3	168.3	128.3	152.8
4	IET 27577	118.8	122.3	154.0	93.1	122.2	124.7	122.5	132.2	135.3	152.0	132.1	124.4	113.7	131.6
5	IET 27581	126.3	142.7	222.5	77.6	131.8	135.7	139.4	108.2	155.0	172.5	102.8	141.5	125.3	134.2
6	IET 27584	96.3	100.7	112.5	77.6	98.1	100.0	97.5	96.8	99.7	127.5	99.8	97.3	111.3	105.4
7	IET 27586	112.7	113.7	157.5	83.8	119.3	107.7	115.8	127.2	111.7	142.0	94.4	127.0	101.0	117.2
8	IET 27588	103.2	108.3	139.5	67.6	107.6	104.3	105.1	102.2	112.7	151.0	94.4	110.0	98.7	111.5
9	IET 26687	96.8	109.0	137.0	80.6	118.6	113.7	109.3	99.8	112.3	133.0	104.3	106.4	97.0	108.8
10	IET 27590	101.8	109.3	143.5	74.0	111.4	108.7	108.1	111.7	141.3	146.0	101.5	112.3	105.3	119.7
11	IET 27592	96.7	106.7	157.5	78.2	111.7	101.7	108.7	106.5	107.3	155.5	95.0	105.7	99.3	111.6
12	IET 27595	113.8	143.7	130.5	77.3	146.7	134.3	124.4	119.0	147.3	137.0	95.1	146.4	135.0	130.0
13	IET 27596	144.8	146.7	148.5	102.9	156.9	128.3	138.0	161.0	167.3	151.5	126.9	157.3	143.3	151.2
14	IET 27597	119.5	137.7	155.0	87.5	124.3	122.3	124.4	124.2	145.0	165.5	108.9	133.7	109.0	131.1
15	IET 27598	125.2	140.7	168.0	90.8	123.3	131.7	129.9	128.8	147.0	178.5	107.4	128.0	124.0	135.6
16	IET 27559	100.3	122.3	163.5	83.6	146.7	108.0	120.7	139.8	127.3	154.0	136.2	123.4	134.3	135.8
17	Swarnaprabha	120.7	118.7	191.0	106.4	138.2	116.0	131.8	139.8	131.3	167.5	132.0	110.2	124.7	134.3
18	IR-8	80.0	88.0	117.0	64.6	99.9	89.7	89.9	82.8	92.3	104.5	81.2	88.2	79.3	88.1
	Mean	**113.7**	**123.8**	**159.4**	**84.0**	**129.1**	**116.7**	**121.1**	**121.0**	**132.3**	**156.0**	**109.3**	**123.6**	**116.2**	**126.4**
	LSD (Treatment)		NS						LSD (Treatment x Genotype)				NS		
	LSD (Location x Treatment)		3.14**						LSD (Location x Treatment x Genotype)				NS		
	LSD (Genotype)		3.85**						CV (%)				5.11		
	LSD (Location x Genotype)		9.44**												

Table 6.6.4 Influence of Low-Light Stress on Leaf weight (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	350	355	0	172	23	84	336	189	272	332	0	236	17	81	266	172
2	IET 27571	251	232	0	204	18	83	289	154	245	229	0	124	8	147	301	151
3	IET 27572	362	281	0	305	18	73	327	195	351	277	0	81	7	80	125	132
4	IET 27577	332	373	0	269	22	56	291	192	341	373	0	133	8	59	277	170
5	IET 27581	270	345	0	288	16	94	256	181	401	396	0	104	9	67	203	169
6	IET 27584	237	344	0	144	6	84	163	140	168	297	0	158	4	62	136	118
7	IET 27586	345	427	0	218	11	68	331	200	336	402	0	138	8	105	242	176
8	IET 27588	235	302	0	140	15	83	242	145	310	280	0	128	5	76	162	137
9	IET 26687	245	173	0	241	15	79	332	155	209	166	0	77	5	128	206	113
10	IET 27590	327	268	0	218	17	84	284	171	370	196	0	55	6	123	246	142
11	IET 27592	272	353	0	221	24	82	278	176	253	366	0	91	8	108	189	145
12	IET 27595	240	865	0	221	17	92	306	249	202	271	0	150	10	128	190	136
13	IET 27596	335	321	0	380	21	143	349	221	392	357	0	149	13	111	378	200
14	IET 27597	240	186	0	289	18	68	252	150	308	187	0	193	5	102	148	135
15	IET 27598	263	223	0	259	18	71	246	154	290	225	0	97	9	97	242	137
16	IET 27559	222	355	0	308	11	65	243	172	295	370	0	143	6	78	209	157
17	Swarnaprabha	219	186	0	187	14	80	146	119	220	174	0	154	4	45	145	106
18	IR-8	160	386	0	189	16	61	120	133	268	343	0	78	5	60	130	126
	Mean	**272**	**332**	**0**	**236**	**17**	**81**	**266**	**172**	**292**	**289**	**0**	**121**	**7**	**93**	**208**	**144**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				14.6**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				NS					CV (%)					20.2		
	LSD (Location x Genotype)				43.8**												

Table 6.6.5 Influence of Low-Light Stress on Stem weight (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	762	777	0	1976	37	460	1001	716	465	665	0	779	26	491	457	412
2	IET 27571	745	662	0	724	36	477	827	496	477	549	0	364	14	602	709	388
3	IET 27572	926	697	0	763	28	425	679	503	549	692	0	601	10	354	633	406
4	IET 27577	922	838	0	1206	39	524	1032	651	538	860	0	355	13	245	529	363
5	IET 27581	742	1131	0	603	34	549	1018	582	681	1158	0	348	13	292	412	415
6	IET 27584	623	586	0	448	15	405	489	367	435	561	0	526	6	275	227	290
7	IET 27586	813	758	0	1127	21	475	1034	604	503	728	0	725	9	411	489	409
8	IET 27588	803	976	0	514	26	559	546	489	370	949	0	547	8	367	246	355
9	IET 26687	625	244	0	653	18	525	1057	446	283	242	0	290	8	498	290	230
10	IET 27590	883	454	0	721	24	629	621	476	495	475	0	327	8	477	325	301
11	IET 27592	748	560	0	648	36	609	572	453	528	557	0	490	9	414	283	326
12	IET 27595	688	870	0	594	27	563	793	505	333	865	0	341	13	565	315	347
13	IET 27596	909	1129	0	992	46	666	1140	698	688	1128	0	794	23	475	872	569
14	IET 27597	733	363	0	400	29	515	684	389	505	326	0	508	9	420	248	288
15	IET 27598	930	857	0	1914	38	467	617	689	467	886	0	492	14	434	534	404
16	IET 27559	746	978	0	637	14	467	896	534	515	725	0	427	9	456	331	352
17	Swarnaprabha	813	682	0	661	31	475	583	464	423	281	0	410	9	274	254	236
18	IR-8	335	693	0	442	17	416	325	318	351	244	0	467	6	358	227	236
	Mean	**764**	**736**	**0**	**835**	**29**	**512**	**773**	**521**	**478**	**661**	**0**	**488**	**12**	**412**	**410**	**351**
	LSD (Treatment)				11.5*					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				38.5**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				35.8*					CV (%)					18.9		
	LSD (Location x Genotype)				115.6**												

Table 6.6.6 Influence of Low-light stress on leaf chlorophyll content in different rice genotypes at panicle initiation stage

S.No.	Genotypes	PNR	TTB	NRRI	Grand Mean	PNR	TTB	NRRI	Grand Mean
1	IET 27570	1.52	2.53	1.74	1.95	2.79	2.82	2.85	2.81
2	IET 27571	1.38	2.79	1.35	1.9	2.04	2.49	1.95	2.18
3	IET 27572	1.49	1.61	1.77	1.61	1.77	1.34	1.65	1.58
4	IET 27577	1.99	1.77	1.7	1.83	2.81	0.86	2.78	2.07
5	IET 27581	1.3	2.51	1.98	1.92	2.48	1.53	1.53	1.89
6	IET 27584	1.72	2.39	2.72	2.22	2.98	1.65	2.85	2.45
7	IET 27586	1.83	2.64	2.38	2.27	2.4	2.11	1.79	2.14
8	IET 27588	1.68	1.29	1.92	1.59	3.35	0.97	2.31	2.2
9	IET 26687	1.88	2.08	1.49	1.86	3.89	1.64	1.8	2.53
10	IET 27590	1.34	2.86	1.31	1.9	2.77	2.87	1.63	2.52
11	IET 27592	2.53	2.4	1.52	2.23	2.35	1.79	1.74	1.99
12	IET 27595	1.53	3.52	1.67	2.31	2.02	3.03	1.97	2.38
13	IET 27596	1.58	2.91	1.49	2.06	2.13	3.22	2.23	2.57
14	IET 27597	1.29	1.55	1.27	1.38	2.53	1.9	3.38	2.5
15	IET 27598	1.51	2.63	1.46	1.92	2.04	2.52	2.44	2.32
16	IET 27559	1.21	2.44	1.72	1.8	2.47	2.06	2.1	2.23
17	Swarnaprabha	1.41	1.65	2.27	1.71	1.85	1.59	2.26	1.85
18	IR-8	2.73	2.49	2.49	2.58	2.01	2.19	2.07	2.09
	Mean	**1.66**	**2.34**	**1.79**	**1.95**	**2.48**	**2.82**	**2.18**	**2.81**
	LSD (Treatment)				0.12*				
	LSD (Treatment x Location)				Ns				
	LSD (Genotype)				NS				
	LSD (Location x Treatment)				NS				
	LSD (Treatment x Genotype)				0.332**				
	CV (%)				15.63				

Table 6.6.7 Influence of Low-light stress on leaf chlorophyll content in different rice genotypes at flowering stage

