Frontline Demonstration: An EffectiveCommunication Approach for Dissemination ofSustainable Rice Production Technology

ABSTRACT

During four consecutive Kharif seasons in the years 2016, 2017, 2018 and 2019, frontline demonstrations were carried out in farmer's fields by the College of Agriculture, Waraseoni (Balaghat), Madhya Pradesh in the agroclimatic zone of the Chhattisgarh plains to assess the performance of rice Hybrids / varieties JRH-5, JRH-19, JR-81 and JRB-1 (developed by Jawaharlal Nehru Agriculture University, Jabalpur) under irrigated ecosystem. Front-line demonstrations, or FLDs, were carried out using a scientific package of rice technology practices. The yield and economic data of the plots that were on display were examined, evaluated, and examined with farmer practices (MTU-1010).With only an average of Rs. 2625/ha as an additional input cost in demonstrations using enhanced production technologies in FLDs, the mean grain yield increased by 23.80% over current farmer practices.Extension gap (10.48 q/ha), Technology gap (10.26 q/h) and the technology index is 15.79%. It is concluded that wide gap existed in potential and demonstration yield in high yielding rice varieties due to technology and extension gap in Balaghat District of Madhya Pradesh.By conductingfront line demonstrations of proven technologies, yield potential of rice can be increased to a greatextent. This will substantially increase the income as well as the livelihood of the farming community.

Key words: Front line demonstration, Hybrid rice, Technology gap, Extension gap, Yield.

Introduction:

Since half of the world's population consumes rice on a daily basis, it is the single most important crop in the world. 20% of the world's dietary energy comes from rice, while the remaining 19% and 5% come from wheat and maize, respectively. Over 70% of the calories in some Asian nations come from rice [1].

In terms of area and production, rice is ranked second in India, behind wheat. Approximately 43.90 million hectares are devoted to rice production, which yields 114.45 million tonnes of total output and 2607 kg/ha of productivity [2,3]. The amount of land planted to rice varies annually based on the amount of rainfall.

The name Madhya Pradesh, which translates to "Central Province," refers to the region that is in the geographic centre of India, between latitudes 21°6' and 26°30' North and longitudes 74°9' and 82°48' East. There is an agrarian economy in the state. The nation's second-largest producer of food grains is Madhya Pradesh. About 44% of the state's GDP comes from agriculture and related services, while 78% of its labour force is employed directly in the sector. According to Agriculture Statistics 2020–21, Madhya Pradesh's paddy acreage, production, and productivity are 3.40 million hectares, 12.31 million tonnes, and 3617 kg/ha, respectively. Compared to 5.36 million tonnes in 2013–14, the state is predicted to produce 13.18 million tonnes of rice in 2022–2023 [4].

The state of Madhya Pradesh's experimental district, Balaghat, is situated in its far southwest. It encompasses the upper Wainganga River valley as well as the southeast corner of the Satpura Range. The district is quadrilateral in shape, spanning from 21°19' to 22°24' North latitude and 79°31' to 81°3' East longitude. The Chhattisgarh plain's rice zone includes the Balaghat district. The zone is distinguished by a variety of soil types, from low water-holding capacity shallow and relatively deep soil layers to a mixed red and yellow soil. The soils have a pH range of 6.4 to 7.2 and are low in accessible phosphorus and nitrogen but medium to high in available potassium.Typically, the region has hot, dry summers and chilly winters due to its semi-humid, subtropical environment. At Balaghat, the zone's mean lowest temperature ranged from 16 to 30 degrees Celsius from June to November, and the average yearly rainfall was 1250 millimetres. The district's field crops in Rabi are rice, wheat, chickpea, teora, urad, moong, mustard and linseed; in Kharif, they are rice, minor millets, pigeonpea and maize. With an area of 0.31 million ha and a yield of 3305 kg/ha, the district is the second-largest rice producer in the state, producing 1.02 million tonnes, or 8.29% of the overall production [5].

