Plant Archives Vol. 17 No. 2, 2017 pp. 1301-1304 ***ISSN 0972-5210***

MAXIMIZATION OF PRODUCTIVITY FOR RICE (*ORYZA SATIVA*) THROUGH IMPROVED TECHNOLOGIES IN FARMER'S FIELDS

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Abstract

The front line demonstrations were conducted on farmer's field at Umaria district during *kharif* season of 2008-09 and 2009-10 at three different locations under real farm situations prevailing farmers practices were treated as control for the comparison with recommended practice. The result of front line demonstration showed a greater impact on farmers due to significant increase in crop yield, higher than FP. The economics and benefit cost ratio of both FP and RP plots were worked out. An average of Rs. 29570/ha net returns was recorded under RP while it was Rs. 13618/ha under FP. Benefit cost ratio was 2.98 under RP, while it was 1.96 under FP. By incorporating proven technologies of rice, yield potential and net income from rice cultivation can be enhanced to a great extent with increase in the income level of the farming community of the district.

Key words : Front line demonstration, rice, PS-5, yield, BC ratio.

Introduction

Rice is the premier food crop of India and foremost cereal. Thus the national food security largely depends on the production and productivity of rice ecosystem. Among the rice growing countries, India stands first in area (43.7 million hectares) and second in production (91.8 million tones) next only to China. For many people in the India, rice is the main source of energy and it plays an important role in providing livelihood to the Indian population. It is largely grown in India under diverse conditions of soil, climate, hydrology and topography. Rice farming is the most important source of employment and income for the majority of rural people in this region.

Rice is the staple food crop of the Umaria district of Madhya Pradesh; occupies 43.35% of total cropped area of *kharif* season (44000 ha of total 92910 ha cultivated area). The productivity of rice in the district is only 1.8 t/ha, which is much below the national productivity (2.1 t/ha). The reason of low productivity may be attributed to non adoption of improved production technology which includes the agronomic practices and socioeconomic conditions of the tribal people.

The productivity of rice in the district can be increase by following the appropriate agronomic practices along with high yielding rice varieties, integrated nutrient management, integrated pest management, integrated weed management, proper water management etc. Farmers are using old seeds of IR-64 or local varieties, transplanting old age seedling (30-45 days old), closer spacing (3-4 seedlings/hill with higher seed rate *i.e.* 30-35 kg/ha), submerged the soil entirely crop season, poor weed management and insufficient supply of nutrients. Hence, an effort made by the KVK scientists by introducing the recommended technologies of paddy production with HYV Pusa Sugandha-5 through front line demonstration on farmers field during *kharif* season of 2008-09 and 2009-10.

Materials and Methods

The present study is a part of the mandatory programme of Krishi Vigyan Kendra, Umaria, Madhya Pradesh, India. Participatory rural appraisal (PRA), group discussion and transect walk were followed to explore the detail information of study area. In between the technology intervention HRD components (Trainings/Kisan sangosthi/Kisan mela/field day etc.) were also included to excel the farmers understanding and skill about the demonstrated technology on rice. Field demonstrations were conducted in Umaria district of Madhya Pradesh under close supervision of krishi vigyan kendra. Total 13 front line demonstrations under real farming situations were conducted during *kharif* season of 2008-9 and 2009-10 at three different villages namely; Kachharwar, Lorha and Chandia, respectively under krishi vigyan Kendra operational area. The area under each demonstration was 0.4 ha. The soil was sandy clay-loam in texture with moderate water holding capacity, low in organic carbon (0.2-0.41%), low in available nitrogen (97.3-142.3 kg/ha), low to medium in available phosphorus (8.2-12.9 kg/ha), low in available potassium (169.7-229.6 kg/ha) and soil pH was slightly acidic to neutral in reaction (6.8-7.2). The treatment comprised of recommended practice (Improved variety Pusa Sugandha-5, integrated nutrient management-@100:60:40 kg NPK/ha + Azotobacter & PSB @ 10 g/kg seed + BGA @ 10 kg/ha, integrated pest management-deep ploughing + seed treatment with *Trichoderma viridae* @ 5g/kg seed + carbendazim @ 2 gm/liter water + Triazophos @ 2 ml/lit water, integrated weed management-application of pyrazosulphuran ethyl @ 25 g a.i./ha at 3-4 DAT along with one hand weeding at 30 DAT etc. *vs* farmers practice. The rice nursery was grown on *puddled* raised beds with irrigation cum drainage channel around the nursery. Sprouted seeds of high yielding paddy variety PS-5 (medium duration) sown using 15 kg/ha seed rate. The demonstration fields were well prepared by the suitable implements; fields were puddle twice and leveled properly. 22-25 days old seedlings were transplanted (two seedling per hill) with the 20 cm x 10 cm spacing in muddy field. Balance dose of fertilizers (100:60:40 kg NPK/ha was supplied; 25% through organic sources i.e. FYM/ vermicompost and remaining 75% through chemical fertilizers *i.e.* urea, DAP and MOP) supplied. The demonstration plots were kept moist throughout the vegetative growth by applying frequent irrigations, when required. During flowering to milking stage about 5-6 cm standing water was maintained continuously. Pyrazosulfuron @ 25 g a.i./ha as pre emergence was applied at 3-4 days after transplanting (DAT).