S.No.	Genotypes	PNR	TTB	NRRI	Grand Mean	PNR	TTB	NRRI	Grand Mean
1	IET 27570	1.7	4.08	1.73	2.6	3.7	3.98	2.72	3.56
2	IET 27571	1.62	4.37	2.1	2.77	3.18	3.24	1.69	2.83
3	IET 27572	1.6	3.01	1.76	2.17	3.13	1.62	1.92	2.26
4	IET 27577	2.5	3.18	2.44	2.74	2.87	1.27	1.73	1.99
5	IET 27581	1.46	3.87	2.21	2.55	2.78	2.33	1.94	2.4
6	IET 27584	2.05	3.54	2.12	2.63	3.51	2.32	2.01	2.69
7	IET 27586	2.24	4.19	1.69	2.84	3.18	3.21	2.35	2.98
8	IET 27588	2.12	2.43	1.68	2.13	4.05	1.75	1.91	2.65
9	IET 26687	2.19	2.85	2.08	2.41	4.42	2.13	2.38	3.05
10	IET 27590	1.43	5.01	1.91	2.89	2.71	3.81	2.98	3.19
11	IET 27592	2.82	3.72	2.37	3.05	3.32	2.83	2.63	2.96
12	IET 27595	1.77	5.4	1.95	3.17	3.18	4.86	2.42	3.62
13	IET 27596	1.72	4.95	2	3	3.17	4.49	1.85	3.34
14	IET 27597	1.57	1.99	2.64	2	3.77	2.32	2.38	2.88
15	IET 27598	1.74	3.37	2.32	2.5	3.22	2.93	1.89	2.78
16	IET 27559	1.7	3.75	1.82	2.5	3.24	2.88	2.17	2.84
17	Swarnaprabha	1.71	2.63	2.07	2.14	2.84	2.3	2.77	2.62
18	IR-8	2.97	3.48	2.45	3.03	3.35	3.28	2.77	3.18
	Mean	**1.94**	**3.66**	**2.07**	**2.62**	**3.31**	**2.86**	**2.25**	**2.88**
	LSD (Treatment)				0.105*				
	LSD (Treatment x Location)				NS				
	LSD (Genotype)				0.43*				
	LSD (Location x Treatment)				NS				
	LSD (Treatment x Genotype)				0.44**				
	CV (%)				13.4				

Table 6.6.8 Influence of Low-Light Stress on Panicle weight (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	213	363	0	107	6.9	156	189	173	76	377	0	70	4.97	121	92	123
2	IET 27571	192	327	0	309	19.9	151	194	199	82	222	0	137	3.33	118	62	104
3	IET 27572	210	373	0	295	12.5	154	311	226	105	286	0	174	5.29	105	191	144
4	IET 27577	167	428	0	348	7.8	153	215	220	80	486	0	192	4.13	88	153	167
5	IET 27581	203	350	0	348	9.3	170	251	222	135	387	0	84	3.05	100	118	138
6	IET 27584	133	347	0	174	5.9	132	147	156	99	397	0	93	1.67	107	163	144
7	IET 27586	222	570	0	271	8.0	183	153	234	84	582	0	73	2.20	106	81	155
8	IET 27588	137	192	0	175	9.4	202	142	143	89	192	0	72	2.52	193	65	102
9	IET 26687	138	218	0	321	6.0	210	169	177	57	212	0	62	2.38	123	76	89
10	IET 27590	175	282	0	253	15.3	148	133	168	119	229	0	43	4.37	117	75	98
11	IET 27592	172	285	0	316	11.5	155	215	193	71	294	0	129	3.50	128	54	113
12	IET 27595	208	285	0	156	7.9	132	182	162	76	284	0	119	3.66	189	63	122
13	IET 27596	235	374	0	356	10.7	153	239	228	131	367	0	84	6.33	201	157	158
14	IET 27597	146	246	0	276	9.9	208	176	177	143	271	0	186	2.10	115	42	126
15	IET 27598	138	238	0	184	13.3	118	169	143	69	312	0	84	2.40	111	173	125
16	IET 27559	130	282	0	301	8.9	160	320	200	133	370	0	131	5.19	132	89	143
17	Swarnaprabha	159	191	0	308	10.7	156	354	197	132	176	0	235	4.86	113	104	127
18	IR-8	153	391	0	143	8.2	111	126	155	281	219	0	58	2.67	135	108	134
	Mean	**174**	**319**	**0**	**258**	**10.1**	**158**	**205**	**187**	**109**	**315**	**0**	**113**	**3.59**	**128**	**104**	**129**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				11.03**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				ns					CV (%)					16.74		
	LSD (Location x Genotype)				33.06**												

Table 6.6.9 Influence of Low-Light Stress on Total dry matter (g/m2) flowering in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	1325	1495	396	2255	66.5	701	1526	1109	808	1397	352	1019	46.0	726	776	732
2	IET 27571	1188	1221	340	1237	73.1	710	1310	868	803	1033	320	625	25.4	866	1073	678
3	IET 27572	1497	1351	389	1363	59.4	652	1317	947	1005	1256	340	856	22.3	539	949	709
4	IET 27577	1420	1639	375	1823	68.2	732	1538	1085	959	1719	364	680	24.9	392	960	728
5	IET 27581	1215	1826	376	1238	59.9	813	1524	1007	1217	1942	376	536	25.6	459	734	756
6	IET 27584	992	1277	428	767	26.9	621	799	701	702	1255	403	778	11.7	444	527	588
7	IET 27586	1379	1755	307	1617	40.0	726	1519	1049	923	1712	247	936	19.4	621	812	753
8	IET 27588	1175	1471	332	829	50.3	844	931	805	769	1421	313	746	16.3	636	473	625
9	IET 26687	1007	1636	293	1214	38.3	815	1558	937	549	1620	294	429	15.5	750	571	604
10	IET 27590	1385	1670	379	1192	56.4	860	1039	940	984	1900	374	424	17.8	716	646	723
11	IET 27592	1192	1199	351	1184	71.6	847	1065	844	851	1217	347	710	20.5	650	527	617
12	IET 27595	1135	2020	361	971	51.8	787	1281	944	611	1419	307	609	26.8	881	568	632
13	IET 27596	1479	1825	363	1729	77.4	961	1729	1166	1210	1852	354	1027	43.0	788	1407	954
14	IET 27597	1119	1795	385	965	57.0	790	1112	889	955	1783	384	887	15.6	637	437	728
15	IET 27598	1330	1317	314	2357	70.0	657	1032	1011	825	1423	302	673	25.7	642	950	692
16	IET 27559	1098	1614	387	1246	30.3	692	1460	932	942	1465	384	701	20.1	666	629	687
17	Swarnaprabha	1191	1059	323	1156	55.8	712	1084	797	774	1031	323	799	17.5	432	503	554
18	IR-8	648	1471	375	773	42.1	588	571	638	899	1373	355	603	14.0	553	466	609
	Mean	**1210**	**1536**	**360**	**1329**	**55.3**	**750**	**1244**	**926**	**877**	**1490**	**341**	**724**	**22.7**	**633**	**723**	**687**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				52.4**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				48.78*					CV (%)					13.5		
	LSD (Location x Genotype)				157.3**												

Table 6.6.10 Influence of Low-Light Stress on Shoot weight (g/m2) maturity in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	1565	1740	497	2905	474	952	1411	1363	818	1570	489	1491	400	536	684	856
2	IET 27571	953	1645	441	1547	574	842	1286	1041	594	1640	434	679	304	562	910	732
3	IET 27572	808	1551	514	1725	474	771	1094	991	787	1956	470	957	217	480	917	826
4	IET 27577	1038	1801	482	2128	451	814	1234	1135	1005	1879	478	781	384	455	763	821
5	IET 27581	865	1699	516	1516	497	834	1323	1036	803	1673	511	638	433	552	638	750
6	IET 27584	688	1200	590	891	265	626	643	700	540	1831	543	888	467	462	298	718
7	IET 27586	835	1653	382	1909	487	729	1025	1003	676	2019	319	1108	402	556	611	813
8	IET 27588	886	1834	430	976	370	907	957	909	716	2147	426	702	440	611	329	767
9	IET 26687	776	1333	394	1384	307	969	1231	913	585	1509	370	425	570	516	483	637
10	IET 27590	793	1210	519	1327	574	822	810	865	601	1452	470	497	446	594	436	642
11	IET 27592	679	1448	445	1444	514	771	884	884	657	1641	418	809	527	508	458	717
12	IET 27595	820	1739	448	1128	481	871	1065	936	974	1667	381	694	588	628	553	784
13	IET 27596	1026	2180	452	2035	524	949	1320	1212	1226	2278	437	1273	403	698	977	1042
14	IET 27597	843	2083	486	1150	527	924	709	960	637	1755	482	1026	464	568	321	750
15	IET 27598	1108	2462	384	2743	569	763	1203	1319	1038	2388	375	791	200	545	808	878
16	IET 27559	749	1699	486	1455	419	761	1068	948	461	1609	482	850	210	580	387	654
17	Swarnaprabha	876	1628	395	1320	361	699	684	852	535	1604	393	970	271	449	483	672
18	IR-8	556	1448	468	916	641	647	405	726	651	1428	440	689	250	409	531	628
	Mean	**881**	**1686**	**463**	**1583**	**473**	**814**	**1020**	**989**	**739**	**1780**	**440**	**848**	**388**	**539**	**588**	**760**
	LSD (Treatment)			ns						LSD (Treatment x Genotype)				70.13*			
	LSD (Location x Treatment)			53.3**						LSD (Location x Treatment x Genotype)				ns			
	LSD (Genotype)			65.3**						CV (%)				12			
	LSD (Location x Genotype)			159.1**													

