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Productivity and Profitability Analysis of Late Sown Wheat under Paddy-Wheat Cropping System

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ABSTRACT

The study was carried out during Rabi 2017-18 to 2019-20 at farmer's fields in the Bundi district of Rajasthan. Frontline demonstrations were conducted with the objectives to analyse the productivity and profitability of late sown wheat under paddy-wheat cropping system. The results revealed that frontline demonstrations recorded higher grain yield of wheat as compared to farmer's practices over the years of study. Improved variety (Raj 4238) of wheat resulted in progressively increased grain yield from 43.44 to 51.46 q/ha with a range of 6.41 to 12.97 per cent higher over farmer's practices during three years of study. In addition to increase in grain yield of wheat, mean of extension gap, technology gap and technology index were found 3.94, 5.92 q/ha and 10.76 per cent, respectively. The extension gap may be reduced by popularization of improved packages and practices of wheat in late sown condition under paddy-wheat cropping system. Improved variety (Raj 4238) of wheat under late sown condition also gave higher gross and net return with more benefit cost ratio as compare to farmer's practices over the years of study. The study also revealed that variety Raj 4238 was found feasible in late sown conditions under paddy-wheat cropping system in Bundi district of Rajasthan.

Key Words: Cropping sequence, Demonstration, Fertilizer use, Paddy, Wheat.

INTRODUCTION

Wheat [*Triticum aestivum* (L)] has significantly contributed towards success of the green revolution and has greatly helped to transform our country from a situation of ship to mouth to being self-sufficient. Its by-product (straw) is also used as dry fodder for animals (Bairwa *et al,* 2013). In Bundi district of Rajasthan wheat is cultivated in an acreage of 1.38 lakh ha and produced 6.42 lakh MT with an average productivity of 4656 kg per ha (Anonymous, 2021-22a). Paddy-wheat is an important cropping system prevailing in Bundi district covering more than 50 thousand ha area. Harvesting of paddy in the month of November is the main reason for late sown wheat crop which results low productivity of wheat. At optimum temperature, early sowing enhances the wheat growth and nutrient uptake, whereas delay in crop sowing cause reduction in yield (Choudhary *et al*, 2010). High yield potential varieties play a pivotal role in increasing yield under optimum growing season (Reager *et al*, 2018). KVK, Bundi promoted and popularized the wheat variety Raj. 4238 at farmers' fields through front line demonstrations. Raj 4238 (HW2021/Raj 3765) was developed by RARI, Durgapura (Raj.) for irrigated late sown condition of Central Zone. The average grain yield of this variety is 45.5 q / ha and maximum yield potential is 62.8 q/ha and it is good for chapatti making (Gupta *et al,* 2017). Concept of front-line demonstration was introduced with the purpose of improving adoption behaviour of the farmers related to improved wheat production technologies and to harvest the maximum yield in real farm conditions. Extending cultivation of improved varieties, get feedback from farmers, constraints in adoption of recommended improved technologies for further research and to maximize the technology dissemination process among the farmers are some of the other important features of this programme (Nagarajan *et al*, 2001). Front

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Table 1. Comparisons between Improved Practices (IP) and Farmer's Practices (FP) under Wheat frontline demonstration.

Sr. No.	Particular	Improve Practices (FLDs)	Farmers Practice (Existing practices)
1.	Farming situation	Irrigated	Irrigated
2.	Previous crops	Paddy	Paddy and Soybean
3.	Variety	Raj. 4238	Raj. 4037
3.	Seed treatments	Seed treatment with Tebuconazole 2 DS (Rexil) at 2 g/kg seed followed by *Azotobacter* and PSB culture	Nil
4.	Time of sowing	25th Nov. to 5th December	25th Nov. to 5th December
5	Seed rate	120 kg/ha	150-160 kg/ha
6.	Fertilizers dose	120:40:30:25 kg NPKZn/ha	150-160:30-40:0:15-20 kg NPKZn/ ha
7	Weeds management	Sulfosulforon 75 % + Metsulfuroun methyl 5 % WG (ready mix) 32 g a.i./ha at 30-35 DAS	2,4-D at 0.50 kg a.i./ha at 30-35 days after sowing (DAS)
8	Plant protection measure	Need based application of chloropyriphos 20 % EC to protect the crop against termite and leaf eating caterpillars	Nil

line demonstrations are one of the practical approaches to maximize the production by display of relevant technologies at farmers field under strict supervision of agriculture expert helped to narrow down the extension and technology gaps to a considerable extent (Singh *et al*, 2022). Keeping in view, the present study was undertaken to analyse the productivity and profitability of late sown wheat under Paddy-Wheat cropping system by conducting front line demonstrations at farmers' fields.

MATERIALS AND METHODS

The study was carried out by Krishi Vigyan Kendra, Bundi (Rajasthan) during Rabi 2017-18 to 2019-20 at farmers' field. During these three years of study, total 133 front line demonstrations were carried out covering 53.2 ha area with active participation of farmers. Participating farmers were selected and trained on various aspect of wheat production. The differences between the demonstration package and existing farmers' practices are mentioned in Table 1. In demonstration plots, all the agronomic practices including use of quality seeds of improved variety (Raj. 4238), line sowing, seed treatment and timely weed management as well as recommended dose of fertilizers were emphasized as per package of practices of the zone for *Rabi* crops (Anonymous, 2021-22b). The traditional practices were followed in case of local checks. Throughout the season, crop was monitored weekly for proper growth, irrigation, plant protection, fertilizer application and intercultural operation were performed as and when needed. The data on output were collected from FLDs plots as well as control plots and finally the grain yield, cost of cultivation, gross return, net returns with the benefit cost ratio worked out. The extension gap, technology gap and technology index were calculated by using formulas as given by Samui *et al* (2000).

