International Journal of Scientific Research in Biological Sciences
Vol.**11**, Issue.**1**, pp.**46-50**, February **2024**
E-ISSN: 2347-7520
Available online at: www.isroset.org

Research Article

Performance of Hybrid Rice varieties JRH-5 and JRH-19in front line demonstrations under irrigated conditions in agro climatic zone Chhattisgarh plains of Madhya Pradesh

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Received: 27/Dec/2023; **Accepted**: 23/Jan/2024; **Published**: 29/Feb/2024. | **DOI**: https://doi.org/10.26438/ijsrbs/v11i1.4650

Abstract— Frontline demonstrations were conducted with scientific package and practices in the farmer's fieldslocated in the Chhattisgarh plain agro climatic zone of Balaghat district, Madhya Pradesh to evaluate the performance oftwo short duration hybrid rice varieties JRH-5 and JRH-19 under irrigated ecosystem during the *Kharif* season of two consecutive years2016 and 2017. The data on yield and economics of demonstrated plotswhen comparedwith the farmers rice cultivating practices on the popular rice variety MTU-1010 revealed thatboth the Hybrid Rice varieties performed superior to MTU1010. JRH-5 and JRH-19 with improved production technologies showed increasedmean grain yield by 27.64% over existing farmers practices with only Rs. 2638/ha extra expenditureon inputs. In addition to this, the mean extension gap (11.88 q/ha) and mean IBCR (5.80)recorded weresufficiently high to motivatefarmers to adoptJRH-5 and JRH-19 with the improved rice production technology.

Keywords — Front line demonstration, Hybrid rice, Technology gap, Extension gap, Yield.

1. Introduction

Rice is the single most important crop of the worldas half of the world population eats rice every day. Ricesupplies 20% of the world's dietary energy supply, whilewheat and maize supply 19% and 5% respectively. In someAsian countries, rice even provides over 70% of calorie supply[1].

In India, rice occupies second position both in area and production followed by wheat. Rice occupies about 43.90 millionhectares of area with total production 114.45 million tonnes and productivity of2607 kg/ha[2]. The area under rice is fluctuatesevery year depending upon the rainfall.

Madhya Pradesh is a centrally located state of India between the latitude of 21°6'to 26°30' North and longitude of 74°9'to82°48'East. The state has an agrarian economyand is the second largest producer of food grains in the country. Agriculture and allied services contributes about 44% share in state economy and 78% of its working force is directly engaged in Agriculture.The area, production and productivity of paddy are 3.40 million hectare, 12.31 million tonnes and 3617 kg/ha respectively of Madhya Pradesh [3]. The state isexpected to produce 13.18 million tonnes of rice in 2022-23 (advance estimates) as compared to 5.36 million tonnes in 2013-14[4].

The Balaghat districtof Madhya Pradesh is located in the extreme South-West of the Madhya Pradesh state and occupies the south eastern portion of the Satpura Range and the upper valley of the Wainganga River. The district extends from 21°19' to 22°24' North latitude and 79°31' to 81°3' East longitude with quadrangle shape.The Balaghat district is classified under rice zone of Chhattisgarh plain, which is characterized by varying soil types ranging from a mixed red and yellow to shallow and moderately deep soil strata with low water holding capacity.Soils of the Balaghatdistrict are poor in available nitrogen and phosphorous. However, medium to high Potassiumis available with pH range 6.4 to 7.2. The climate of the zone is typically semi-humid and sub-tropical with hot dry summers and cold winters. The mean minimum temperature of the zone varies from 16° to 30° C (June to Nov.) at Balaghat with average annual rainfall of 1250 mm.The field crops of district in Kharif are rice, minor millets, pigeonpea, maize and in Rabi are rice, wheat, chickpea, teora, urad, moong, mustard, linseed. The district is the second highest producer of rice in the state **(**1.02 million tonnes**)** which is

8.29% of total production in state with area of 0.31 million ha and 3305 kg/ha yield [3].