Table 6.6.11 Influence of Low-Light Stress on Panicle weight (g/m2) maturity in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	867	743	858	204	548	667	734	660	485	623	509	154	305	375	229	383
2	IET 27571	666	383	726	588	507	591	656	588	511	353	617	338	317	393	235	395
3	IET 27572	896	527	771	794	508	539	710	678	467	430	556	400	187	336	244	374
4	IET 27577	1003	878	600	927	437	571	588	715	455	738	444	426	305	319	206	413
5	IET 27581	652	460	597	696	488	585	782	609	448	519	426	203	402	388	256	377
6	IET 27584	989	452	816	653	463	439	454	609	672	405	520	226	439	323	179	395
7	IET 27586	917	972	485	560	460	510	725	661	478	844	348	187	410	389	497	451
8	IET 27588	654	294	597	591	488	640	307	510	374	264	567	211	471	428	151	352
9	IET 26687	551	330	494	878	385	736	452	546	347	290	363	131	388	362	258	305
10	IET 27590	785	258	461	765	472	571	738	578	253	162	367	163	285	416	235	269
11	IET 27592	529	379	823	826	428	541	768	613	365	362	674	293	318	355	184	364
12	IET 27595	722	352	597	317	337	610	546	497	471	323	523	275	426	438	271	389
13	IET 27596	942	764	728	616	447	664	524	669	552	654	531	157	347	488	370	443
14	IET 27597	733	370	645	793	360	646	571	588	284	296	580	422	374	398	171	361
15	IET 27598	713	473	697	354	507	535	654	562	479	425	615	195	433	381	272	400
16	IET 27559	663	674	702	960	349	533	777	665	333	624	582	341	341	406	245	410
17	Swarnaprabha	1053	247	600	888	402	490	483	595	250	167	462	480	206	314	311	313
18	IR-8	908	263	584	607	322	453	821	565	237	263	485	127	220	286	258	268
	Mean	**791**	**490**	**655**	**667**	**439**	**573**	**627**	**606**	**414**	**430**	**509**	**263**	**343**	**378**	**254**	**370**
	LSD (Treatment)				12.7*					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				41.17**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				ns					CV (%)					17		
	LSD (Location x Genotype)				123.5**												

Table 6.6.12 Influence of Low-Light Stress on Grain number/panicle in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	113	0	156	0	185	127	208	158	75	0	123	0	188	135	147	133
2	IET 27571	68	0	143	0	183	189	230	163	55	0	129	0	225	138	120	133
3	IET 27572	88	0	143	56	166	173	290	143	60	0	128	80	161	123	158	119
4	IET 27577	98	0	132	117	153	158	263	134	53	0	117	0	146	103	137	111
5	IET 27581	91	0	169	0	139	163	238	160	60	0	134	0	187	118	155	131
6	IET 27584	94	0	104	117	159	152	250	152	73	0	81	39	197	125	138	123
7	IET 27586	78	0	143	0	166	189	290	173	49	0	113	0	124	124	196	121
8	IET 27588	70	0	130	98	183	193	155	138	54	0	116	41	135	187	117	122
9	IET 26687	66	0	134	130	125	147	165	128	57	0	121	0	150	145	135	121
10	IET 27590	87	0	144	141	140	132	308	159	40	0	121	48	116	137	157	114
11	IET 27592	71	0	171	106	156	139	290	155	39	0	152	71	87	151	178	121
12	IET 27595	113	0	146	0	200	191	193	169	60	0	126	0	169	196	165	143
13	IET 27596	130	0	179	0	215	220	233	196	77	0	140	0	153	206	157	147
14	IET 27597	79	0	133	119	167	164	285	158	32	0	121	0	148	135	138	115
15	IET 27598	73	0	173	0	157	118	281	161	49	0	151	0	157	131	163	130
16	IET 27559	82	0	143	140	177	158	240	160	76	0	127	69	163	155	178	128
17	Swarnaprabha	73	0	71	140	163	155	280	149	35	0	56	98	147	132	238	118
18	IR-8	96	0	188	126	200	164	385	206	31	0	167	0	146	159	225	121
	Mean	**87**	**0**	**145**	**72**	**169**	**163**	**255**	**164**	**54**	**0**	**123**	**25**	**155**	**144**	**161**	**111**
	LSD (Treatment)					5.01**				LSD (Treatment x Genotype)						ns	
	LSD (Location x Treatment)					12.26**				LSD (Location x Treatment x Genotype)						ns	
	LSD (Genotype)					ns				CV (%)						25	
	LSD (Location x Genotype)					36.8**											

Table 6.6.13 Influence of Low-Light Stress on Spikelet number/panicle in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	NRRI	TTB		IIRR	KJT	MTU	PNR	RPR	NRRI	TTB	
1	IET 27570	190	0	173	255	138	240	149	191	147	0	153	235	162	157	167	170
2	IET 27571	111	0	154	133	195	127	206	154	83	0	152	177	161	96	171	140
3	IET 27572	132	0	156	181	190	132	194	164	92	0	148	174	126	118	153	135
4	IET 27577	136	0	145	161	166	139	170	153	79	0	143	107	208	86	128	125
5	IET 27581	121	0	191	135	140	193	201	164	76	0	166	190	175	127	147	147
6	IET 27584	109	0	115	157	142	93	171	131	94	0	102	85	183	76	156	116
7	IET 27586	107	0	156	114	209	157	209	159	75	0	134	272	142	170	153	158
8	IET 27588	119	0	141	134	196	169	207	161	92	0	138	183	140	128	222	151
9	IET 26687	92	0	147	223	152	156	160	155	71	0	138	210	163	174	178	156
10	IET 27590	108	0	155	216	120	122	145	144	74	0	142	149	194	141	169	145
11	IET 27592	162	0	182	183	142	226	158	176	95	0	177	359	165	175	187	193
12	IET 27595	140	0	159	179	230	171	208	181	79	0	145	159	188	79	237	148
13	IET 27596	179	0	194	159	170	103	253	176	113	0	165	347	187	128	251	198
14	IET 27597	115	0	146	173	176	154	179	157	71	0	142	176	149	153	169	143
15	IET 27598	91	0	188	52	166	104	132	122	57	0	175	118	140	111	161	127
16	IET 27559	125	0	159	200	192	123	172	162	108	0	151	156	178	97	193	147
17	Swarnaprabha	121	0	79	226	190	63	171	142	83	0	70	417	142	105	164	164
18	IR-8	123	0	200	163	155	77	180	150	67	0	187	132	110	86	195	130
	Mean	**127**	**0**	**158**	**169**	**170**	**142**	**181**	**158**	**86**	**0**	**146**	**203**	**162**	**123**	**178**	**150**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				20.7**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				ns					CV (%)					31.6		
	LSD (Location x Genotype)				62.1**												

Table 6.6.14 Influence of Low-Light Stress on Grain number/m2 in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	35933	0	65439	0	4625	19651	40376	40350	20072	0	41690	0	4708	18041	14619	22157
2	IET 27571	19752	0	63085	0	4575	41183	26975	37749	18104	0	42504	0	5625	36113	8433	22078
3	IET 27572	33233	0	62766	25950	4158	27753	31305	26452	19303	0	46343	16000	4033	21829	11445	19826
4	IET 27577	39194	0	60654	37083	3833	35374	28933	29296	17415	0	42614	0	3658	24796	8537	19404
5	IET 27581	24855	0	64922	0	3483	30287	42006	32414	19179	0	44374	0	4575	20064	16195	20877
6	IET 27584	33592	0	46123	23400	3967	35953	21830	23577	25142	0	26763	7183	4917	22083	9393	14348
7	IET 27586	32480	0	50226	0	4158	40191	41056	21176	18054	0	33198	0	3092	30846	26367	22311
8	IET 27588	26355	0	47344	27867	4575	39717	23000	36850	17703	0	39633	7400	3375	41748	12332	22958
9	IET 26687	22041	0	37400	32267	3117	36986	22751	29721	16432	0	27896	0	3742	31192	20790	13210
10	IET 27590	36007	0	57046	25517	3492	27731	33315	46526	12441	0	39864	4800	2900	28339	17935	17713
11	IET 27592	21106	0	79013	44133	3908	40915	47285	50059	14782	0	59851	10700	2167	34103	20557	23693
12	IET 27595	28983	0	60929	0	5000	43256	30054	33644	19593	0	47124	0	4217	52522	9687	26628
13	IET 27596	33910	0	73106	0	5375	55364	22242	37999	21600	0	50930	0	3833	36406	15823	25718
14	IET 27597	27888	0	54010	25617	4175	45014	40821	26117	12407	0	41195	0	3700	25564	18374	20248
15	IET 27598	26684	0	74437	0	3925	28188	25853	31817	18876	0	59697	0	3917	30860	16038	25878
16	IET 27559	29119	0	61347	30033	4425	34449	26823	31033	16678	0	44539	11283	4083	37778	14301	21444
17	Swarnaprabha	32405	0	29139	27933	4083	38220	14619	21963	11197	0	19855	14700	3667	30057	21179	16776
18	IR-8	29803	0	73986	22967	5000	31988	22916	27291	7994	0	55088	0	3642	39134	17413	20545
	Mean	**29630**	**0**	**58943**	**17931**	**4215**	**36234**	**30120**	**24492**	**17054**	**0**	**42398**	**10295**	**3881**	**31193**	**15523**	**20878**
	LSD (Treatment)					768*				LSD (Treatment x Genotype)						NS	
	LSD (Location x Treatment)					2476**				LSD (Location x Treatment x Genotype)						NS	
	LSD (Genotype)					NS				CV (%)						24.31	
	LSD (Location x Genotype)					7429**											