RESULTS AND DISCUSSION

A comparison of productivity level between improved practices (IP) and farmers practices (FP) has been shown in Table 2. It was evident that under

Table 2. Details of acreage, yield, per cent increase in yield, extension gap, technology gap and technology index of wheat frontline demonstrations

Season & year	No. of Demo.	Area (ha)	Variety	Yield (q/ha)		Additional yield over FP (q/ha)	Per cent increase in yield over FP	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
				IP	FP					
Rabi 2017-18	47	18.8	Raj. 4238	51.46	45.55	5.91	12.97	5.91	3.54	6.44
Rabi 2018-19	50	20.0	Raj. 4238	50.80	47.74	3.06	6.41	3.06	4.20	7.64
Rabi 2019-20	36	14.4	Raj. 4238	50.96	47.44	3.52	7.72	3.52	4.04	7.35
Total/ Mean	133	53.2	-	51.07	46.91	4.16	8.87	4.16	3.92	7.14

IP: Improved Practices *i.e.* FLD; FP: Farmers' Practice

demonstration plots, yield performance of wheat variety Raj 4238 was found to be substantially higher as compared to farmer's practices during study (2017-18 to 2019-20). The yield of wheat under frontline demonstrations in the range of 50.80 to 51.46 q/ha as compared to farmers practices 45.55 to 47.74 q/ha during the study period. The technology interventions thus gave yield enhancement to the tune of 6.41 to 12.97 per cent higher over farmer's practices during the investigation. Similarly, additional yield reported under demonstration plots was in the range of 3.06 to 5.91 q/ha, respectively over the control. Though, the fluctuations in yield over the years were observed mainly on account of variations in soil type, climatic conditions prevailed and insect pest attacked as well as the change in the location of trials every year. The results were conformity with the findings of Gupta *et al*, (2017) that variety Raj 4238 (HW2021/Raj 3765) developed by RARI, Durgapura (Raj.) which was suitable for irrigated late sown conditions and give higher yield. Similar findings on yield enhancement under frontline demonstrations was also reported by Singh (2017), Chourasiya *et al* (2022) in wheat, Ashem and Ralte (2022) in maize, Morwal *et al* (2018) in cumin, Singh *et al* (2022) in lentil, Pathak (2018) in soybean, Dhaka *et al* (2016) and Bairwa *et al* (2013) in black gram.

Extension gap

The data (Table 2) varied from 3.06 to 5.91 q/ha during the period of study emphasizes the need to educate the farmers through various means for adoption of improved agricultural production technologies to reverse the trend of wide extension gap. The technology gap, which is the difference between potential and demonstration yield was highest during 2018-19 (4.20 q/ha) and lowest in the year of 2017-18 (3.54 q/ha). However, overall mean of technology gap during the study was 3.92 q/ha. The variation in technology gap observed may be attributed to the dissimilarity in soil fertility status and weather condition prevails during the study. Mukharjee (2003) was also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing system productivity.

Technology index

Technology index shows the feasibility of the technology at farmers' fields. The lower the value of technology index means more is the feasibility of the technology (Jeengar *et al*, 2006). It was revealed that minimum technology index value of 6.44 per cent was reported during 2017-18 followed by 7.35 in the year of 2019-20 whereas maximum value of technology index of 7.64 was reported in the year

Table 3. Economics of wheat under frontline demonstration.

Year	Cost of cultivation Rs/ha		Gross Return Rs/ha		Net Return Rs. /ha		Additional return over local check		B:C Ratio	
	IP	FP	IP	FP	IP	FP	Cost (Rs/ ha)	Return (Rs/ha)	IP	FP
Rabi 2017-18	40802	40425	82336	72880	41534	32455	377	9079	2.02	1.80
Rabi 2018-19	41070	42292	93472	87841	52407	45549	-1222	6858	2.28	2.08
Rabi 2019-20	44174	44914	98098	91322	53923	46408	-740	7515	2.22	2.03
Mean	42015	42543	91302	84014	49287	41471	-528	7817	2.17	1.97

of 2018-19. These finding were in close conformity of Singh (2017), Chourasiya *et al* (2022) in wheat, Singh *et al* (2022) in lentil and Morwal *et al* (2018) in cumin, Dhaka *et al* (2016) and Bairwa *et al* (2013) in black gram.

Economics

Economics of the variety (Raj. 4238) under frontline demonstration was estimated and the results have been presented in Table 3. Economic analysis of frontline demonstration revealed that besides higher production, FLDs participating farmers fetches more return from their produce as compared to farmers practice during three consecutive years. This was so because of better pricing of the produce in the market. Frontline demonstration recorded higher gross return, net return and benefit cost ratio as compared to farmer's practices during five years of study as well as on mean basis. These lines were in the of findings of Singh (2017), Chourasiya *et al* (2022), Morwal *et al* (2018) and Singh *et al* (2022).

CONCLUSION

From the above findings it can be concluded that use of scientific method of wheat cultivation can reduce the technology gap to a considerable extent thus leading to increased productivity of late sown wheat in Bundi district of Rajasthan. Moreover, extension agencies in the district need to provide proper technical support to the farmers through different educational and extension methods to reduce the extension gap for higher yield of wheat under Paddy-Wheat cropping system.

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