Farmer's practice constituted the application of high seed rate (30 kg/ha), planting of old seedling (30-45 DAS), closer planting (3-4 seedlings/hill), not adopting the line sowing, imbalance and insufficient supply of nutrients (50:30:0 kg NPK/ha), submerged the paddy field throughout the crop season, one hand weeding between 30-50 days after transplanting (DAT) etc. Harvesting and threshing operation done manually; 5m×3m plot harvested in 3 locations in each demonstration and average grain weight taken at 14% moisture. Similar procedure adopted on FP plots under each demonstration then grain weight converted into quintal per hectare (q/ha).

Before conduct the demonstration training to farmers of respective villages was imparted with respect to envisaged technological interventions. All other steps like site selection, farmers selection, layout of demonstration, farmers participation etc were followed as suggested by Choudhary (1999). Visits of farmers and extension functionaries were organized at demonstration plots to disseminate the technology at large scale. Yield data was collected from farmers practice and demonstration plots; cost of cultivation, net returns and benefit cost ratio were computed and finally the extension gap, technology gap and technology index were worked out. To estimate the technology gap, extension gap and technology index, following formula have been used.

$$\text{Technology Index} = \frac{(Pi - Di)}{Pi} \times 100$$

Where,

Pi- Potential yield of i^{th} crop.

Di- Demonstration yield of i^{th} crop.

Results and Discussion

Yield attributes and biomass yield analysis

The yield attributing characters *i.e.* number of tillers/m^2, grain yield (q/ha), straw yield (q/ha) and harvest index (%) of front line demonstration are presented in table 1. In the present findings number of tillers was influenced positively due to recommended practice (RP). Thus, the maximum number of tillers 21.5/hill was noted in case of RP as compared to farmers practices *i.e.* 13 tillers/hill (table 1). Growing of high yielding variety PS-5 with full package and practices increased the quantitative parameters of rice. The data revealed that under demonstration plot, the performance of rice yield was found to be higher than that under FP during both the years (2008-09 and 2009-10). The yield of rice under demonstration was recorded 51.3 and 47.5 q/ha during 2008 and 2009, respectively. The yield enhancement due to technological intervention was to the tune of 57% and 64% over FP. The cumulative effect of the technological intervention over two years, revealed on average yield of 49.4 q/ha, 60.7% higher over FP. The year to year fluctuations in yield and cost of cultivation can be explained on the basis of variations in prevailing social, economical and prevailing microclimatic condition of that particular village. Mukhargee (2003) has also reported that depending on identification and use of farming situation, specific intervention may have greater implications in enhancing systems productivity. Yield enhancement in different crops in front line demonstration has amply been documented by Haque (2000), Sharma (2003), Gurumukhi and Mishra (2003), Tiwari *et al.* (2003)

and Tomar *et al.* (2003). Higher grain and straw yield of rice (49.4 and 69.5 q/ha) were observed in RP over FP (30.7 and 50 q/ha), respectively. Among both the treatment harvest index was observed (table 1) 38% and 41.5% in farmers practice (FP) and recommended practices (RP), respectively.

Economics

Economic indicators *i.e.* gross expenditure (Rs/ha), gross returns (Rs/ha), net returns (Rs/ha) and B:C ratio of front line demonstration are presented in table 2. The data clearly revealed that the net return from the recommended practice were substantially higher than FP plot during both the years of demonstration. Average net returns from recommended practice were observed to be Rs. 29570/ha in comparison to FP plot *i.e.* Rs. 13618/ ha. On an average Rs. 15952/ha as additional income is attributed to the technological intervention provided in demonstration plots.