Table 6.6.15 Influence of Low-Light Stress on Spikelet number/m2 in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	60647	0	72556	51067	3458	23041	50191	43493	39505	0	52151	41700	4042	22303	22949	30442
2	IET 27571	32304	0	68024	30367	4875	44826	29158	34926	27587	0	50116	41167	4033	44743	11463	29851
3	IET 27572	49579	0	68354	84267	4750	31108	38198	46043	29055	0	53845	34800	3142	26992	18583	27736
4	IET 27577	54115	0	66792	50917	4158	38084	37139	41868	26414	0	51953	18967	5208	30931	11646	24187
5	IET 27581	32987	0	73260	55517	3508	37479	45968	41453	24182	0	54901	33200	4375	25025	19576	26877
6	IET 27584	39130	0	51106	31467	3542	40582	23163	31498	32185	0	33583	15283	4583	27522	10418	20596
7	IET 27586	44390	0	55088	43200	5217	44262	45465	39604	27224	0	39556	75833	3550	38083	33497	36291
8	IET 27588	45029	0	51469	37950	4892	42685	25970	34666	30185	0	47036	35200	3500	49089	14866	29979
9	IET 26687	30513	0	40777	54733	3800	40438	25749	32668	20533	0	31801	59333	4075	38408	23303	29576
10	IET 27590	44458	0	61655	39100	3000	30553	37606	36062	23327	0	47003	14867	4858	35062	22064	24530
11	IET 27592	48711	0	84403	76050	3542	46398	65737	54140	35688	0	69443	53850	4117	42260	31194	39425
12	IET 27595	36094	0	66209	68600	5742	47242	33380	42878	25895	0	54098	31800	4708	63541	12985	32171
13	IET 27596	46465	0	79035	50033	4258	63472	23986	44542	31993	0	60082	34733	4667	44232	19971	32613
14	IET 27597	40518	0	59444	37433	4392	49076	45474	39389	27720	0	48587	38667	3717	31911	21063	28611
15	IET 27598	33184	0	80553	12650	4150	31248	29049	31806	21778	0	69421	21767	3508	38130	18143	28791
16	IET 27559	44623	0	68409	44083	4800	37465	29465	38141	23794	0	53130	26333	4458	47004	17335	28676
17	Swarnaprabha	53469	0	32285	45267	4750	42171	17716	32610	26355	0	24530	62600	3550	37223	26487	30124
18	IR-8	38664	0	78705	29117	3867	35040	29854	35874	17909	0	61941	26750	2742	48082	21334	29793
	Mean	**43049**	**0**	**64340**	**46768**	**4261**	**40287**	**35182**	**38981**	**27296**	**0**	**50177**	**37047**	**4046**	**38363**	**19826**	**29459**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					NS		
	LSD (Location x Treatment)				4533**					LSD (Location x Treatment x Genotype)					NS		
	LSD (Genotype)				NS					CV (%)					20.72		
	LSD (Location x Genotype)				13601**												

Table 6.6.16 Influence of Low-Light Stress on Grain yield (g/m2) in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	665	391	515	0	399	469	551	498	374	274	470	0	256	202	129	284
2	IET 27571	508	321	463	0	401	453	537	447	425	225	412	0	212	196	138	268
3	IET 27572	728	348	501	494	382	462	544	494	392	244	421	229	205	175	185	265
4	IET 27577	853	554	477	704	329	458	499	554	373	388	426	0	226	146	151	285
5	IET 27581	541	637	543	0	445	509	658	555	388	446	495	0	190	167	198	314
6	IET 27584	898	406	639	556	474	397	390	537	597	284	530	160	206	178	118	296
7	IET 27586	798	680	398	0	473	548	591	581	398	476	326	0	255	176	403	339
8	IET 27588	506	442	440	442	376	606	270	440	295	310	415	176	177	322	114	259
9	IET 26687	459	194	408	503	338	631	366	414	304	136	373	0	162	205	103	214
10	IET 27590	685	294	530	514	367	443	620	493	203	206	445	83	179	194	174	212
11	IET 27592	362	385	459	583	437	465	610	472	254	270	408	186	184	214	132	235
12	IET 27595	621	529	466	0	377	396	458	475	399	370	357	0	223	315	176	307
13	IET 27596	788	780	484	0	497	458	425	572	461	546	434	0	194	336	214	364
14	IET 27597	609	236	512	514	458	623	496	493	218	165	475	0	241	192	111	234
15	IET 27598	607	482	383	0	374	354	553	459	424	338	359	0	201	185	208	286
16	IET 27559	555	529	515	749	383	481	608	546	270	370	482	260	194	221	181	283
17	Swarnaprabha	856	167	415	728	397	468	352	483	218	150	380	350	207	188	202	242
18	IR-8	794	193	474	458	406	333	660	474	169	139	436	0	211	226	179	227
	Mean	**657**	**421**	**479**	**347**	**406**	**475**	**510**	**471**	**342**	**296**	**425**	**80**	**207**	**213**	**173**	**248**
	LSD (Treatment)				9.5**					LSD (Treatment x Genotype)					NS		
	LSD (Location x Treatment)				23.5**					LSD (Location x Treatment x Genotype)					NS		
	LSD (Genotype)				NS					CV (%)					13.01		
	LSD (Location x Genotype)				70.3**												

Table 6.6.17 Influence of Low-Light Stress on Total dry matter (g/m2) maturity in different rice varieties during Kharif 2019 at different centres

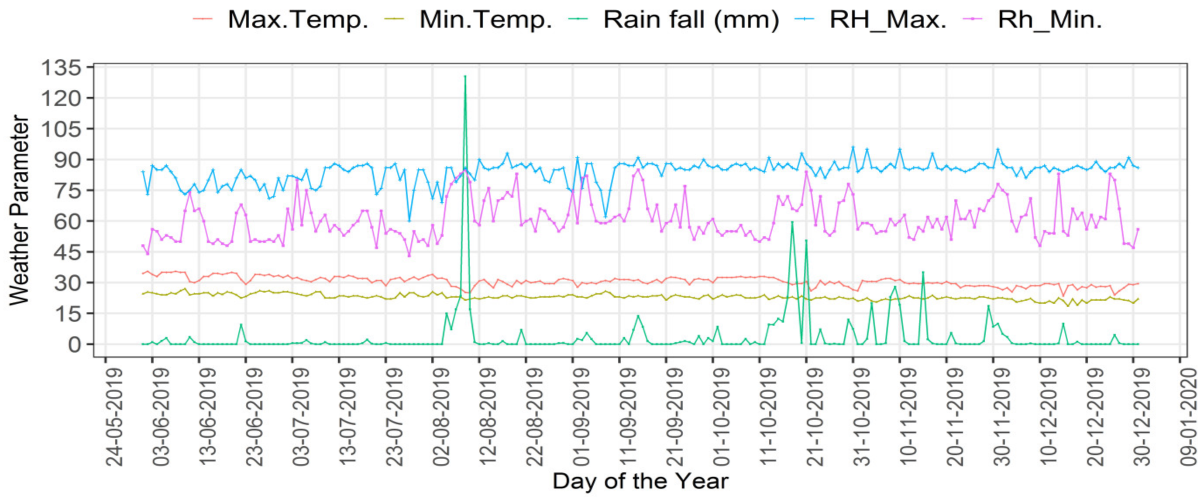
S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI		IIRR	KJT	MTU	PNR	RPR	TTB	NRRI	
1	IET 27570	2432	1253	1011	3109	1022	1619	2145	1799	1303	1200	959	1645	704	912	913	1091
2	IET 27571	1619	1142	904	2134	1081	1434	1942	1465	1104	993	846	1018	620	955	1145	955
3	IET 27572	1704	1130	1015	2519	982	1310	1804	1495	1254	1101	891	1357	404	816	1061	984
4	IET 27577	2041	1683	959	3055	887	1385	1822	1690	1460	1659	904	1207	689	774	919	1087
5	IET 27581	1517	1942	1059	2212	986	1419	2106	1606	1251	1935	1005	841	835	940	894	1100
6	IET 27584	1677	1226	1229	1544	728	1065	1096	1224	1212	1175	1073	1114	906	784	727	999
7	IET 27586	1752	1632	780	2469	947	1239	1749	1510	1154	1663	645	1295	813	945	1008	1075
8	IET 27588	1540	1273	870	1567	859	1547	1265	1274	1090	1221	842	913	911	1039	630	949
9	IET 26687	1327	946	802	2261	692	1705	1682	1345	932	952	742	556	958	878	741	823
10	IET 27590	1578	972	1049	2092	1046	1393	1548	1382	854	999	915	660	731	1009	771	848
11	IET 27592	1208	1114	904	2269	942	1313	1652	1343	1022	1110	826	1102	846	863	642	916
12	IET 27595	1542	1172	914	1445	818	1481	1611	1283	1445	1306	738	969	1014	1066	824	1052
13	IET 27596	1968	1465	936	2652	970	1613	1445	1578	1778	1739	871	1430	749	1186	1547	1329
14	IET 27597	1576	998	998	1943	887	1570	1280	1322	921	993	957	1448	838	966	491	945
15	IET 27598	1821	1408	768	3096	1076	1298	1857	1618	1517	1397	734	986	633	926	1080	1039
16	IET 27559	1412	1146	1001	2415	768	1294	1644	1383	793	1442	964	1191	552	986	782	958
17	Swarnaprabha	1929	1026	810	2208	763	1189	1217	1306	786	986	774	1451	476	764	794	861
18	IR-8	1464	1059	943	1523	962	1100	1226	1182	888	958	876	816	470	695	789	785
	Mean	**1673**	**1255**	**942**	**2251**	**912**	**1387**	**1616**	**1434**	**1154**	**1268**	**865**	**1111**	**731**	**917**	**875**	**989**
	LSD (Treatment)				NS					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				70**					LSD (Location x Treatment x Genotype)					ns		
	LSD (Genotype)				85**					CV (%)					11.7		
	LSD (Location x Genotype)				210**												

Table 6.6.18 Influence of Low-Light Stress on 1000 grain weight (g) in different rice varieties during Kharif 2019 at different centres

