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Promising Technologies to Bridge the Rice Yield gaps across the Country: Experiences from Frontline Demonstrations program

Shaik N.Meera*, S. Arun Kumar, Praveen Rapaka, Amtul Waris and S.R. Voleti

ICAR-Indian Institute of Rice Research (ICAR-IIRR), Hyderabad-500 030.
* Corresponding author (email: shaiknmeera@gmail.com)

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Abstract

Frontline demonstrations are considered to be the most effective and useful extension activity to demonstrate the latest technologies developed at research stations to the ultimate clientele, that is, farmers, in their own fields. The principle of "seeing is believing" is operational in these demonstrations, as the farmers become easily convinced when they see the performance of new technologies in the fields of their neighboring farmers. During 2017-18, through this programme, a cafeteria of rice technologies were demonstrated in 723 hectare area covering 20 states and five major rice ecosystems of the country. Out of 723 FLDs reported, about 78.7 % were conducted in irrigated rice ecosystem; whereas about 6.87% of FLDs were conducted in rainfed uplands. More than 11.51 % of FLDs were organized in shallow lowlands and 2.07% in hill ecologies. FLD technologies demonstrated in irrigated ecosystems have recorded mean yield of 5.16 t/ha whereas in Shallow lowlands FLD technologies have recorded an average yield of 5.34 t/ha. Average demonstration yields in rainfed uplands was 3.94 t/ha. A critical analysis revealed that the mean yield advantage was the highest in hill ecologies (29%). There is a tremendous scope to bridge the yield gaps (particularly Yield gap-II) in case of Rainfed uplands (24.66 % mean yield advantage), irrigated ecologies (20.66%) and Shallow lowlands (20.97%). For this, proper extension strategies need to be deployed for large scale adoption of these technologies. In total 50 technologies have been identified from 20 states based on their performance in farmers field conditions. This shows the attainable yield potential in the farmers' fields, which needs to be considered for planning the extension programs in these regions. The range of yield advantages explains that there are few promising technologies, if properly adopted by the farmers may result in enhancing the farm level productivity.

Key words: Rice, Frontline Demonstrations, Adoption behaviour, Promising rice technologies

Introduction

The yield gaps in rice between potential and farmers' yields are still substantially high due to the combination of factors like, bio physical, poor management and low socio-economic conditions of farmers and lack of resources, especially credit and knowledge. Majority of the constraints can be overcome by targeting the most suitable varieties / hybrids to specific agro-climatic and other conditions. Technology targeting and encouraging large scale adoption of recently released varieties will lead help not only in bridging the yield gaps but also in improving the income levels of the farmers.

The main reason for low productivity of rice in India is that rice is grown under various production ecologies mainly grouped as irrigated and rainfed systems. While former is considered most favourable, rainfed system has again a wide range of subsystems like shallow, mid and deep water rainfed lowlands and rainfed uplands. Productivity in these systems varies widely. This warrants regular identification of the promising technologies suitable for these ecosystems that could be promoted on large scale.

To address the problems of stagnating food grain production and need to bridge the yield gaps, Government of India has launched the Centrally Sponsored Scheme, 'National Food Security Mission' (NFSM) in August 2007. The major objective of this scheme is to increase production and productivity of rice, wheat and pulses on a sustainable basis so as to ensure food security of the country. The approach is to bridge the yield gap through dissemination of improved technologies and farm management practices.

The Frontline Demonstrations (FLDs) for Rice are an approved component of the National Food Security

Mission to augment production of food grains in the country and are conducted by the ICAR/SAUs system. The ICAR-Indian Institute of Rice Research, Hyderabad, is the nodal Institution for organizing the FLDs on rice.

Frontline Demonstration is a form of applied research through ICAR/SAUs system on latest notified/released varieties along with full package of practices on selected farmers' fields with a view to demonstrate the potentiality of the technologies to (a) participating farmers (b) neighbouring farmers and other agencies; (c) to analyze the production (d) performance of the technologies for scientific feedback.

Frontline Demonstrations (FLDs) helps to identify the suitable and promising technological solutions for different ecosystems based on their performance in the farmers conditions in comparision with the technologies conventionally used.

Methodology of conducting FLDs

A comprehensive package consisting of new seed (variety/ hybrid) and recommended cultivation and plant protection practices, etc., is demonstrated to farmers. Financial assistance is provided for critical inputs such as seed, fertilizer, weedicide, pesticide, etc.