Economic analysis of the yield performance revealed that benefit cost ratio of demonstration plots were observed significantly higher than FP plots. The benefit cost ratio of demonstration and FP plots were 3.10, 2.87 and 2.08, 1.84 during 2008-09 and 2009-10, respectively. Hence, favorable benefit cost ratios proved the economic viability of the intervention made under demonstration and convinced the farmers on the utility of intervention. The data clearly revealed that the maximum increase in yield and benefit cost ratio was observed during 2008-09. The variation in benefit cost ratio during both the years may mainly on account of yield performance and input output cost in that particular years.

The result of front line demonstration convincingly brought out that the yield of rice could be increased higher with the intervention on varietal replacement *i.e.* PS-5, integrated nutrient management, integrated pest management and integrated weed management in rice production in the Umaria district. To safeguard and sustain the food security in India, it is quite important to increase the productivity of rice under limited resources. Favorable benefit cost ratio is self explanatory of economic viability of the demonstration and convinced the farmers for adoption of improved technology of rice production. The technology suitable for enhancing the productivity of rice and calls for conduct of such demonstration under the transfer of technology programme by KVKs.

Extension and technology gap

The extension gap ranging between 18.6-18.65 q/ha during the period of study emphasized the need to educate the farmers through various means for the adoption of improved agricultural production to reverse the trend of

Table 1 : Productivity, growth and yield parameters, technology gap, extension gap and technology index of rice as affected by recommended practices as well as farmer's practices.

Year	Area (ha)	No. of farmers	No. of tillers/hill		Grain yield (q/ha)			% increase over FP	Straw yield (q/ha)		Harvest index (%)		Technology gap (q/ha)	Extension gap (q/ha)	Technology index (q/ha)
			RP	FP	Potential	RP	FP		RP	FP	RP	FP			
2008-09	2.4	6	24	15	60	51.3.0	32.65	57.12	70	51	42	39	8.7	18.65	14.5
2009-10	2.8	7	19	11	60	47.5	28.9	64.35	69	49	41	37	12.5	18.60	20.8
Total/Mean	**5.2**	**13**	**21.5**	**13.0**	**60**	**49.4**	**30.7**	**60.7**	**69.5**	**50**	**41.5**	**38**	**10.6**	**18.60**	**17.65**

Table 2 : Economics of Front Line Demonstration of rice as affected by recommended practices as well as farmer's practices.

Year	No. of demonstration	Yield (q/ha)		% increase over FP	Gross expenditure (Rs/ha)		Gross returns (Rs/ha)		Net returns (Rs/ha)		B:C ratio	
		RP	FP		RP	FP	RP	FP	RP	FP	RP	FP
2008-09	6	51.3	32.65	57.12	14890	14080	46170	29385	31280	15305	3.10	2.08
2009-10	7	47.5	28.9	64.35	14890	14080	42750	26010	27860	11930	2.87	1.84
Total/Mean	**49.4**	**30.7**	**60.7**	**14890**	**14080**	**44460**	**27698**	**29570**	**13618**	**2.98**	**1.96**	

Table 3 : HRD component : Cumulative data of 2008-09 & 2009-10.

S. no.	HRD components	Frequency	Beneficiaries
1.	Trainings on paddy production	14	548
2.	Radio talk	2	Mass
3.	CD shows	6	Mass
4.	Kisan mela	4	5890
5.	Kisan sangosthi	8	161
6.	News paper coverage	8	Mass
7.	Folders	1	Mass

wide extension gap (table 1).

The trend of technology gap ranging between 8.7-12.5 q/ha reflected the farmer's cooperation in carrying out such demonstration with encouraging results in both the years. The technology gap observed may be attributed to the dissimilarity in weather conditions.

The technology index showed the feasibility of the evolved technology at the farmer's field. The lower the value of technology index, the more is the feasibility of the technology. As such, the reduction in technology index from 14.5% during 2008-09 to 20.8% during 2009-10 exhibited the feasibility of the demonstrated technology in this region.

HRD components

During the study period, Human Resources Development Components *i.e.* training, radio talk, field day, CD shows, popular articles, training handout, Kisan Mela and Kisan Sangosthi were also taken to increase the farmers understanding and skill about the recommended practice on rice production (table 3).

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