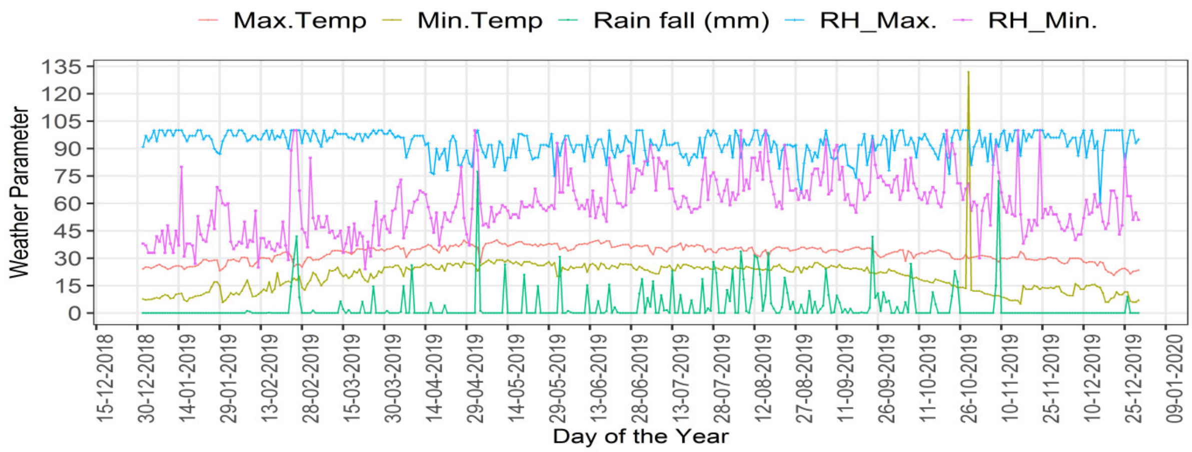
S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR	NRRI	TTB		IIRR	KJT	MTU	PNR	RPR	NRRI	TTB	
1	IET 27570	18.5	0.0	22.9	0.0	30.5	22.9	19.3	22.8	18.6	0.0	18.7	0.0	15.6	22.2	18.3	18.7
2	IET 27571	25.8	0.0	20.5	0.0	30.0	28.4	25.3	26.0	23.5	0.0	18.8	0.0	14.9	24.8	18.7	20.1
3	IET 27572	22.0	0.0	22.1	27.0	31.2	21.9	22.7	24.5	20.3	0.0	16.9	19.4	17.9	22.0	21.7	19.7
4	IET 27577	21.8	0.0	22.1	23.2	29.3	22.9	21.0	23.4	21.4	0.0	17.3	0.0	15.8	23.2	18.7	16.1
5	IET 27581	21.8	0.0	22.0	0.0	30.1	22.7	23.3	20.0	20.3	0.0	19.9	0.0	15.9	20.8	20.7	16.2
6	IET 27584	26.7	0.0	22.0	26.6	28.7	26.7	24.3	25.8	23.8	0.0	16.3	22.8	16.2	25.1	19.0	20.5
7	IET 27586	24.6	0.0	21.4	0.0	29.1	25.2	29.0	21.5	22.1	0.0	17.4	0.0	18.3	24.1	24.3	17.7
8	IET 27588	19.2	0.0	21.9	18.7	30.1	21.8	19.7	21.9	16.7	0.0	19.4	15.3	15.3	21.1	18.7	17.7
9	IET 26687	20.8	0.0	22.9	24.0	31.4	21.6	23.7	24.1	18.4	0.0	19.8	0.0	68.1	20.7	19.0	24.3
10	IET 27590	19.0	0.0	22.5	25.1	27.1	21.5	22.0	22.9	16.3	0.0	20.5	17.8	15.7	19.4	20.0	18.3
11	IET 27592	17.2	0.0	21.4	16.6	30.5	19.2	20.0	20.8	17.2	0.0	18.4	20.1	18.0	20.4	17.0	18.5
12	IET 27595	21.4	0.0	20.8	0.0	31.3	22.4	25.7	24.3	20.3	0.0	18.8	0.0	18.3	23.3	20.7	20.3
13	IET 27596	23.3	0.0	21.1	0.0	30.3	27.1	27.3	25.8	21.2	0.0	17.7	0.0	19.2	24.7	23.7	21.3
14	IET 27597	21.8	0.0	19.9	26.7	30.8	22.3	23.7	24.2	17.6	0.0	18.5	0.0	19.3	20.6	18.0	18.8
15	IET 27598	22.7	0.0	20.7	0.0	30.8	25.2	25.3	25.0	22.5	0.0	18.9	0.0	19.0	23.4	21.7	21.1
16	IET 27559	19.1	0.0	20.5	28.5	29.4	22.4	30.7	25.1	16.2	0.0	17.1	23.3	18.9	21.3	20.7	19.6
17	Swarnaprabha	26.4	0.0	21.1	28.8	29.5	27.6	27.7	26.8	19.5	0.0	16.8	25.7	16.8	22.9	22.7	20.7
18	IR-8	26.7	0.0	21.0	24.4	28.9	26.4	30.0	26.2	21.1	0.0	18.6	0.0	16.0	22.8	20.0	19.7
	Mean	**22.1**	**0.0**	**21.5**	**15.0**	**29.9**	**23.8**	**24.5**	**22.8**	**19.8**	**0.0**	**18.3**	**8.0**	**20.0**	**22.4**	**20.2**	**18.1**
	LSD (Treatment)				0.96*					LSD (Treatment x Genotype)					ns		
	LSD (Location x Treatment)				3.113**					LSD(Location x Treatment x Genotype)					ns		
	LSD (Genotype)				ns					CV(%)					28		
	LSD (Location x Genotype)				9.33**												

Table 6.6.19 Influence of Low-Light Stress on Harvest Index (%) in different rice varieties during Kharif 2019 at different centres

S.No.	Genotypes	Control							Grand Mean	Treated (Low light)							Grand Mean
		IIRR	KJT	MTU	PNR	RPR		TTB		IIRR	KJT	MTU	PNR	RPR		TTB	
1	IET 27570	27.3	45.4	50.9	0.0	42.2	25.7	29.0	36.7	28.4	44.4	49.0	0.0	44.3	14.3	22.3	33.8
2	IET 27571	31.2	44.4	51.2	0.0	37.1	27.7	31.6	37.2	38.4	45.4	48.7	0.0	35.4	18.5	20.5	34.5
3	IET 27572	42.5	45.5	49.3	19.6	40.5	30.2	35.3	37.5	31.4	45.5	47.3	16.9	51.0	22.8	21.5	33.8
4	IET 27577	41.8	44.4	49.9	23.0	38.9	27.4	33.1	36.9	25.7	44.4	47.1	0.0	32.9	22.6	18.8	31.9
5	IET 27581	35.6	45.5	51.3	0.0	46.2	31.2	35.9	40.9	31.2	45.5	49.2	0.0	31.8	22.3	17.8	33.0
6	IET 27584	53.5	44.4	52.0	36.0	65.7	35.4	37.3	46.3	49.1	50.0	49.4	14.4	27.1	24.9	22.7	33.9
7	IET 27586	45.7	44.4	51.0	0.0	51.3	33.6	44.4	45.1	34.4	44.4	50.6	0.0	36.8	40.0	18.6	37.5
8	IET 27588	32.8	45.5	50.6	28.2	48.8	21.3	39.2	38.1	27.9	45.5	49.3	19.8	21.5	24.0	30.9	31.3
9	IET 26687	34.5	46.5	50.9	22.2	52.7	21.7	37.0	37.9	32.2	45.5	50.3	0.0	17.3	14.0	23.4	30.4
10	IET 27590	43.4	47.6	50.5	24.5	37.1	40.1	31.8	39.3	23.6	44.5	48.7	12.9	28.9	25.9	19.3	29.1
11	IET 27592	29.9	45.4	50.8	25.6	46.2	37.0	35.4	38.6	24.6	45.4	49.4	16.8	22.4	20.6	24.8	29.1
12	IET 27595	40.1	46.5	51.0	0.0	53.9	28.4	26.7	41.1	27.8	43.5	48.3	0.0	24.8	21.3	29.6	32.5
13	IET 27596	40.2	46.7	51.7	0.0	54.9	31.6	28.4	42.3	25.6	45.5	49.8	0.0	29.4	15.9	28.3	32.4
14	IET 27597	38.5	45.4	51.3	26.6	63.3	38.8	39.7	43.4	23.6	44.4	49.7	0.0	40.4	22.4	19.9	33.4
15	IET 27598	33.5	44.4	50.0	0.0	36.1	29.9	27.3	36.9	28.0	50.0	49.0	0.0	34.1	19.3	20.1	33.4
16	IET 27559	39.4	45.5	51.4	31.0	50.2	40.8	37.2	42.2	34.0	45.5	50.0	21.8	39.5	28.6	22.4	34.5
17	Swarnaprabha	44.5	46.5	51.3	33.0	55.3	33.0	39.4	43.3	27.8	44.5	49.2	24.1	45.6	25.2	24.6	34.4
18	IR-8	54.3	45.5	50.3	30.1	45.5	53.9	30.3	44.3	19.2	46.1	49.7	0.0	48.3	22.8	32.5	36.4
	Mean	**39.4**	**45.5**	**50.9**	**16.7**	**48.1**	**32.6**	**34.4**	**38.2**	**29.6**	**45.5**	**49.1**	**7.0**	**34.0**	**22.5**	**23.2**	**30.1**
	LSD (Treatment)					ns				LSD (Treatment x Genotype)						ns	
	LSD (Location x Treatment)					3.92**				LSD (Location x Treatment x Genotype)						ns	
	LSD (Genotype)					ns				CV (%)						21.90	
	LSD (Location x Genotype)					9.9**											



Important weather parameters recorded at CBT centre during the crop growth period in Kharif-2019 season



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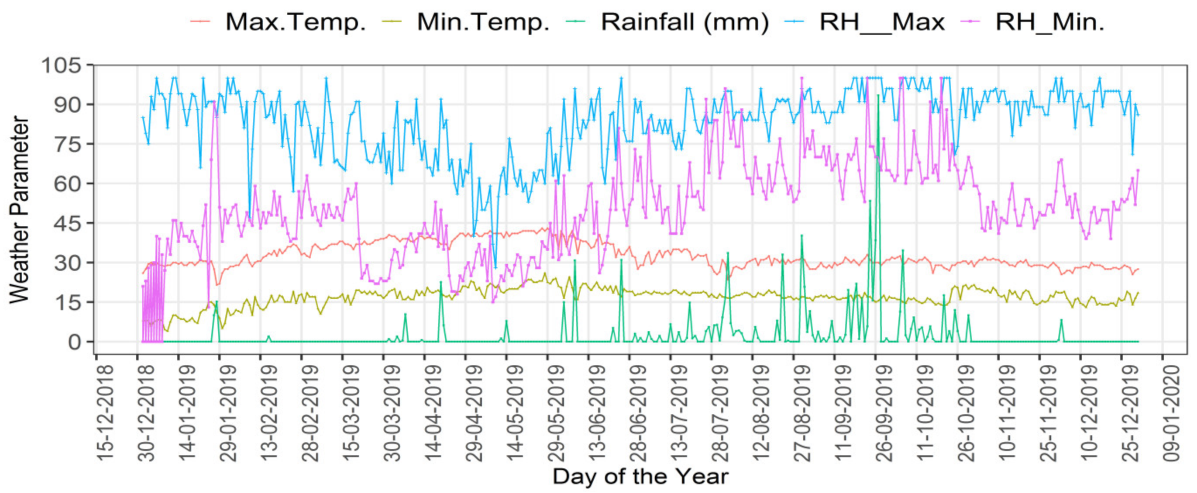