Figure 1: Identifying promising technologies under FLD programme

The unique feature of these demonstrations is the active involvement of concerned scientists for providing technical guidance from time to time and the active participation of farmers in implementing the recommended technologies. The organization of field days at an appropriate stage of the crop at strategic locations for a cluster of 20−30 demonstrations is an integral part of these demonstrations, which adds significantly to their effectiveness. These field days provide an on-the-spot opportunity for a large number of interested farmers to acquaint themselves with the advantages of the new potential promising technologies, to have their doubts clarified with subject matter specialists during question-and-answer sessions, and to meet the scientists and extension officials who are aware of the latest developments in agriculture. Technologies demonstrated have addressed various issues of productivity, profitability and sustainability in rice production (Table 1.)

Table 1: Issues addressed through Rice Frontline demonstrations

S No.	Ecosystem	States Covered	Issues addressed
1.	Irrigated	Andhra Pradesh, Bihar, Gujarat, Haryana , Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Odisha, Telangana, Tripura, Uttar Pradesh, Uttarakhand	Higher yields, Water saving, Reduced cost of cultivation; Nutritional Security, Better Market, Biotic stress management, Submergence Tolerance Disease resistance, Labour saving, Retain rice farming,Farm mechanization,Seed production, Drudgery reduction, Drought tolerance, Resource Conservation
2.	Hill	Himachal Pradesh Uttarakhand	Early duration; Introduction of Hybrids; Higher yield drudgery reduction; Cold tolerance
3.	Rainfed Shallow Lowlands	Jharkhand, Tripura , West Bengal	Higher Yields, Introduction of Biofortified product Better Market stress tolerance
4.	Rainfed Upland	Jharkhand, Maharashtra, West Bengal	Abiotic stress management; Higher yields; Early maturing varieties
5.	Coastal Saline/ Problem soils	West Bengal	Higher yield; Submergence tolerance

Results and Discussion

During the year 2017-18, demonstrations were conducted in different ecosystems viz., irrigated, rainfed uplands, shallow lowlands, hills and coastal saline. The technologies demonstrated have recorded differential performance and yield advantages in different ecosystems.

Technology performance under FLDs

Andhra Pradesh Rice Research Institute & Regional Agricultural Research Station, Maruteru, West Godavari district demonstrated the flood tolerant variety Bheema (MTU 1140) that tolerates three types of floods viz. flash floods for 10 days at vegetative stage, stagnant flooding and submergence during germination for 2 weeks with non lodging trait. The demonstration undertaken in Ramanapalem, Mogulthur Mandal, West Godavari had yield advantage of 33% wheras it was 30% in the Luthukur, Mamidikudur Mandal, East Godavari. This varietal technology is reported to be suitable for direct seeded conditions as it possesses 2 weeks anaerobic germination (80% plant survival) and is being suggested for wider cultivation during *kharif* season in place of PLA1100 (Badava mahsuri), MTU 1064 (Amara) and Swrna sub1. In the changing climatic conditions, such varieties would best address the problems like submergence or drought etc.

The variety CR Dhan 909 was demonstrated by ICAR-Research Complex for Eastern Region, Patna at 68 beneficiary farmers' field in 30.25 hectares of land in Madhubani and East Champaran districts of Bihar. An average yield of 5.15 t/ha was obtained in FLD plots. The demonstration of the same variety conducted in 6.4 ha with the help of KVK Buxar, Bihar recorded an average grain yield of 5.35 t/ha. Both the demonstrating and neighbouring farmers were very happy and excited over the performance of aromatic rive variety CR Dhan 909 for its aroma and high tillering ability in the variety. The demonstrated variety displayed its resilience when affected by flood for about 10-12 days and was able to quickly recover from the effect of flood in comparison to other rice varieties.

Department of Genetics and Plant Breeding, IGKV Raipur conducted 6 FLDs in two districts namely, Raipur and Durg to showcase the relative advantage of Chhattisgarh sugandhitbhog and Indira Aerobic 1. In the demonstrated locations, both the varieties recorded 16.59 and 20.91 % of yield advantage (with 4.92 t/ha and 3.99 t/ha productivity respectively).

