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Integrated Crop Management Practices of Wheat through Frontline Demonstration in Bundelkhand Region

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ABSTRACT

Krishi Vigyan Kendra, Datia, Madhya Pradesh conducted 365 demonstrations on wheat varieties GW-366 and RVW-4106 during 2017-18 to 2020-21 at farmers' field in Datia district to find out the worth of the improved technology. The parameters like technological impact, economical impact and extension gap were analyzed and the feasibility of demonstrated technologies at grass root levels was assessed. The results of four years of studies revealed that the yield under demonstration plots was 4684 kg/ha as compared to 3875 kg/ha in traditional farmer practices plots. This additional yield of 809 kg/ha and the increase in average wheat productivity by 21.43 per cent may contribute to the present wheat requirement on national basis. The average technology gap, extension gap and technology index were found to be 376.50 kg/ha, 807.75 kg/ha and 7.40 per cent respectively. An additional investment of Rs. 1470 per ha coupled with scientific monitoring of demonstrations and non-monetary factors resulted in an additional net return of Rs. 13531 per ha. Fluctuation in the sale price of wheat during different years influenced the economic returns per unit area. On four years overall average basis incremental benefit cost ratio was found as 3.41. The results indicate the positive effects of FLDs over the existing practices.

INTRODUCTION

Wheat (*Triticum aestivum* L.), a leading cereal grain that belongs to the Gramineae family, is a staple food of billions of people in the world; used to make flour for leavened, flat and steamed bread, cookies, cakes, pasta, noodles and couscous; for fermentation to make beer and alcohol (Khan & Habibi, 2003). In India, wheat is the second most important food crop after rice being cultivated on 31.45 m ha with a production of 107.59 m tons with average productivity of 34.21 q/ha (Ministry of Agriculture and farm, 2020). In Madhya Pradesh, it is grown on a 5.52 m ha area with a production of 15.47 m tons and productivity of 28.02 q/ ha (Directorate of Economics & Statistics, DAC & FW, 2019). However, in the past decade, a general slowdown in the increase in the productivity of wheat has been noticed, particularly under environments relatively unfavorable for the growth and development of wheat (Nagarajan, 2005). During the past few years, More than 50% area of wheat sowing gets delayed and goes up from last December to early January causing a substantial loss in grain yield due to late harvesting of preceding *kharif* crops like rice, which ultimately results in poor seed yield due to unavailability of sufficient irrigation water. Moreover, poor agronomic practices such as higher seed rate, unsuitable varieties, faulty nutrient management as well as weed control etc. are responsible for the low productivity of wheat in Datia district of Madhya Pradesh and also in India (Tiwari et al., 2014).

KVKs are grass root level organizations meant for the application of technology through assessment, refinement and demonstration of proven technologies under different micro-farming situations in a district (Das, 2007). Front line

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demonstrations (on farmer's fields) on wheat were conducted to demonstrate the production potential and economic benefits of improved varieties with the latest technologies and also convincing the farmers to adopt the improved production technologies of wheat for enhancing the productivity of wheat in the region. Keeping these in view, FLDs of improved production technology on wheat was conducted to enhance the productivity and economic returns and also convincing the farmers for adoption of improved production technologies in wheat crop.

METHODOLOGY

The study is a part of the mandatory programme of Krishi Vigyan Kendra, Datia, Madhya Pradesh. Front-line demonstration with the improved package of practices on wheat (0.2 ha. each) was conducted at 365 farmers' fields during *rabi* season of four consecutive years of 2017-18 and 2020-21 in different villages i.e. Kharag, Sanora, Barodi and Rajpur of Datia district (Madhya Pradesh). The soils of the farmer fields were Sandy-loam in texture and medium to low in NPK. FLD plot was kept for assigning farmers practices. Before conducting FLDs, group meetings and specific skill training were given to the selected farmers regarding the package of practices of wheat crop. Improved variety seed (GW-366 and RVW-4106), with a seed rate of 100 kg/ha along with a recommended dose of fertilizer 120:60:40 kg of NPK/ha and weed control measures were used. The crop was sown between18th to 25th November in the demonstration field, with 20 cm row spacing. The crop received a full dose of P_2O_5 and K_2O and a half dose of nitrogen as basal dose and remaining nitrogen in 2 equal splits i.e. at tillering and at boot stage. The source of fertilizer was urea, single super phosphate and muriate of potash for N, P and K, respectively. A mixture of Sulfosulfuron 75% + Metsulfuron Methyl 5% WG @ 40 g/ha was applied as post emergence after first irrigation at 25-30 days of sowing for weed management. Fields were irrigated at the critical stages of the crop and the crop was harvested from 29th March to 9th April during all the years of the demonstration. Farmer's practice constituted the seed of an age-old variety of Lok 1. The crop was sown at the same time as a demonstration, broadcasting method of sowing, higher seed rate (125 kg/ha), imbalance dose of fertilizers applied (100:40:0 kg NPK/ha), no seed treatment, no plant protection measures and applied of 2,4-D @ 750g a.i./ha for weed management. The crop was harvested at the same time as harvesting demonstration plots. Harvesting and threshing operations had done manually and by a thresher, respectively. Before conducted the demonstration training to farmers of respective villages was imparted for envisaged technological interventions. All other steps like site selection, farmer's selection, the layout of demonstration, farmers participation *etc*. were followed as suggested by Choudhary (1999).