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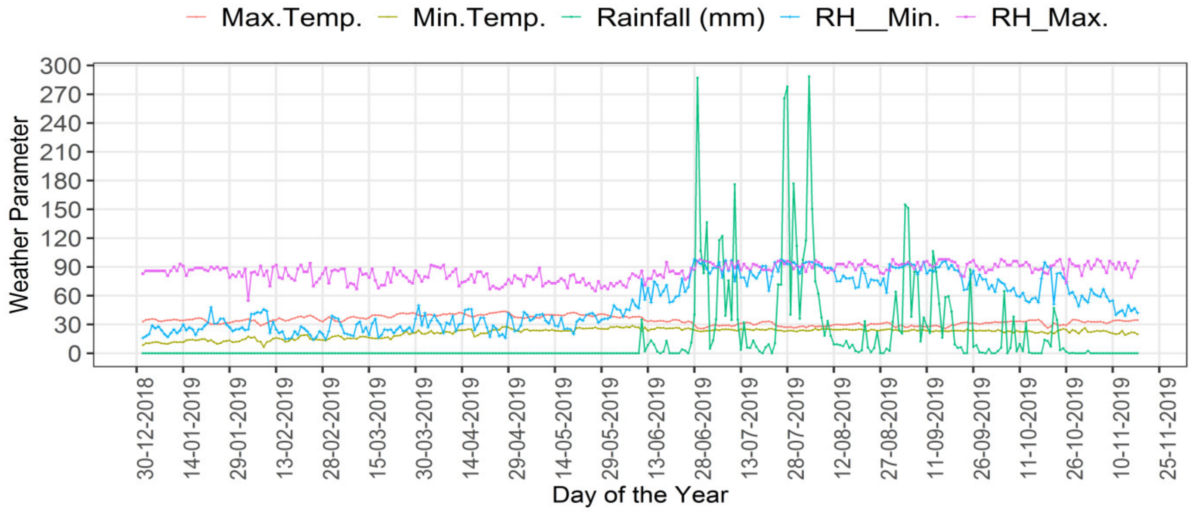

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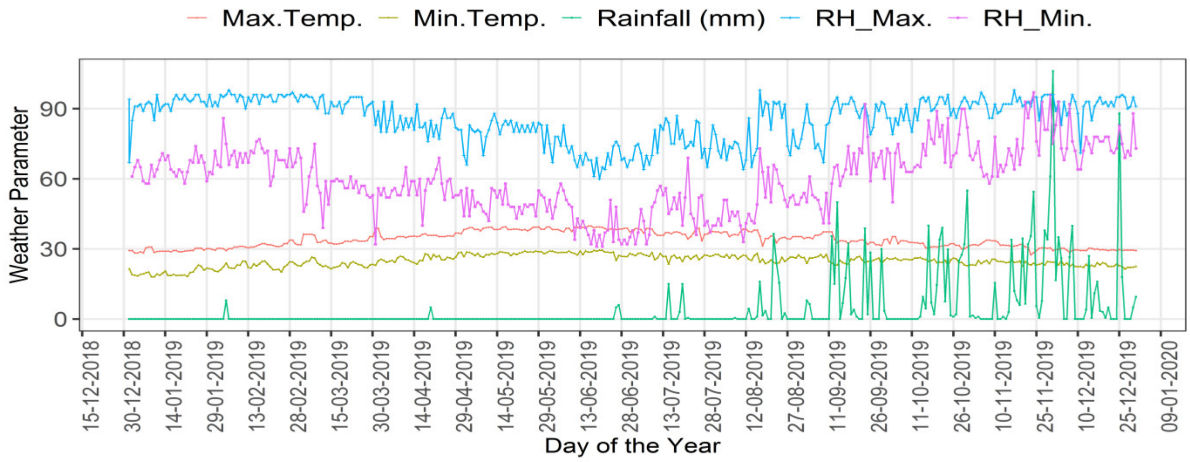

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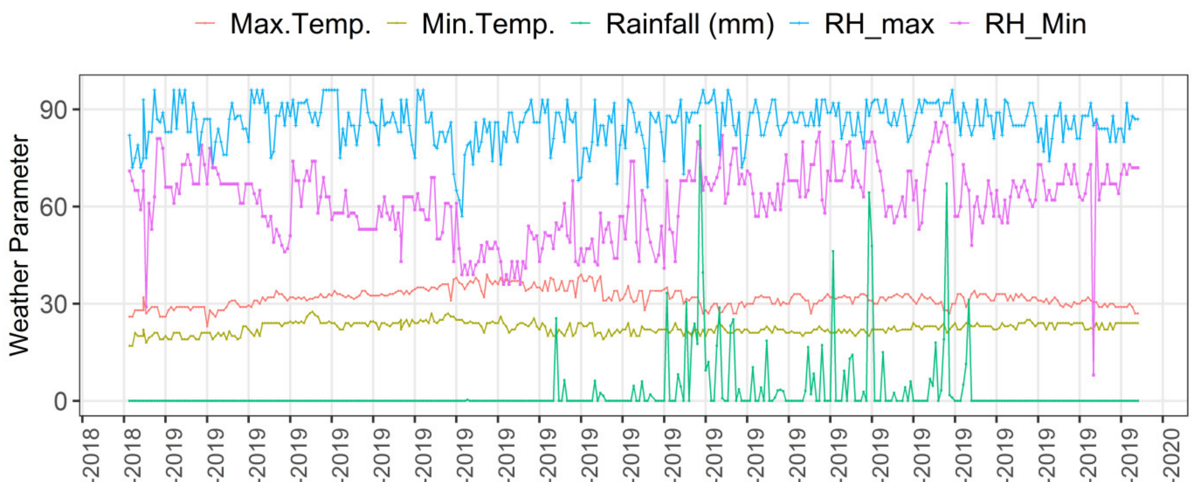
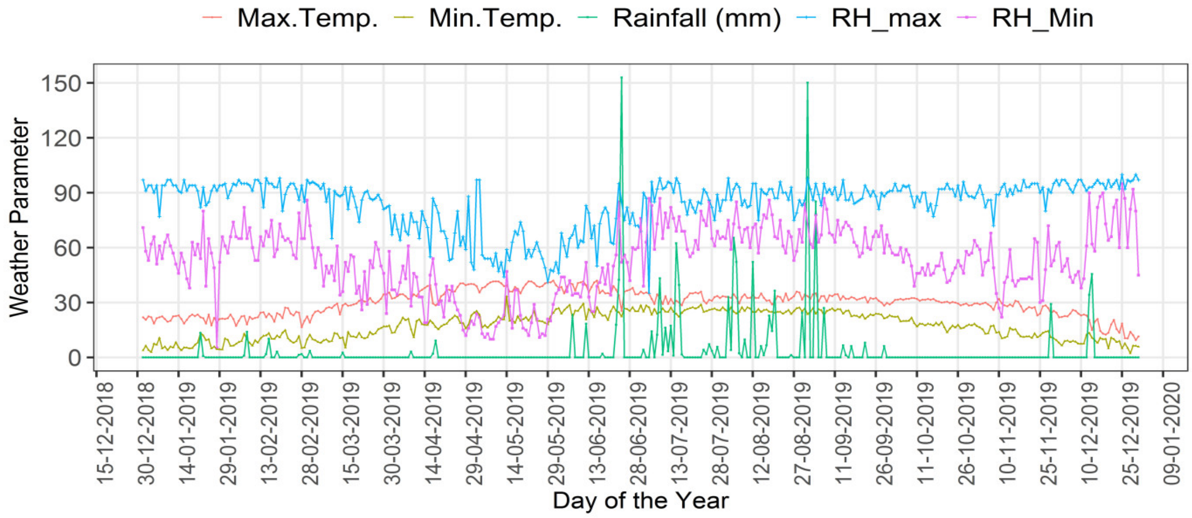


Important weather parameters recorded at MTU centre during the crop growth period in Kharif-2019 season