Henri de Laulanie, a French missionary priest, developed the System of Rice Intensification (SRI) in Madagascar in the early 1980s as complementing rice (*Oryzasativa L.*) system. Rice is not regarded as an aquatic crop, and under an SRI system, standing water is not permitted in the field. In this approach, irrigation is only carried out when soil fissures are discovered, thus alternating dry and wet conditions are prevalent in SRI.The planting method used in SRI is a square scheme, with plants spaced 15 cm apart from one another and 20 rows apart. The third idea involves using seedlings that are 12 to 14 days old. This allows the plant to develop more tillers, which increases yield. The primary elements of SRI are widening the spacing between single young seedlings with care, managing water so that the soil is moist but not constantly flooded, mechanically or manually weeding early and frequently (three to four times) prior to canopy closure, and making sure there is an adequate supply of nutrients [6].

Poor yield in the farmers' fields is a reflection of the large disparity between the available techniques and their actual adoption by the farmers. In general, farmers are using outdated seedlings and applying fertiliser in an uneven manner. Therefore, by implementing the upgraded production technology, there is a great chance to increase rice productivity and production. Agricultural universities and research stations have developed a variety of methods for rice cultivation, but inadequate technology transfer from research farms to farmers' fields has resulted in low rice output.There is a big gap between the production and use of information since very little new knowledge finds its way into farmers' fields. It may be beneficial to watch Front Line Demonstrations (FLD) of rice in farmers' fields, particularly the recently released high yielding varieties with INM, IWM, and IPM. There are two goals for the FLDs. In the first, the relative yield advantage will be shown; in the second, the increased cropping intensity, weed control, and plant protection measures compared to current farmer practices will be discussed.

Material and Methods:

During the crop growing period, field diagnostic visits, farmer meetings, training programmes, field days and participatory approaches were used to identify the production restrictions. A low rice yield was thought to be caused by an inappropriate rice variety, imbalance fertiliser use, old seedlings, drought, weed infestation, and incorrect crop geometry. Based on the issues raised by the farmers, The College of Agriculture, Waraseoni (Balaghat) conducted field experiments (FLDs) on early-maturity rice varieties JR-81, JRB-1 and hybrid rice varieties JRH-5, JRH-19, developed by Jawaharlal Nehru Agriculture University, Jabalpur, respectively, under irrigated ecosystems at three blocks in the Balaghat District of Madhya Pradesh during four consecutive *Kharif* seasons in 2016, 2017, 2018 and 2019 (Table 1).The hybrid rice types JRH-5 and JRH-19 have medium-slender grains, a crop length of 100-105 days, and a short plant height of 100-105 cm. The rice types JR-81 and JRB-1 have medium-slender grains, a crop length of 115-125 days, and a short plant height of 100-105 cm.Each demonstration covered 0.4 hectares.The farmers that were chosen for the demonstrations came from a variety of socioeconomic backgrounds and farmed 2.5 to 5 acres of rice.

Table 1: Front line demonstrationandcarrying out site.

Year	Variety	Check	No. of	Area (ha)	Village	Block

			FLD			
2016	JRH-5	MTU-1010	25	10(0.4ha/FLD)	Aanwlajhari	Balaghat
2017	JRH-19	MTU-1010	25	10(0.4ha/FLD)	Nevergaon	Lalburra
2018	JRH-19	MTU-1010	60	24(0.4ha/FLD)	Phogaltola, Pathri Sonbatola	Lalburra
2019	JR-81	MTU-1010	20	8(0.4ha/FLD)	BottaHajari	Lalburra
2019	JRB-1	MTU-1010	25	10(0.4ha/FLD)	Koste	Waraseoni

In order to address the issues identified, farmers were given JRH-5, JRH-19, JR-81 and JRB-1 varieties seeds as essential inputs, and during the front-line demonstration project, scientifically indicated technologies (Table 2) were implemented as an intervention.

Table 2: Technological intervention and farmer's practices under FLD.