Rice productivity in India is lower than China due to uneven erratic rainfall, unbalanced and inadequate use of fertilizer and incidence of pest and diseases[5].Therefore, there is a need to promote the early duration high yielding varieties/hybrids with adoption of plant protection measures and new agronomic practices such as System of Rice Intensification for combating water scarcity and economic losses in the region[6]. However, unfortunately, a wide gap exists between the available techniques and its actual application by the farmers, whichreflected by thepoor yield in the farmers' field. Farmers are generally practicing old age seedlings and imbalance use of fertilizers. Thus, there is tremendous opportunity for increasingthe production and productivity of rice by adopting the improved production technologies. A range of rice production technologies have been developed during the recent years, but the productivity of rice is still low due to poor transfer of technologies from the research farms to the farmers' fields. Very little new knowledge percolates to the farmers' field, hence a vast gap has been observed between knowledge production and knowledge utilization. Fortunately, Front Line Demonstrations (FLD) on rice including recently released high yielding varieties with INM, IWM and IPM on farmers' field may be helpfulas its objectives is two-fold. First is to . demonstrate the relative yield advantage and second is to address the increase cropping intensity, weed management and plant protection measures over existing farmer's practices.

2. Material and Methods

The constraints inproduction were identified through participatoryapproach such asfarmer's meetings, trainingprogrammes and field diagnostic visits duringcrop growth period. Low yield of rice wasconceived due to lack of suitable variety of rice,imbalance use of fertilizers, old age seedling, drought, infestation of weeds and improper cropgeometry. Based on the farmer's problems, The College of Agriculture, Waraseoni(Balaghat) conducted FLD's on rice duringtwo consecutive seasons of *Kharif* 2016 and 2017 on early maturingHybrid rice varieties JRH-5 and JRH-19developed by Jawaharlal Nehru Agriculture University, Jabalpur, respectively under irrigated ecosystem at two Blocks of Balaghat District of Madhya Pradesh (Table 1).Hybrid rice JRH-5 and JRH-19 both are medium slender grain, 100-105 Days crop duration and short plant height (100-105 cm) varieties. The area under each demonstration was 0.4 ha.The farmers selected for demonstrations were from different social background having rice area ranging from 2.5 to 5 acres

Table 1: Front line demonstration andcarrying out site.

Year	Variety	Check	No. of FLD	Area (ha)	Village	Block
2016	JRH-5	MTU-1010	25	10(0.4ha/FLD)	Aanwlajhari	Balaghat
2017	JRH-19	MTU-1010	25	10(0.4ha/FLD)	Nevergaon	Lalburra

To manage the identified problems, JRH-5 and JRH-19 varieties seeds wereprovided to the farmers as critical inputs andscientific recommended technologies (Table 2) werefollowed as intervention during the course offront line demonstration programme.

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

Particulars	Technological intervention	Existing practices
Variety	JRH-5, JRH-19	MTU-1010
Seed rate (kg/ha)	15	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)	100:60:40 + 20 (Zink sulphate 21%)	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 saving	55 man-day /ha	68 man-day /ha

Thenursery was raised during the onset of monsoon in the second fortnightof June each year. Rice seedlings of 15-18 days old were transplanted in the fields during mid of July everyyear. The demonstrations on farmer's fields wereregularly monitored from nursery raising toharvesting. In case of local check (control plots), existing farmers' practices were followed by thefarmers. Well before conducting thedemonstrations, a training programme wasorganized for the selected farmers of therespective villages each year to impart thetechnological knowledge of rice productiontechniques. 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 parametersas earlier suggested [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

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

3. Result and Discussion

Grain yield: The increase in grain yield underdemonstration was 26.29-28.99% percent than farmers' local practices. On the basis oftwo years, 27.64 percent yield advantage wasrecorded under demonstrations carried outwith improved cultivation technology as compared to farmer's traditional way ofpaddy cultivation.