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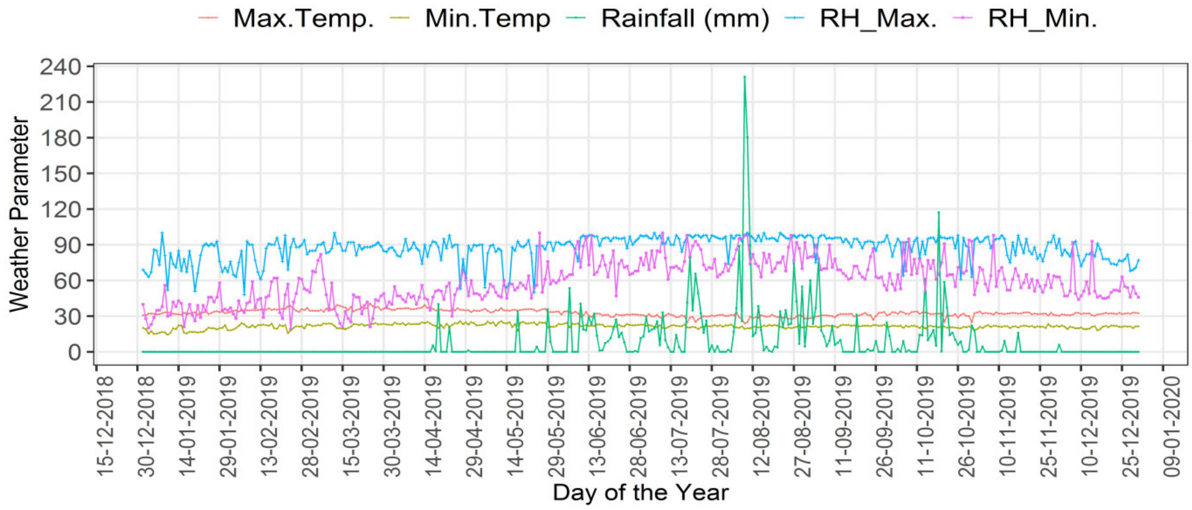
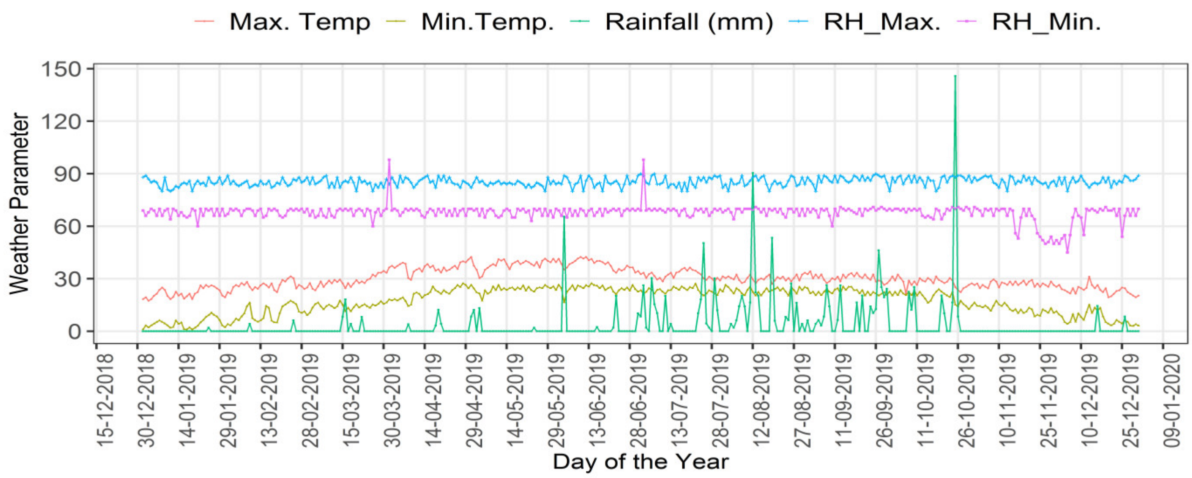
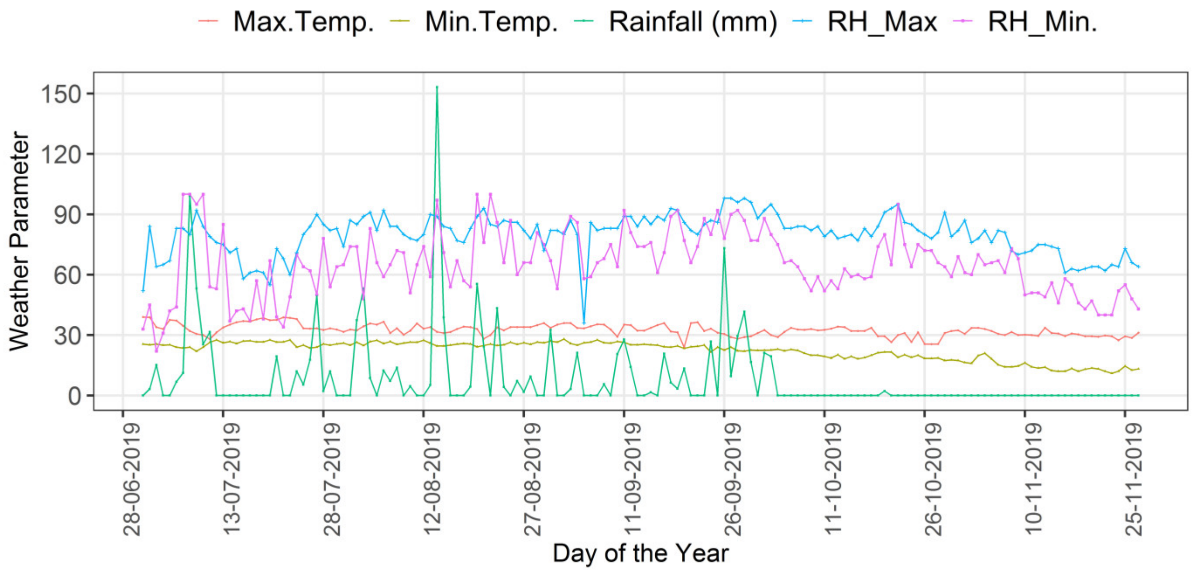


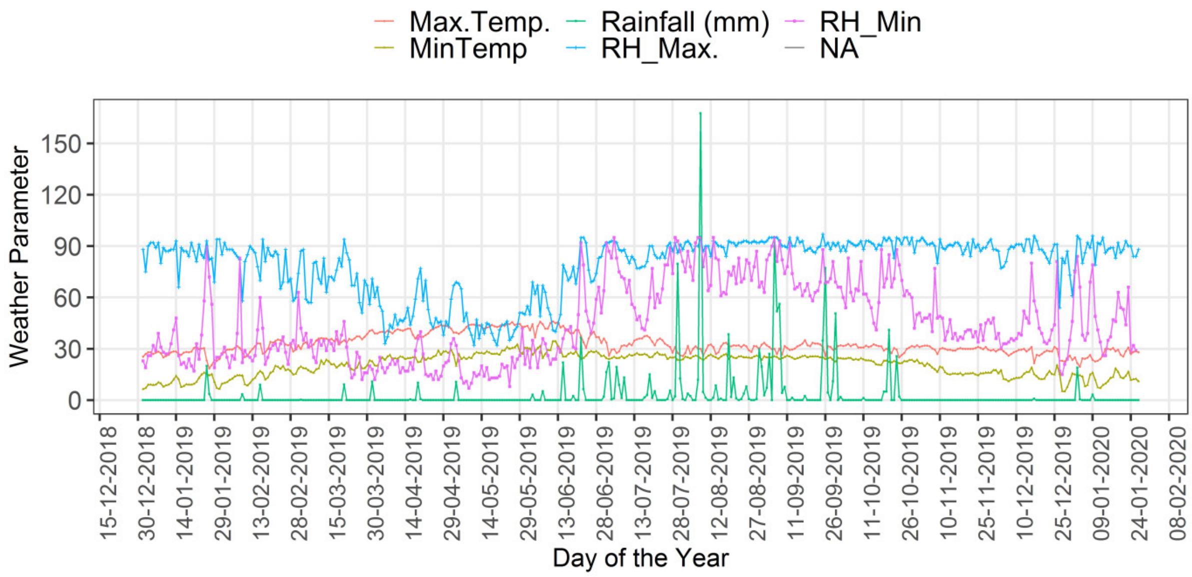
Important weather parameters recorded at PTB centre during the crop growth period in Kharif-2019 season



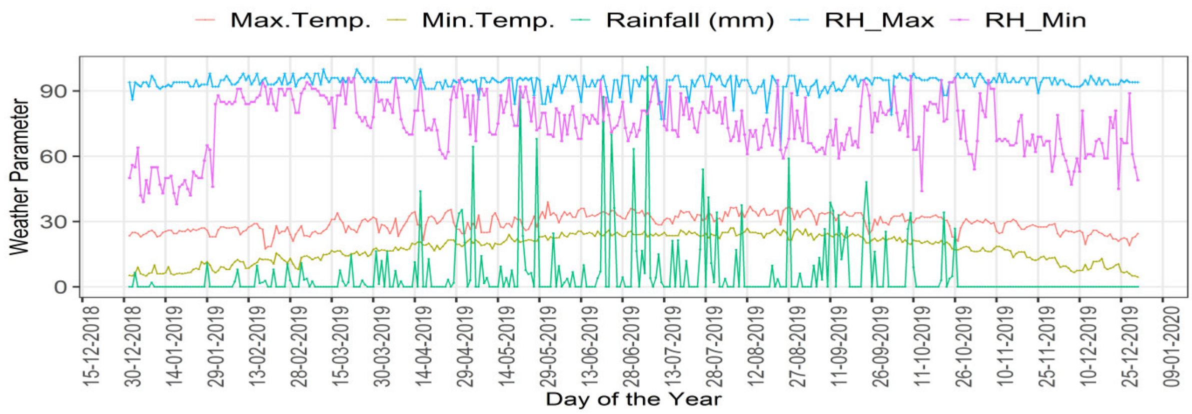
Important weather parameters recorded at Ranchi centre during the crop growth period in Kharif-2019 season



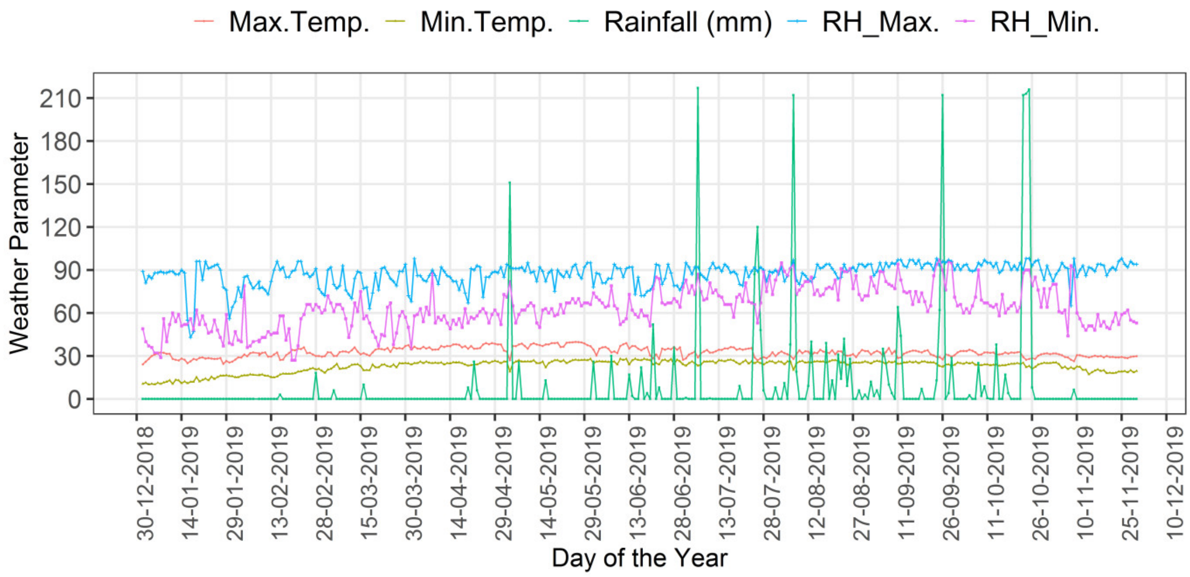
Important weather parameters recorded at Rewa centre during the crop growth period in Kharif-2019 season



