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YIELD GAP ANALYSIS OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER IRRIGATED CONDITIONS

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SUMMARY

Present investigation was conducted by Krishi Vigyan Kendra, Chandgothi (Churu), Rajasthan at farmer's field in Dingli, Basmamraj and Kailash to analyze the effect of improved practices on productivity, economics, extent of farmers' satisfaction, yield gap and constraints faced by the farmers' with the cultivation of wheat. in growing barley. In this study, the selected 150 respondents selected were the beneficiary farmers conducted front line demonstrated (FLD) at their fields during 2018-19 to 2019-20. The plot size was 0.4ha for both the demonstration and farmers' practice. Before conducting FLD, the respondents were made aware of the latest recommended package of practices for wheat. The demonstrated technologies under FLD resulted in an increase of in 23.5% in mean barley yield over farmer's practice check. Thus, experimental results envisaged technology gap, extension gap, and technology index to the tune of 729 kg/ha, 2383 kg/ha, and 38.02 percent, respectively. The mean additional return of 12599/ha were fetched by demonstration plots. Further, on average, demonstration plots recorded a net return to the tune of 49,174/ha compared to 36,575/ha with farmer's practice with incremental B:C ratio of 10.96 over the years. The results also further indicated that 52.10 percent of the respondents expressed their high satisfaction towards the performance of FLD, followed by 33.25 and 14.65% who expressed medium and low satisfaction respectively.

Key words: Wheat, demonstration, economics, grain yields, yield gap

Wheat (*Triticum aestivum* L.) is the second most important cereal crop in India. It significantly improves national food security by supplying people with more than 50% of their daily caloric needs (Awika and Rooney, 2004) with a 12.77% share in global wheat production; India is the second-largest producer of wheat. Production of wheat during 2022-23 is estimated at a record 110.55 million tonnes. It is 2.8 million tonnes more than the previous year's wheat production. It is also an improvement of 4.8 million tonnes compared to the average wheat production of 105.73 million tonnes (Anonymous, 2022). In Rajasthan, wheat is cultivated in an area of 2.81 million hectares with a production of 9.19 million tonnes and a productivity of 3270 kg/ha. This accounts for 9.22% of total wheat production in India (Anonymous, 2022).

Frontline demonstration is the new concept of field demonstration evolved by the Indian Council of Agriculture Research with the main objective to demonstrate newly released crop production and protection technologies and their management practices at the farmers' fields in various climatic regions of the country. It is one of the most important and powerful tools for the transfer of technology based on the concept of 'learning by doing' and 'seeing believes.'

The field demonstrations are conducted under the close supervision of scientists of the National Agriculture Research System and are termed as frontline demonstrations (Singh *et al*., 2019). The main objective of frontline demonstrations is to demonstrate newly released varieties, improved crop production and protection technologies, and their management practices at farmers' fields under different agro-climatic regions and farming situations. While demonstrating the technologies at farmers' fields, the scientists are required to study the factors contributing to higher crop production, field constraints of production, and thereby generate production data and feedback information. Realizing the importance of FLDs in the transfer of the latest technologies, Krishi Vigyan Kendra, Chandgothi, Churu-II, has regularly been conducting FLDs on wheat at farmers' fields in three blocks of Churu district (Rajgrah, Taranagar, and Churu) of Rajasthan with the objective of convincing farmers' and extension functionaries together about the production potentialities of production technologies for further wide-scale diffusion. Keeping in view an effective extension approach of FLDs for the dissemination of wheat technology, it was felt necessarily that the impact of FLDs conducted by KVK, Churu-II needs to be assessed.