Particulars	Technological intervention	Existing practices
Variety	JRH-5, JRH-19, JR-81, JRB-1	MTU-1010
Seed rate (kg/ha)	15 (JRH -5 , JRH-19) 30 (JR-81, JRB-1)	35-40
Seed treatment	Carbendazim + Mancozeb (2g/kg seed)	No seed treatment
Age of Seedling	15-18	20-30
Transplanting Method	SRI/Line transplanting	Local practices
Fertilizer (NPK)	120:60:40 + 20 (Zink sulphate 21%) Hybrids 100:60:40 + 20 (Zink sulphate 21%) Varieties	100:60:30/60:40:00
Weed management	Spray of 0.75kg/ha Pendimethalin herbicide + one hand weeding	Only one hand weeding
Insects	Stem borer, gall midge,	Stem borer, gall midge
Diseases	Sheath blight, Blast	Sheath blight, Blast
Insecticides	Chlorpyrifos 50% EC	Chlorpyrifos 50% EC
Fungicides	Hexaconazole 5% SC, Propiconazole 25% EC	Tricyclazole 85% WP
Harvesting	Reaper	Manually/Reaper
Threshing	Thresher	Thresher/ Manually
Labour serving	55 man-day /ha	68 man-day /ha

Every year, during the last fortnight of June, when the monsoon season began, the nursery was raised. Every year in the middle of July, the fields are replanted with 15–18-day-old rice seedlings. From planting to harvesting, the farmer's field demonstrations were routinely observed. The farmers adhered to the established farming procedures in the event of local inspection (control plots). Each year, a training curriculum was arranged for the chosen farmers from the individual villages to provide them with technological knowledge related to rice producing practices, well in advance of the demonstrations. All other steps like site selection,layout of demonstrations, farmers' participationetc. were followed as suggested by [7]. The grain yield of demonstrations as wellas farmers' practice (local check) were recordedand analysed according to different parameterssuggested by [8]. The details ofthese parameters are as:

Extension gap = Demonstration yield–Farmer's yield

Technology gap = Potential yield - Demonstration yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

Additional Cost = Demonstration cost of cultivation - Farmer's cost of cultivation

Additional Return = Demonstration return - Farmer's return

Effective Gain = Additional return - Additional cost

$$\text{Increment B: C ratio} = \frac{\text{Additional return}}{\text{Additional cost}}$$

Result and Discussion:

Grain yield: Compared to farmers' local methods, the demonstration's increased grain output ranged from 16.13 to 29.36 percent. In comparison to farmers' traditional methods of paddy farming, demonstrations using better cultivation technology resulted in a yield advantage of 23.80 percent over a four-year period.

Gap analysis: Between farmer behaviours and shown technology across three distinct years, there was an extension gap ranging from 7.32 to 13.05 q/ha; on average, this difference was 10.48 q/ha (Table 3). In *Kharif*2019 (JRB-1), the extension gap was at its lowest point (7.32 q/ha), whereas in *Kharif* 2018, it reached its highest point (13.05 q/ha). This discrepancy may be related to demonstrations of better technology that produced higher grain yields than conventional farming methods. A significant gap in technology was noted in different years; it was lowest (7.50 q/ha) in *Kharif* 2018 and greatest (12.29 q/ha) in *Kharif* 2019 (JRB-1). The technology gap of all 155 demonstrations was found to be 10.26 q/ha on an average basis across four years. The variation in the technology gap between years may be the result of proposed technologies being more feasible in that year. In a similar vein, every demonstration's technology index across various years matched the technology gap. A higher technology score was indicative of both insufficient extension services and insufficiently tested technology to be transferred to farmers. The viability of the variety in the farmer's field is indicated by the technology index. The more feasible something is, the lower its technology index value is. Table 3 showed that the average value of the technology index was 15.79. The results of this investigation are consistent with those of [9,10].

Table 3: Gap in grain yield production of rice varieties under FLDs.