Demonstrations of GNR-2, GNR-3, Purna and GNRH-1 were conducted in an area of 5.0 ha, 7.70 ha, 2.5 ha and 4.80 ha, respectively performed very well in South Gujarat where they exhibited overall 21.2%, 10.4%, 35.8 % and 10.5 % grain yield superiority over respective checks. They were happy about the substantial market price of GNR-3 and Purna. Incidentally, both varieties were non-lodging.

Rice and Wheat Research Centre, Malan of CSK Himachal Pradesh Krishi Vishvavidyalaya conducted 10 FLDs on four rice varieties HPR 2612, HPR 2720 (Red rice), HPR 2880 and HPR 2143 with complete package of practice, in four clusters of Rait, Dharamshala, Bhawarna and Nagrota Bhagwan blocks of Kangra district. HPR 2720 is a high yielding blast resistant red rice variety recommended for irrigated ecology in area with 650 to 1500 m altitude. The variety has more of iron and zinc content and has medicinal properties. It fetches more prices in the market. HPR 2656 has been recommended for rainfed upland conditions of low and mid hill conditions of the state. The red rice variety HPR 2720 recorded yield advantage of 0.8 t/ha over the local checks and farmers were happy to accept and increase area under this variety as it is more nutritive and fetches higher price. Compared to commonly grown variety RP 2421, new variety HPR 2880 recorded yield advantage of 19.3 per cent and was found suitable for increasing the rice production and productivity in the district. Farmers were happy to put more and more area under this variety under irrigated conditions. For upland area which forms a significant share in rice production of the state, HPR 2656 attracted the attention of the farmers as its productivity is more as well as it gives more of straw yield which is fed as dry fodder to the animals in the hill farming.

In Kashmir, 20 FLDs were organized by Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir. Totally 50 farmers benefitted demonstrating the Shalimar Rice 4 (SKAU 408) for lower altitudes of Valley upto 1600 metres above mean sea level and Shalimar Rice 5 (SKAU 402) for high altitudes of Valley beyond 1800 metres above mean sea level that had better yield advantages.

Central Rainfed Upland Rice Research Station (CRURRS - NRRI), Hazaribagh conducted 20 FLDs on Sahbhagi Dhan and IR 64 *Drt* 1 involving 44 farmers from Masipirhi, Chichikala, Dasokhap, Bongadag, Babhanbhai and Digwar. Sahabhagidhan recorded an average yield of 3.73 t/ha with yield advantage of 24.33% over local variety. In case of IR 64 *Drt* 1, 22% more yield was recorded

Krishi Vigyan Kendra (KVK), Koderma under the aegis of CRURRS, Hazaribagh (NRRI) carried out 5 FLDs on DSR with Sahbhagi Dhan. While DSR condition yielded 30% more yield compared to normal transplanting, the former method also had other advantages such as reduced cost of cultivation.

Zonal Agricultural Research Station, Mandya (UAS, Bengaluru) organized demonstrations on KMP – 175 under Aerobic method (high water use efficient, released for aerobic cultivation in Zone 6 of Karnataka) and KMP 149. Across the locations, KMP – 149 recorded higher yield of 6.2 t/ha with 30% yield advantage.

Kerala, like many other rice growing states of the country, has been facing acute shortage of labour. Hence mechanized farming was taken up under demonstrations. RARS, Pattambi organized 20 hectares of Farm mechanization in six different panchayats Viz., Thachampara, Mannur, Nellepilly, Pudunagaram, Kodumbu and Kottayi. Machine transplanting successfully addressed the problem of labour shortage and delayed transplanting.

Mechanization in rice farming with active involvement of women's' SHGs in Kerala is bringing about remarkable changes in rice production. Yield advantages are observed in all the panchayats when compared to the normal practice of manual planting. Farm mechanization in rice farming recorded the yield advantage of minimum of 625 to the maximum of 1550 kg extra yield in mechanical transplanting over manual planting. Farm mechanization in rice is also resulting in cost reduction of minimum of Rs.2250 to the maximum of Rs. 7500 per hectare. Besides this timely planting and attracting the farmer's to continue rice farming is an additional advantage from the program.