The average yield of each FLD and farmer practice was taken in all the years for interpretation of the results. The extension gap, technology gap and technology index were calculated using the following formula as suggested by Samui *et al.*, (2000).

Extension gap = Demonstration yield – farmers' yield (control)
Technology gap = Potential yield – Demonstration yield
Technology index (%) = Technology gap x 100/Potential yield

The data were collected through personal contact with farmers at farmer's fields and after that tabulated and analyzed with percentage.

RESULTS AND DISCUSSION

A comparison of the productivity level between front line demonstrations and local checks is shown in Table 1. It is evident from the results that under the demonstrate plot, the performance of Wheat (yield) was sustainable higher than that in the local check in all the years of the study (2017-18 to 2020-21). The cumulative results of four years revealed that the average yield of wheat was recorded at 4684 kg/ha under demonstrated plots as compared to farmer practice 3876 kg/ha. The highest yield in the front line demonstration plot was 4875 kg/ha in 2020-21 and farmers' practices 4447 kg/ha during 2020-21. The lowest yield of front line demonstration was 4518 kg/ha in 2017-18 and farmers' practice was recorded 3587 kg/ha in 2019-20. The increase in grain yield under demonstration was 9.62 to 29.11 per cent than farmers' local practices. Based on four years, 21.43 per cent yield advantage was recorded under demonstrations carried out with improved cultivation technology as compared to farmers' traditional way of wheat cultivation. The results indicated that the front line demonstrations have given a good impact on the farming community of Datia district as they were motivated by the new agricultural technologies applied in the Front Line Demonstration plots (Table 1). However, the obtained seed yield in FLD's was low as compared to the potential yield of the varieties and year-to-year fluctuations in yield due to soil fertility level and uncertain weather situations. The results were found to be in close conformity with the research results of Nain et al., (2012); Sharma et al., (2016); Singh (2017); *Mukherjee (2019)*.

Gap analysis

An extension gap of 428 to 1086 kg/ha was found between demonstrated technology and farmers' practices during different four years. On an average basis, the extension gap was 807.75 kg/ha (Table 1). The extension gap was lowest (428 kg/ha) during *rabi* 2020-21 and it was highest (1086 kg/ha) during *rabi* 2018-19 (Table

Table 1. Grain yield and gap analysis of front line demonstrations on wheat at farmers' field from 2017-18 to 2020-21

Year	No. of Demo	Variety	Potential yield	Demo yield (kg)	Farmers practice yield (kg)	Yield increase (%)	Extension gap (kg)	Technology gap (kg)	Technology index (%)
2117-18	100	GW-366	5180	4518	3738	20.87	780	662	12.78
2018-19	125	RVW- 4106	5020	4817	3731	29.11	1086	203	4.04
2019-20	120	RVW- 4106	5020	4524	3587	26.12	937	496	9.88
2020-21	20	RVW- 4106	5020	4875	4447	9.62	428	145	2.89
			5060.00	4683.50	3875.75	21.43	807.75	376.50	7.40

Table 2. Economic analysis of front line demonstrations on wheat at farmers' field from 2017-18 to 2020-21

