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Impact of Farmers' Participatory Programme on Rice (*Oryza sativa* L.) Production and Economics Under Temperate Hill Ecology

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ABSTRACT

There is a huge scope for tapping rice potential in Kashmir valley owing to congenial environment and abundant natural resources. Productivity of rice crop is however very low compared to the potential, particularly in the mid belts. With an aim to narrow down the yield gaps, Krishi Vigyan Kendra Kulgam –SKUAST, Kashmir conducted 550 frontline demonstrations on rice technologies under various rice ecologies from year 2011-2020. Results of these demonstrations revealed a significant improvement in yield with introduction of new varieties, over those existing at farmers field. The yield superiority over farmers' practice ranged from 9.2 per cent to 15.8 per cent. On an average the yield was 12.7per cent higher with the improved varieties compared to the old ones. An extension gap of 7.1 q/ ha hectare was also recorded. Net returns were ₹99306/ha in improved practice against ₹ 89034/ha in the farmers practice, indicating an additional income of ₹ 10272/ha with improved varieties. B:C ratio was 2.5 and 2.6 for farmers' and improved practice, respectively. Over the decade rice production in district Kulgam increased by 34 % despite 2.5per cent decrease in area under rice.

Key Words: Demonstration, Impact, Paddy, Rice.

INTRODUCTION

Despite the fact that India has largest area under rice in the world, the productivity level of rice in the country is far below the world average. There exists is a gap between what we produce and what can be produced at farmers' field (Mubarak and Shakoor, 2019). Technology dissemination through agriculture extension system has been quite effective in narrowing the yield gaps in rice (Sheikh *et al,* 2014). Being staple food for majority of the population of Jammu and Kashmir Union Territory (UT), particularly in the temperate Kashmir Valley, rice gets ample research and extension attention. The crop however, faces many challenges including crop diversification, land conversion to non-agriculture purposes, climate change and so on. The productivity therefore is much lower than potential (Mubarak and Sheikh, 2014). To bridge the yield gap it is therefore important that new varieties with higher yield potential and resilience to biotic and abiotic stresses are developed and popularized among farmers. Mountain Research Center for Field Crop (MRCFC)-SKUAST, Kashmir did a pioneer work by developing such varieties from time to time. The Shalimar Rice(SR) series along with related production technology has proven quite fruitful in improving the rice production and productivity in the temperate valley (Sofi *et al,* 2020). During surveys conducted by the Kendra the rice productivity was found very less in the mid belts of district Kulgam compared to the potential. In the on-farm testing of technologies by Kendra it was found that yields can be improved by 33per cent in this belt and around 16 per cent in the planes. In this article an effort has been made to sum up the impact of the technology dissemination in farmers'

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Table 1: Grain yield and gap analysis of front line demonstrations on paddy over ten years

Year	Name of technology/ Varieties	Ecology	No. of demonstrations	Area under demonstration (ha)	Average yield in Improved Practice (q/ha)	Average yield in Farmers practice (q/ha)	%age yield increase	Extension gap (q/ha)
2011	China-1039 /K-39 (FP) K-448(IP)	Mid Belts	82	33	57.8	50.3	14.9	7.5
2012	China-1039 /K-39 (FP) K-448(IP)	Mid belts	125	50	58.2	51.6	12.8	6.6
2013	China-1039 /K-39 (FP) K-448(IP)	Mid Belts	75	30.0	60.6	52.3	15.8	8.3
2014*	China-1039 /K-39 (FP) K-448(IP)	Mid belts	98	39.0	42.6	38.3	11.2	4.3
2015	China-1039 /K-39 (FP) K-448(IP)	Mid belts	25	10.0	63.8	58.4	9.2	5.4
2016	Transplanted rice K-448 (FP) System of rice intensification and Zn nutrition in K-448(IP)	Mid belts	21	8.4	66.2	59.4	11.4	6.8
2017	Transplanted rice K-448 (FP) System of rice intensification and Zn nutrition in K-448(IP)	Mid belts	60	24.0	64.2	57.4	11.8	6.8
2018	Transplanted rice K-448 (FP) System of rice intensification and Zn nutrition in K-448(IP)	Lower belt	25	10	65.3	58.6	14.8	6.7
2019	K-448/SR-1(FP) Shalimar Rice (SR)-4	Lower belt	25	10	73.9	65.2	13.3	8.7
2020	K-448/SR-1(FP) Shalimar Rice (SR)-4	Lower belt	14	5.6	74.5	64.7	15.1	9.8

participatory mode as a case study from district Kulgam of Jammu &Kashmir UT.

MATERIALS AND METHODS

District Kulgam is situated at 75° 01' east longitude and 33° 39' north latitude in the lap of Peer Panchal , Himalayan Ranges. The study area falls between an altitude of 1650 and 1850 m amsl in the district. With a goal of boosting rice production, Krishi Vigyan Kendra-Kulgam ,SKUAST-Kashmir conducted Frontline demonstration on rice varieties developed by the Mountain Research Center for Field Crops (MRCFC)-SKUAST, Kashmir in farmers participatory mode. The present study was conducted for the period 2010 to 2020, taking year 2010 as the baseline for impact analysis. During this period 550 Frontline Demonstrations over an area of 220 ha throughout different rice ecologies of the district were conducted by Kendra in collaboration with department of agriculture. In the Frontline Demonstration programme two practices were performed at each location over and area of 0.4 ha per demonstration viz. farmers' own practice (old varieties) and improved practice (new varieties). The crop was monitored during each season at different stages and necessary training and awareness was imparted to beneficiary farmers. Yield was recorded for data analysis and for overall impact. Data of baseline year (2010) was compared with the latest data available on area, production and productivity. For economics, value of both grain and paddy straw was taken into consideration, as paddy straw has economic value in the valley particularly for cattle and as apple packing material. Extension gap, additional gains and effective gains were calculated as below;