JNKVV College of Agriculture Balaghat, organized FLD's on rice on recently released Hybrid JRH-19, under irrigated ecosystem at village- Nevergaon, Block-Lalburra (Balaghat). AICRIP COA Balaghat conducted 25 demonstrations in Balaghat district. The demonstrations on partial SRI with Hybrid JRH-19 as well as local improved varieties were taken up using plant protection measures. The average yield reported by adopting the improved practice was 5.45 t/ha as against 4.22 t/ha and increased in yield over farmer's practice. Partial SRI demonstrations not only increased grain yield but also saved water by 30%. There is a need to demonstrate the early maturing highly yielding hybrids (110-115 days) due to the erratic poor rainfall and limited irrigation for successful succeeding *rabi* crops. Farmers expressed satisfaction for improved early maturing high yielding hybrid.

Agricultural Research Station, Shirgaon conducted FLDs on the improved high yielding variety Ratnagiri 5 in the districts of Palghar, Ratnagiri, Sindhudurg, Raigad. In the demonstrated fields the variety Ratnagiri 5 which is short slender type, Short slender grain, moderately resistant to leaf blast, neck blast and bacterial leaf blight, early maturing (115-120 days) variety performed well and yielded 43% more than that of the Ratnagiri 24. Also in Maharashtra, Regional Agricultural Research Station, Karjat conducted 4 demonstrations on Karjat 9 with 24% yield advantage over the check varieties.

ICAR Research Complex for North East Hill region, Regional Centre Lamphalphet organized 25 FLDs on recently released rice varieties (RC Maniphou 9, 10, 13) in Bishnupur District, Imphal West, Thoubal districts. The RC Maniphou 13 recorded an average yield of 5.52 t/ ha with yield advantage of 50 % over local checks. Similarly, all the demonstrated varieties yielded better than the local check varieties.

National Rice Research Institute, Cuttack organized 60 FLDs on several varieties like CR Dhan 200, CR Dhan 204, CR Dhan 205, CR Dhan 206, CR Dhan 304, CR Dhan 310, CR Dhan 311, CR Dhan 505, Satyabhama, Sahabhagidhan, Swarna Sub-1 and CR Dhan 500.

A promising variety CR Dhan 204 that was demonstrated in Danpur, Kendrapada Cluster recorded an average yield of 5.2 t/ha with yield advantage of 35% over local popular checks. All the varieties demonstrated in different clusters have recorded impressive yield advantages and farmers were willing to adopt these varieties in subsequent seasons.

Rice variety CO 52 is suited to *samba* season of Tamil Nadu state wherein sowing was taken up in the month of September-October. Apart from delta regions, Western and Northern and Eastern parts of Tamil Nadu are being cultivated with medium duration fine grain rice varieties like BPT 5204 and Improved white. Ponni which occupy an area of about 10 lakh hectares representing 50% of rice total area in Tamil Nadu . In order to replace these varieties, FLDs were conducted with CO 52 to popularize by Department of Rice, TNAU.

In Telangana, IIRR conducted demonstrations to popularize the high zinc variety DRR Dhan 45 under Integrated Weed Management, IPM. Special attention towards soil problems like acidity, alkalinity, micro-nutrients deficiency effectively managed through soil test based fertilizer applications and soil borne pests and diseases were tackled through spraying of *Pseudomonas fluorescence* and pheromone trap installations, Cartap hydrochloride,

neem oil spray for stem borer management. The farmers were satisfied with the interventions followed during the demonstrations to get 17.25% yield advantage. RARS Warangal conducted demonstrations on WGL 44 and proved its higher yield advantage of 58.5% in Rayaparthi mandal of Warangal district.

ICAR Research Complex for NEH Region Tripura Centre, Lembucherra conducted demonstrations on recently released variety- Tripura Nirog plus SRI or ICM showed about 15-50% per cent yield advantage over the farmers practice across the locations.

Department of Genetics and Plant Breeding, BHU conducted 15 FLDs on various varieties like HUR 917, HUR 105 Sub-1, HUR 917 + INM, HUR 1309, HUR 105, HUR 105 + INM, HUR 4-3 and HUBR 10-9 in Varanasi, Mirzapur, Ghazipur, Ganj, Jaunpur, Azamgarh, Gorakhpur, Kushi Nagar and Chandauli districts. HUR 105 recorded better yields compared to the normal package of practices. Department of Agronomy, BHU organized FLDs in 10 ha area among 20 farmers of three districts viz. Varanasi, Chandauli and Mirzapur in different villages of U.P on three agronomic technologies i.e. INM, IWM and double transplanting in the demonstrations. These technologies were tested on 5 rice varieties, viz. HUBR 2-1, HUR-105, HUR 4-3, HUR-917 developed by BHU along with DRR Dhan-44 developed by IIRR. DRR Dhan -44, a new variety introduced among farmers has performed well and has given 20-40% increase in yield over local varieties like Sonam, Rupali etc. Most of the farmers are convinced about INM and IWM technology in rice crop through FLDs. The demonstrated varieties have replaced the local varieties like Sonam, Rupali and Moti.

ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora conducted demonstration on VL Dhan 68 involving 101 farmers from Almora district. VL Dhan 68 was released for commercial cultivation in 2014 for the irrigated transplanted medium duration condition of the mid-hills of Uttarakhand and Meghalaya. It matures within 125-130 days and can give yield up to 45 quintals per hectare under standard agronomic practices. It is also resistant to blast, the most important disease of rice in the hills. In the demonstrated fields, the variety recorded better yields with yield advantage of 34% compared to local checks.

Rice Research Station (Govt. of West Bengal), Chinsurah (Hooghly) in collaboration with various local organisations demonstrated fourteen improved varieties under different rice ecosystems viz. coastal saline (Gosaba 5 and Gosaba 6), rainfed shallow lowland (Swarna-Sub1, BINA Dhan 11, Dhiren, Sampriti, Dhruba, Sujala and Kaushalya), and rainfed upland (Sahbhagi Dhan, Ajit, MTU 1010, Puspa and IR 64 Drt1) at farmers' fields in 20 villages under 10 different Community Development (CD) Blocks of the four districts. They exhibited yield advantages to the extent of 3.41-3.98% under coastal saline ecosystem, 4.61-19.87% under rainfed shallow ecosystem, and 4.83-40.56% under rainfed upland ecosystem when demonstrated with whole package of practices. In drought-prone rainfed upland areas, tolerant rice varieties like IR 64 Drt1 and Sahbhagi Dhan did withstand better than local varieties.

Out of 723 FLDs conducted, about 78.7 % were conducted in irrigated rice ecosystem; whereas about 6.87% of FLDs were conducted in rainfed uplands. More than 11.51 % of FLDs were organized in shallow lowlands and 2.07% in hill ecologies. The summary table reveals that the mean yield advantage was the highest in Hill ecologies (29%). There is a tremendous scope to bridge the yield gaps (particularly Yield gap-II) in case of Rainfed uplands (24.66 % mean yield advantage), irrigated ecologies (20.66%) and Shallow lowlands (20.97%).

FLD technologies demonstrated in irrigated ecosystems have recorded mean yield of 5.16 t/ha where as in Shallow lowlands FLD technologies have recorded an average yield of 5.34 t/ha. Average demonstration yields in rainfed uplands was 3.94 t/ha. This shows the attainable yield potential in the farmers' fields, which needs to be considered for planning the extension programs in these regions. The range of yield advantages explains that there are few promising technologies, if properly adopted by the farmers may result in enhancing the farm level productivity.

Table 2: FLDs in various ecosystems (2017-18)

Ecosystem	Total FLDs (ha)	Mean FLD Yield (t/ha)	Mean Check Yield (t/ha)	Mean % Yield Advantage
Irrigated	569.55	5.16	4.35	20.66
Shallow Lowlands	83.26	5.34	4.46	20.97
Hills	15	3.62	2.82	29.55
Rainfed Upland	49.74	3.94	3.14	24.66
Coastal Saline	6	3.80	3.32	14.89
Total or Mean	723.55	4.37	3.61	22.14