Year	Cost of cultivation		Selling price (MSP) Rs./kg	Gross return		Increase in gross return (%)	Net Return		Increase in net return (%)	B: C ratio	
	Improved technologies	Local farmers practices		Improved technologies	Local farmers practices		Improved technologies	Local farmers practices		Improved technologies	Local farmers practices
2117-18	24800	23500	17.35	78387	64854	20.87	53587	41354	29.58	3.16	2.76
2018-19	24800	23500	18.40	88633	68650	29.11	63833	45150	41.38	3.57	2.92
2019-20	26200	24500	19.25	87087	69050	26.12	60887	44550	36.67	3.32	2.82
2020-21	26940	25360	19.75	96281	87828	9.62	69341	62468	11.00	3.57	3.46
	25685	24215	18.69	87597	72596	21.43	61912	48381	29.66	3.41	2.99

1). Such gap might be attributed to the adoption of improved technology in demonstrations which resulted in higher grain yield than the traditional farmers' practices. The cumulative extension gap of four years emphasized the need to educate the farmers through various extension means i.e. front line demonstration, for the adoption of improved production and protection technologies to revert the trend of wide extension gap. More and more use of the latest production technologies with high-yielding varieties will subsequently change this alarming trend of galloping extension gap. Singh et al., (2017) showed in their study on extension gap also agrees with the present observation.

Technology gap

A wide technology gap was observed during different years and this was lowest (145 kg/ha) during *rabi* 2020-21 and was highest (662 kg/ha) during *rabi* 2017-18. On the basis of four years, the technology gap of the total of 365 demonstrations was found as 376.50 kg/ha (Table 1). The observed technology gap may be attributed to dissimilarity in soil fertility status, timely sowing, rainfall distribution, disease and pest attacks as well as the change in the locations of demonstration plots every year. The difference in technology gap during different years could be due to more feasibility of recommended technologies during different years. Lower the value of the technology gap more is the feasibility of the technologies which could be easily adopted by the farmers as they are user friendly. These findings are similar to the findings of Patel et al., (2013).

Technology index

The technology index shows the feasibility of the evolved technology at the farmer's fields and the lower the value of the technology index more is the feasibility of the technology. The technology index for all the demonstrations during different years was in accordance with the technology gap. The highest technology index per cent of 12.78 was recorded in the year *rabi* 2017-18 and the lowest was observed in the year *rabi* 2020-21 which is 2.89 per cent (Table 1). The average technology index was observed at 7.40 per cent during the four years of front line demonstration programmes, which shows the efficacy of the good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of Wheat. This result was in conformity with the result of Dhaka et al., (2010) and Singh (2017).

Economic return

The input and output prices of commodities that prevailed during the demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit-cost ratio. Use of pricey seeds for crop sowing, seed treatment, the recommended dose of chemical fertilizers, proper pest management etc., all is the main reasons for the high cost of cultivation in demonstration fields than local check. Therefore, the average cost of cultivation of four years increased in demonstration practice (Rs.25685/ha) as compared to Local check (Rs. 24215 /ha) (Table 2). The data reveal that the net returns from the demonstration plots were substantially higher than control plots during all the years. An average net return was observed to be Rs. 61912.00 in comparison to the control plot i.e. Rs. 48381.00. Thus on an average additional income of Rs. 13531.00 (29.66 per cent more) is attributed to the technological intervention provided in demonstration plots. Economic analysis revealed that the benefit-cost ratio in demonstration plots was comparatively higher than control plots. The highest benefit-cost ratio (3.57) was observed in the year 2018-19 and 2020-21 followed by 3.32 in the year 2019-20. The variation in the benefit cost ratio could be due to price variation and grain yields obtained during the study years. The average benefit cost ratio of demonstration and control plots was 3.41 and 2.99 respectively during the study period (Table 2). Hence favorable benefit cost ratio proved the economic viability of the intervention made under demonstration and convinced the farmers of the utility of intervention. Similar results were reported by Sreelakshmi et al., (2012); Joshi et al., (2014); Singh (2017); Layek et al., (2021).

CONCLUSION

The results showed that the integration of improved technology along with the active participation of farmers has a positive effect on increase the grain yield and economic return of wheat crop production. The suitable technology for enhancing the productivity of wheat and the need to conduct such demonstrations may lead to the improvement and empowerment of farmers. These demonstration trails also enhance the relationship and confidence between farmers and KVK scientists. The recipient farmers of front line demonstration also play an important role as the source of information and quality seeds for wider dissemination of the improved varieties of the crop for other nearby farmers. It is concluded that the front line demonstration programme is a successful tool in enhancing the production and productivity of Wheat through changing the knowledge, attitude and skill of farmers.

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