(i) Extension gap= Improved practice yield – farmers' practice yield

(ii) Additional gains = Net returns (₹/ha) from Improved practice – Net returns(₹/ha) from farmers' practice

(iii) Effective gains= Additional returns (₹/ha) – additional costs (₹/ha)

RESULTS AND DISCUSSION

Crop yield and yield gaps

Data pertaining to the Frontline demonstrations conducted by the Kendra (Table 1) indicate that improved rice varieties performed better than the existing varieties cultivated by the farmers. The yield advantage ranged between 9.2 and 15.8 per cent over farmers practice in the demonstrations. On an average the yield was 12.7 per cent higher with the improved varieties compared to the old ones. The latest variety Shalimar Rice-4 released in year 2018 after successful farmers' participatory trials conducted across Kashmir valley, recorded average yield of 74.5 q/ha, which was the highest observed so far. Kirandeep *et al (*2020) and Sharma and Singh (2020) also concluded that new technology have significant yield advantage over tradition one. Similar findings were also reported by Patil *et al (* 2017). Higher yields during 2019 (73.9 q/ha) and 2020 (74.5 q) may be attributed to better performance of new varieties possessing higher yield potential under respective ecologies. Similar kind of conclusions were drawn by Singh *et al* (2014) and Asif *et al* (2017) during their studies. The yields were overall low in 2014 due to abnormal weather condition during flowering period.

The yield gap analysis in the present study revealed an extension gap ranging between 5.4 to 9.8 q/ ha (Table-2). On an average the extension gap was 7.1q/ha, which indicates that there is further scope to enhance the rice production in the district by popularizing the latest high yielding varieties developed by MRCFC-SKUAST,Kashmir. This can be achieved through collaborative efforts of extension functionaries involving KVK and line department.

Economic impact

Economic in terms of costs of cultivation, gross and net returns, additional returns, effective gain and B:C ratio varied during different years both in the improved technology and farmers practice. This was due to variation in cost of inputs and the price of produce due to multiple factors (Table 2 and

Table 2: Economic Analysis of frontline demonstration programme on paddy at farmers' field

Year	Input cost (₹./ha)		Additional cost in IP	Gross returns (₹/ha)		Net returns (₹/ha)		Additional returns from IP (₹/ha)	Effective Gain from IP(₹)	B:C ratio	
	Farmers Practice (FP)	Improved Practice (IP)		FP	IP	FP	IP			FP	IP
2011	24900	27530	2630	65390	75140	40490	47610	7120	4490	1.6	1.7
2012	25900	28834	2934	78240	86640	52340	57806	5466	2532	2.0	2.0
2013	25690	28700	3010	80855	93796	55165	65096	9931	6921	2.1	2.3
2014	26200	29200	3000	99630	111739	73430	82539	9109	6109	2.8	2.8
2015	26600	29415	2815	103700	114615	77100	85200	8100	5285	2.9	2.9
2016	37800	40872	3072	142110	154688	104310	113816	9506	6434	2.8	2.8
2017	38192	42448	4256	144766	160012	106574	117564	10990	6734	2.8	2.8
2018	40560	41990	1430	159571	171739	119011	129749	10738	9308	2.9	3.1
2019	47280	49242	1962	176536	195694	129256	146452	17196	15234	2.7	3.0
2020	48229	53068	4839	180899	200300	132670	147232	14562	9723	2.8	2.8

Fig 1&2). The cost of cultivation varied from ₹24900/ha in year 2011 in farmers' practice to ₹53068/ha in the improved practice in year 2020 . Fig 1 indicates no measure change in the costs of cultivation from 2011 to 2017. An increasing trend however can be seen 2017 onwards. Gross and net returns showed an increasing trend over the years. This could be due to the change in the monetary value of farm produce, which is governed by multiple factors.Net returns pooled over the years were ₹99306/ha in technology demonstrated against ₹ 89034/ha from the farmers practice indicating an additional income of ₹ 10272/ ha. The higher additional returns and effective gain obtained under improved varieties could be due to high yield potential under existing ecology, timely execution of field operations, monitoring of demonstration plots and on spot advisories. Vinay Gaur and Jadav (2020) also concluded their study with similar results. The highest benefit: cost ratio (3.1) was registered during year 2018. This was attributed to higher value of paddy straw due to its increased demand. On an average B:C ratio was 2.5 and 2.6 for farmers' and improved practice, respectively.

Over all impact in the district

Area, Production and productivity of the base line year were compared with the existing (Fig.3). The data indicates that rice production increased by 34 per cent over the base line, despite 2.5 per cent loss of area under paddy, from 16411 ha to 16000 ha due to conversion to horticulture of non-farm activities . The increase in production was attributed to higher productivity of the crop which improved from 4.8t/ha in 2010 to 6.7t/ha at present. The increase in the district rice productivity was 39.6per cent which is substantially higher. It may be attributed to the adoption of latest varieties of rice and related package of practices being popularized by the agriculture extension agencies at district level, involving both the Krishi Vigyan Kendra and agriculture development department. Shalimar rice -4 variety, which was released in 2018 is spreading fast in the lower parts of the district and has reported a yield of >10 t/ha at farmers' field. This indicates a further scope for improvement in the rice production with the horizontal spread of this variety in the coming years.

CONCLUSION

Rice being the staple food of the people of Kashmir Valley will remain a top priority of agriculture research and extension. The area is shrinking day by day due to diversification into other sectors especially horticulture and non-agriculture activities indicating that we need to get more from less land. To meet the demand, the present productivity must not only sustain but increase in future. So demonstration of all the proven technology capsules pertaining to different rice ecologies in farmers' participatory mode is vital.

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