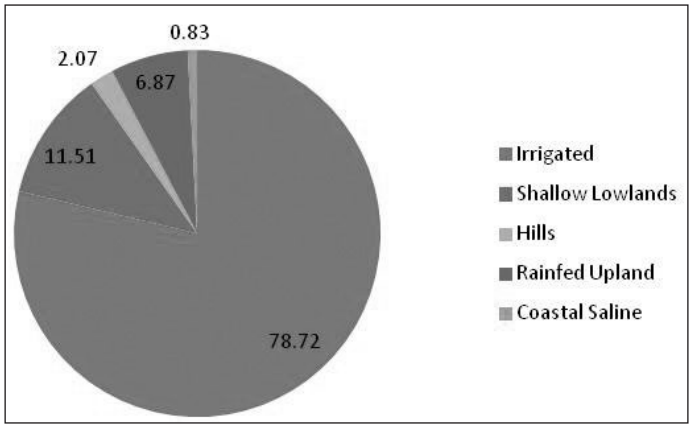

Figure 2: Ecosystem wise breakup of Rice FLDs conducted

Promising Technologies Identified through FLD Program

In total 50 technologies have been identified from 20 states. The criteria adopted to identify these technologies are relative yield advantage over the existing technologies and the kind of local problem the technology tried to address. This is not an exhaustive list, but only indicative list giving those technologies that could be tried in these states. These technologies will help either in withstanding abiotic stresses (such as submergence –Samba Sub-1, IR 64 Drt-1), improving the field productivity (JRH 19, HUBR 2-1), solving the local problems (Problem soil management, Indira Aerobic -1), labour scarcity (Demonstrations of Paddy Thresher, mechanical transplanting), early harvest for facilitating *rabi* crops (Sahbhagi dhan), better basmati options for farmers (Pusa 1509 and Basmati 564), consumer preferences (RC Maniphou-13), replacing the popular varieties (CO 52, CR Dhan 909) etc., But a viable strategy should be in place before these promising technologies making a difference in the livelihoods of farmers.

It may be noted that, a technology with highest percentage yield advantage may not necessarily be a technology that has wider adaptability. In such cases, the percentage yield advantage may help in enhancing the farm level productivity. A technology with average percentage of yield advantage may have wider adaptability, which may result in enhancing the production in larger area. Hence, the development departments may consider these technologies to take up for popularization programmes in much larger areas.

Table 3: Performance of promising technologies identified from FLDs 2017-18

S. No.	State	Ecosystem	Promising technology identified	FLD Yield (t/ha)	Check Yield (t/ha)	% Yield Advantage
1.	Andhra Pradesh	Irrigated	MTU 1140(Bheema)	5.76	4.31	33.64
2.	Bihar	Irrigated	CR Dhan 909	5.15	2.77	85.92
3.	Chhattisgarh	Irrigated	Chhattisgarh sugandhitbhog 1	5.2	3.2	62.5
4.	Chhattisgarh	Irrigated	Dubraj selection 1	5.02	3.1	61.93
5.	Chhattisgarh	Irrigated	Tarunbhog Selection 1	4.87	3.2	52.18
6.	Chhattisgarh	Irrigated	Indira Barani dhan	4.08	3.2	27.5
7.	Gujarat	Irrigated	PURNA	2.20	1.62	35.80
8.	Himachal Pradesh	Hill	'HPR 2720' red rice variety	3.39	2.58	31.2
9.	Himachal Pradesh	Hill upland	"HPR 2656'	3.28	2.23	46.9
10.	Jammu & Kashmir	Irrigated	Shalimar Rice 4 (SKAU 408)	7.47	5.90	26.61
11.	Jammu & Kashmir	Irrigated	Shalimar Rice 5 (SKAU 402)]	5.50	4.20	30.95
12.	Jharkhand	Rainfed Upland & Shallow lowland	Sahabhagidhan	3.73	3.00	24.33
13.	Jharkhand	Rainfed Upland & Shallow lowland	DRR Dhan 42	4.38	3.59	22.01
14.	Jharkhand	Rainfed Upland & Shallow lowland	Sahabagi Dhan with DSR	3.45	2.65	30.1
15.	Karnataka	Irrigated	KMP – 149	6.20	4.75	30.53
16.	Karnataka	Irrigated	KMP – 175(Aerobic Method)	5.15	4.00	28.75
17.	Kerala	Irrigated	Rice farm mechanisation	5.13	4.15	23.61
18.	Kerala	Irrigated	Management of weedy rice	7.35	5.86	25.43
19.	Madhya Pradesh	Irrigated	MTU1010	4.27	3.25	31.38
20.	Madhya Pradesh	Irrigated	JR767	4.05	3.13	29.39