Season-Year variety	Potential Yield (q/ha)	Demonstration Yield (q/ha)	Farmer`s practice Yield (q/ha)	Increase over Farmer`s practices (%)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
Kharif -2016 JRH-5	65.00	55.25	43.75	26.29	11.50	9.75	15.00
Kharif-2017 JRH-19	65.00	54.50	42.25	28.99	12.25	10.50	16.15
Kharif-2018 JRH-19	65.00	57.50	44.45	29.36	13.05	7.50	11.54
Kharif-2019 JR-81	65.00	53.72	45.44	18.22	8.28	11.28	17.35
Kharif-2019 JRB-1	65.00	52.71	45.39	16.13	7.32	12.29	18.91
Average	**65.00**	**54.74**	**44.26**	**23.80**	**10.48**	**10.26**	**15.79**

Table 4: Economic impact of rice varieties under FLDs.

Season-Year Variety	Cost of cultivation (Rs/ha)		Additional cost in Demo. (Rs./ha)	Sale price (MSP) of (Rs./q)	Net Return (Rs/ha)		Additional return in Demo. (Rs./ha)	Effective gain (Rs./ha)	IBCR
	Demo.	FP			Demo.	FP			
Kharif -2016 JRH-5	36875	34375	2500	1470	44343	29938	14405	11905	5.76
Kharif-2017 JRH-19	38400	35625	2775	1550	46075	29863	16213	13438	5.84
Kharif-2018 JRH-19	39650	36700	2950	1770	62125	41977	20149	17199	6.83
Kharif-2019 JR-81	40750	38300	2450	1815	56752	44174	12578	10128	5.13
Kharif-2019 JRB-1	40750	38300	2450	1815	54919	44083	10836	8386	4.42
Average	**39285**	**36660**	**2625**	**1684**	**52843**	**38007**	**14836**	**12211**	**5.60**

Economic analysis: In addition to farmer practices, many factors like as seed, fertilisers, bio-fertilizers, and pesticides were taken into consideration as cash inputs for the demonstrations. On average, an extra expenditure of Rs. 2625 per hectare was made under the demonstrations. The relationship between the MSP sale price and grain yield determined the economic returns in a given year. The year *Kharif* 2018 yielded the maximum profits (Rs. 20149 per hectare) because of a higher grain output. These outcomes agree with the conclusions made by [9]. Higher effective gains and increased returns under demonstrations may be the result of scientific monitoring, timely crop production, non-monetary factors, and improved technology. Based on generated grain production and MSP sale rates, the lowest and highest incremental benefit: cost ratios (IBCR) were 4.42 & 6.83 in *Kharif* 2019 (JRB-1) and *Kharif* 2018, respectively (Table 4). The average IBCR across the board was 5.60. [11,12] also reported similar results.

Conclusion:

The front-line demonstration programme was successful in altering participant's attitudes, abilities, and understanding of better and suggested paddy cultivating techniques, including adoption. Additionally, this strengthened the trust and relationship between scientists and farmers. In addition to serving as the main source of information on better paddy cultivation techniques, the demonstration farmers supplied high-quality, pure seeds for the following harvest to their community and surrounds. In comparison to current farmer practices, the JRH-5, JRH-19, JR-81 and JRB-1 type of paddy and production technology used in demonstrations boosted grain yield by an average of 23.80%. The yield increase only average cost of Rs. 2625/ha. Since it's so little, even marginal and small farmers can afford it.IBCR (5.60) and the mean extension gap (10.48 q/ha) are both large enough to encourage farmers to use recommended varieties. A favourable benefit-cost ratio persuaded the farmers to accept the intervention by itself and explained the demonstration's economic viability. The idea of "Front Line Demonstration" can be used by progressive farmers as well as other types of farmers to quickly and widely introduce the suggested techniques to other farmers. This will facilitate the dismantling of the farming population's cross-sectional barrier.Paddy can close the yield gap if improved practices are widely publicised. This can be done by using a variety of extension approaches, with Front Line Demonstrations being one of the most crucial ways to illustrate the benefits of improved practices.

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