Gap analysis: An extension gap of 11.50-12.25 q/ha was foundbetween demonstrated technology andfarmer's practices during different two-yearsand on average basis the extension gap was 11.88 q/ha (Table 3). The extension gap was lowest (11.50 q/ha) during *kharif* 2016 and was highest (12.25 q/ha) during *kharif* 2017. Such gapmight be attributed to adoption of improvedtechnology in demonstrations which resultedin higher grain yield than the traditionalfarmer's practices. Wide technology gap wasobserved during different years and this waslowest (9.75 q/ha) during *kharif*2016 and was highest (10.50 q/ha) during*kharif* 2017. On twoyears' average basis the technology gap of total 50 demonstrations was found as 10.13 q/ha. The difference in technology gapduring different years could be due to morefeasibility of recommended technologiesduring different years. Similarly, thetechnology index for all the demonstrationsduring different years were in accordancewith technology gap. Higher technologyindex reflected the inadequate proventechnology for transferring to farmers andinsufficient extension services for transfer oftechnology.Technology index shows the feasibility of thevariety at the farmer's field. The lower thevalue of technology index more is thefeasibility. Table 3 revealed that the technology index value was 15.58. Thefindings of the present study are in line with earlier findings [9,10].

Economic analysis: Different variables like seed, fertilizers, biofertilizers and pesticides were considered ascash inputs for the demonstrations as well asfarmer's practice and on an average anadditional investment of Rs. 2638 per ha wasmade under demonstrations. Economicreturns as a function of grain yield and MSPsale price varied during different years. Maximum returns (Rs. 16213 per ha) during the year *kharif* 2017 was obtained due to higher grain yield. These results are in line with theearlier findings [9]. The higheradditional returns and effective gain obtainedunder demonstrations could be due toimproved technology, non-monetary factors, timely operations of crop cultivation andscientific monitoring. The lowest and highest incremental benefit: costratios (IBCR) were 5.76 & 5.84 in *kharif* 2016 and *kharif* 2017 respectively (Table 4) depends on producedgrain yield and MSP sale rates. Overall average IBCR was found as 5.80 Similarresults have also been earlierreported [11,12,13,14].

Table 3: Gap in grain yield production of Hybrid JRH-5 and JRH-19 under FLD.

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
Average	65.00	54.88	43.00	27.64	11.88	10.13	15.58

Table 4: Economic impact of Hybrid JRH-5 and JRH-19 under FLD

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
Average	37638	35000	2638	1510	45209	29900	15309	12671	5.80

4. Conclusion

Front line demonstration program waseffective in changing attitude, skill andknowledge of improved / recommended practices of paddy cultivation includingadoption. This also improved the relationshipbetween farmers and scientists and builtconfidence between them. During demonstration the farmers alsoactedas primary source of information on the improved practices of paddy cultivation andalso acted as new source of good quality pureseeds in their locality and surrounding areafor the next crop. The Hybrid JRH-5 and JRH-19 variety of paddy and production technologies followedin demonstrations, on an average increased thegrain yield by 27.64% over existing farmer's practice. The increment in yield cost only Rs. 2638/ha. This amount is so negligible that even smalland marginal farmers can afford it. The mean extension gap (11.88 q/ha) and IBCR (5.80) aresufficiently high to motivate the farmers foradoption of Hybrid JRH-5 and JRH-19.Favourable benefitcost ratio itself explanatory of economicviability of the demonstration and convincedthe farmers for adoption of intervention imparted.The concept of Front-linedemonstration may be applied to all farmercategories including progressive farmers forspeedy and wider dissemination of therecommended practices to other members ofthe farming community. This will help in theremoval of the cross-sectional barrier of thefarming population. The yield gap in paddy can be overcome, through the wide publicityof the improved practices paddy cultivationby use of various extensions methodologiesincluding Front Line Demonstrations as oneof the most important method to show theresult of improved practices.

Data availability
None

Conflict of Interest
None

Funding Source
None

Acknowledgements
None

Author Contributions
Uttam Kumar Bisen wrote the abstract, designed the work, prepared the draft and finally the proof reading of the research paper

Vikram Singh Gaur wrote the introduction, results, and conclusion and finally the proof reading of the research paper

Ramkrishna Singh Solanki performed the statistical analysis, wrote the results, and conclusion and finally the proof reading of the research paper

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