Important weather parameters recorded at RPR centre during the crop growth period in Kharif-2019 season



Important weather parameters recorded at TTB centre during the crop growth period in Kharif-2019 season



Important weather parameters recorded at NRRI centre during the crop growth period in Kharif-2019 season

A P P E N D I X - II

Rice cultures of Physiology

	SUB		**HT**			**RFU**				**MAS**			**LLS**	
S.No.	**Entries**	**S.No.**	**Entries**		**S.No.**	**Entries**			**S.No.**	**Entries**		**S.No.**	**Entries**	
1	AC 1303	1	IET 28384	IVT-IME	1	IET 28240	IVT-E-DS		1	AC 1303	AVT-1-IME	1	IET 27570	IVT-SDW
2	AC 42088	2	IET 28386	IVT-IME	2	IET 28241	IVT-E-DS		2	Rashpanjor	AVT-1-IME	2	IET 27571	IVT-SDW
3	AC 38575	3	IET 28387	IVT-IME	3	IET 28242	IVT-E-DS		3	Black Gora	AVT-1-IME	3	IET 27572	IVT-SDW
4	SABITA	4	IET 28390	IVT-IME	4	IET 28243	IVT-E-DS		4	Parijat	AVT-1-IME	4	IET 27577	IVT-SDW
5	NAVEEN	5	IET 27668	IVT-IME	5	IET 28244	IVT-E-DS		5	Brahman-nakhi	AVT-1-IME	5	IET 27581	IVT-SDW
6	SWARNA SUB-1	6	IET 28393	IVT-IME	6	IET 28245	IVT-E-DS		6	AC 3577	AVT-1-IME	6	IET 27584	IVT-SDW
7	BLACK GORA	7	IET 28397	IVT-IME	7	Sahbhagidhan	IVT-E-DS		7	Mahulata	AVT-1-IME	7	IET 27586	IVT-SDW
8	BAI KANI	8	IET 28400	IVT-IME	8	IET 28246	IVT-E-DS		8	BVD 109	AVT-1-IME	8	IET 27588	IVT-SDW
9	SWARNA	9	IET 28402	IVT-IME	9	IET 28246	IVT-E-DS		9	IET 27736	AVT-1-IME	9	IET 26687	IVT-SDW
10	PARIJAT	10	IET 28403	IVT-IME	10	IET 28248	IVT-E-DS		10	IET 26861	AVT-1-IME	10	IET 27590	IVT-SDW
11	PAU 9	11	Gontra Bidhan-3	IVT-IME	11	IET 28248	IVT-E-DS		11	IET 27750	AVT-1-IME	11	IET 27592	IVT-SDW
12	BRAHMAN NAKHI	12	IET 28407	IVT-IME	12	IET 28250	IVT-E-DS		12	IET 27773	AVT-1-IME	12	IET 27595	IVT-SDW
13	MAHULATA	13	IET 28408	IVT-IME	13	Vandana	IVT-E-DS		13	IET 27772	AVT-1-IME	13	IET 27596	IVT-SDW
14	BVD 109	14	IET 28409	IVT-IME	14	IET 28251	IVT-E-DS		14	IET 27768	AVT-1-IME	14	IET 27597	IVT-SDW
15	IET 18720	15	IET 28411	IVT-IME	15	IET 28252	IVT-E-DS		15	IET 27762	AVT-1-IME	15	IET 27598	IVT-SDW
16	IET 18727	16	IET 28412	IVT-IME	16	IET 28253	IVT-E-DS		16	IET 27758	AVT-1-IME	16	IET 27559	IVT-SDW
17	IC 516009	17	IET 28417	IVT-IME	17	IET 28254	IVT-E-DS		17	IET 27737	AVT-1-IME	17	Swarnaprabha	IVT-SDW
		18	IET 28422	IVT-IME	18	Tulasi	IVT-E-DS		18	IET 27775	AVT-1-IME	18	IR-8	IVT-SDW
		19	IET 28423	IVT-IME	19	IET 28255	IVT-E-DS		19	IET 27356	AVT-1-IME			
		20	IET 28425	IVT-IME	20	IET 28256	IVT-E-DS		20	IET 27757	AVT-1-IME			
	SILICON	21	IET 28427	IVT-IME	21	US 314	IVT-E-DS		21	IET 26961	AVT-1-IME			
1	27P63	22	IET 28429	IVT-IME	22	IET 28257	IVT-E-DS		22	IET 27755	AVT-1-IME			
2	HRI-174	23	IET 28432	IVT-IME	23	IET 28258	IVT-E-DS		23	IET 27748	AVT-1-IME			
3	IIRRH-122	24	IET 27908	IVT-IME	24	IET 28259	IVT-E-DS							
4	IIRRH-131	25	IET 27876	IVT-IME	25	IET 28260	IVT-E-DS							
5	IRRH-132	26	IET 25713	IVT-IME	26	Gangavathi Ageti	IVT-E-DS							
6	JKRH-3333	27	IET 26468	IVT-IME	27	IET 28261	IVT-E-DS							
7	KRH-4	28	IET 26780	IVT-IME	28	Anjali	IVT-E-DS							
8	SB.DHAN	29	N-22	IVT-IME	29	IET 28262	IVT-E-DS							
9	US-314	30	Vandana	IVT-IME	30	Local	IVT-E-DS							

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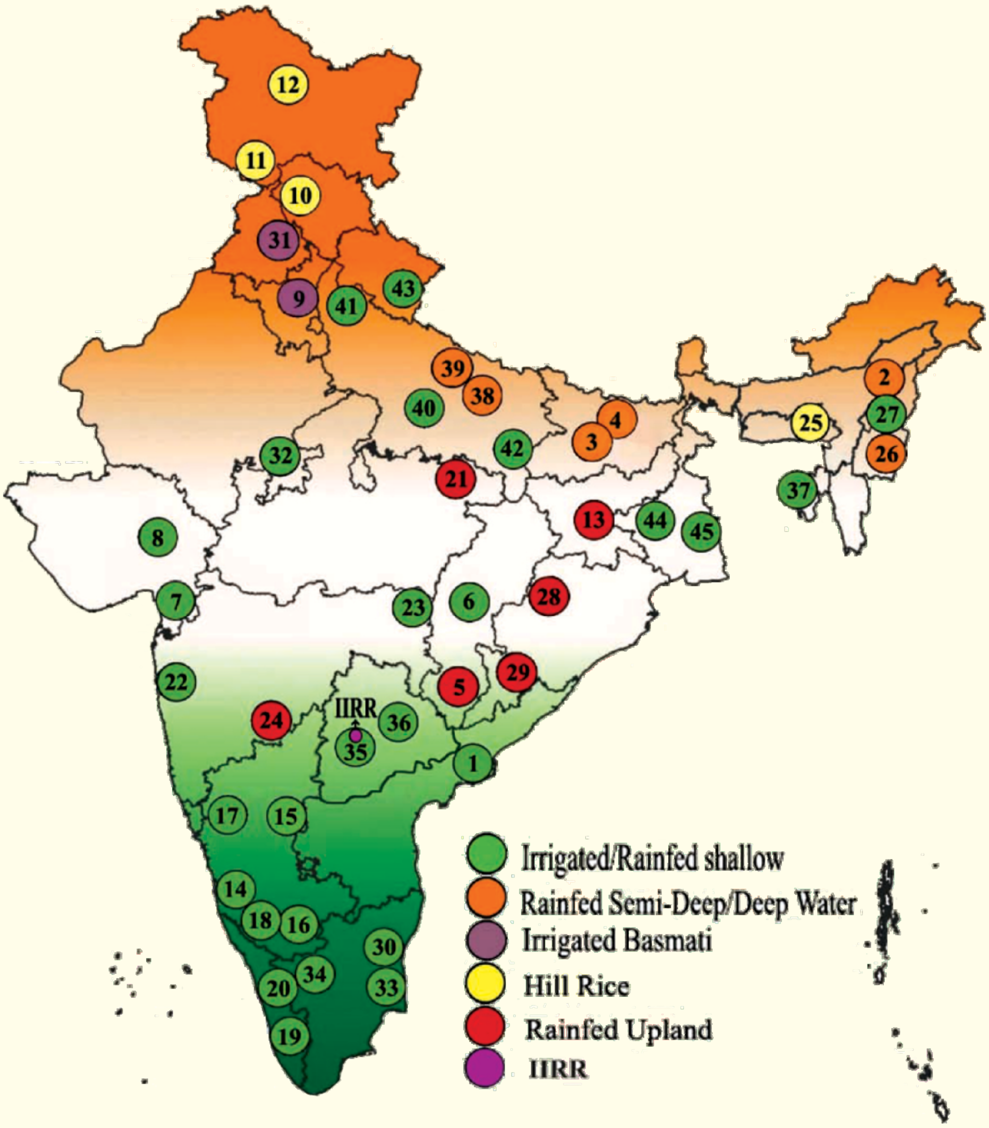

भाकृअनुप - भारतीय चावल अनुसंधान संस्थान

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