S. No.	State	Ecosystem	Promising technology identified	FLD Yield (t/ha)	Check Yield (t/ha)	% Yield Advantage
21.	Madhya Pradesh	Semi irrigated	JRH 19	5.45	4.22	29.15
22.	Maharashtra	Rainfed	Ratnagiri 5	4.51	3.15	43.17
23.	Maharashtra	Rainfed	Karjat 9	4.39	3.52	24.72
24.	Manipur	Hill and NE Plain	RC Maniphou- 9	5.04	3.50	44.00
25.	Manipur	Hill and NE Plain	RC Maniphou- 10	5.07	3.63	39.67
26.	Manipur	Hill and NE Plain	RC Maniphou- 13	5.52	3.66	50.82
27.	Odisha	Irrigated	CR Dhan 204	5.20	3.850	35.06
28.	Odisha	Irrigated	CR Dhan 206	5.00	3.98	25.63
29.	Odisha	Irrigated	CR Dhan 310	5.00	3.94	26.90
30.	Odisha	Irrigated	CR Dhan 311	5.10	4.00	27.50
31.	Tamil Nadu	Irrigated	CO 52	6.88	5.92	16.0
32.	Tamil Nadu	Irrigated	DRR Dhan 42	2.52	2.09	20.65
33.	Tamil Nadu	Irrigated Ecology	Direct Seeded Rice, Alternate Wetting Drying, Mechanized TP	5.93	4.87	21.77
34.	Telangana	Irrigated	Integrated Weed Management in DRRDhan 45	7.00	5.97	17.25
35.	Telangana	Irrigated	Siddhi (WGL-44)	5.69	3.59	58.5
36.	Telangana	Irrigated	DRR Dhan 45	5.26	4.61	14.10
37.	Tripura	Shallow Lowland	SRI + Tripura Nirog	7.80	5.10	52.94
38.	Tripura	Shallow Lowland	SRI + Tripura Nirog	7.40	4.90	51.02
39.	Tripura	Shallow Lowland	SRI + Tripura Nirog	7.10	4.70	51.06
40.	Uttar Pradesh	Irrigated	HUR 105	6.77	5.02	34.86
41.	Uttar Pradesh	Irrigated	IWM + DRR Dhan 44	4.95	4.0	23.75
42.	Uttar Pradesh	Irrigated	NDR 2065	5.33	4.21	26.60
43.	Uttar Pradesh	Irrigated	Sambha Sub- 1+ INM	4.97	4.14	20.05
44.	Uttar Pradesh	Irrigated	NDR 2065 + INM	5.47	4.25	28.71
45.	Uttarakhand	Irrigated Hills	VL Dhan 68	4.13	3.06	34.95
46.	West Bengal	Rainfed upland	Sahbhagi Dhan	4.54	3.23	40.56
47.	West Bengal	Rainfed upland	Ajit	4.17	3.33	25.23
48.	West Bengal	Rainfed upland	MTU 1010	4.24	3.38	25.44
49.	West Bengal	Rainfed upland	Puspa	4.36	3.19	36.68
50.	West Bengal	Rainfed upland	IR 64 Drt1	4.15	3.24	28.09

Conclusion

During the year 2017-18, through this programme, a cafeteria of rice technologies were demonstrated in 723 hectare area covering 20 states and five major rice ecosystems of the country. FLDs organized during this year have been effective in creating the awareness about the potential of new rice varieties, hybrids and other management technologies. In majority of the cases the yield advantages recorded by the FLD technologies were significant.

Out of 723 FLDs reported, majority (78.7 %) were conducted in irrigated rice ecosystem and there is a scope to increase the number of FLDs in rainfed ecologies. It is also revealed that the mean yield advantage was the highest in Hill ecologies (29%). There is a tremendous scope to bridge the yield gaps (particularly Yield gap-II) in case of Rainfed uplands (24.66 % mean yield advantage), irrigated ecologies (20.66%) and Shallow lowlands (20.97%). For this, suitable extension strategies need to be identified and deployed for large scale adoption of these technologies.

In total 50 technologies have been identified from 20 states based on their performance in farmers field conditions. These technologies will help either in withstanding abiotic stresses, improving the field productivity, solving the local problems, labour scarcity, early harvest for

facilitating *rabi* crops, better basmati options for farmers, consumer preferences, replacing the popular varieties etc. Identification of promising varieties coupled with a viable strategy should be in place for making significant difference in the livelihoods of farmers. The new varieties and technologies demonstrated need to be popularized in an extensive way, so as to enhance the productivity and production on a location specific basis. The fruits of FLDs can be harnessed on large scale, if proper follow up activities are taken up by the state departments of agriculture.

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