In the study major region, the productivity of wheat is very lower as compared to state average productivity. The basic and prime reasons for lower productivity in the region identified are, viz., the cultivation of the crop under rainfed conditions, poor knowledge of drought-tolerant improved varieties, and poor adoption of production practices. Further, low productivity in the region has also been as cribbed to improper management of irrigation water to the crop, especially at critical stages of growth for the proper growth and development (Joshi *et al.*, 2007). Moreover, in the recent past, it has also been noticed that sowing to the late harvesting of preceding *Kharif* crops, more than 45% of sowing of wheat gets delayed till December. The late sown leads to substantial loss in grain yield due to unavailability of sufficient irrigation water at the last stages of crop. Furthermore, poor agronomic practices such as seed rate, selection of suitable varieties, nutrient management, weed management, and irrigation management, etc., are also responsible for the low productivity of wheat in India (Tiwari *et al.*, 2014). In order to increase the productivity of wheat and get the feedback of farmers on the performance of new varieties and technology, FLDs of improved production technology on wheat were conducted to enhance productivity and economic returns and convince the farmers to adopt improved production technologies.

MATERIALS AND METHODS

The front line demonstration on wheat variety Raj-4238 and were conducted by Krishi Vigyan Kendra, Chandgothi; 150 selected farmer's field Dingli, Basmamraj and Kailash in a compact block of Churu District (Rajasthan) during *Rabi* 2018-19 to 2019-20. The selection of villages was done based on non-adoption of improved and recommended varieties. After the selection of villages, most approachable sides of farmer's field were selected, so that other farmers can see the performance of demonstrated technology. The farming situation was irrigated and soil was sandy loam, low in nitrogen, medium in phosphorus and medium to high in potash. The area for each demonstration and framers practices was 0.4 ha. Wheat was grown following the recommended package of practices as mentioned in Table 1. The KVK provided only high quality seed of wheat varieties i.e. Raj-4238, while all other critical input like DAP, micro-nutrients, bio fertilizers, herbicide and pesticides were purchased by the farmers and used with the guidance of KVK during the years.

Frontline demonstrations were planned based on the top rank problems identified during interactions with farmers and demonstrations were conducted at farmers' fields accordingly. The improved technologies selected for FLD include improved high yielding wheat varieties for rainfed conditions, supplementary irrigation and sowing with seed drills. The other management practices like, seed inoculation, recommended fertilizers and plant protection measures etc. were applied for improved as well as for farmers' practice. The crop of wheat was sown at the spacing of 22.5 cm (row-row) during last week of October to second week of November during all the three years of experimentation. The seed rate was kept 120 kg/ha. The Technology index, Extension gap, and Technology gap were calculated by using the formula according to Samui *et al.*, 2000. The details of different parameters are as follows:

TABLE 1

Details of improved technologies of wheat demonstrated under front line demonstration and farmer's practices

S. No.	Technology	Improved technology	Farmers practice	GAP (%)
1.	Variety	Improved varieties Raj-4238 and Raj-4037	Raj-3077,Raj-3765 Raj 2552	75-80
2.	Farming Situation	Irrigated	Irrigated	Nil
3.	Land preparation	Ploughing & harrowing	Ploughing & harrowing	Nil
4.	Sowing Method	Sowing Method Line Sowing (22.5×10 cm)	Line sowing (30×10 cm)	90-95
5.	Seed Rate	Seed Rate 120 kg/ha	Seed Rate 120 kg/ha	Nil
6.	Seed inoculation	PSB	No Seed Inoculation	95-98
7.	Fertilizer dose (kg ha^{-1})	40 kg N, 20 kg P_2O_5 and 25 $ZnSO_4$	31 kg N and 23 kg P_2O_5	22-24
8.	Micro-nutrients	Use of micro nutrients for balance fertilizer	No use of Micronutrients	90- 95
9.	Weed Control	Herbicide application	Hand weeding No herbicide use	85-90
10.	Plant protection	Need based spray of Insecticide and fungicides	No spray	90-97

1. Extension gap=Demonstration yield – Farmers practice yield
2. Technology gap=Potential yield – Demonstration yield

3. $$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

4. Additional return=Demonstration return–Farmers practice return
5. Effective gain = Additional return – Additional cost

6. $$\text{Incremental B:C ratio} = \frac{\text{Additional return}}{\text{Additional cost}}$$

The respondents were interviewed personally with the help of a pre-tested and well-structured interview schedule. Client Satisfaction Index was calculated as developed by Kumaran and

Vijayara gavan (2005). The individual obtained scores were calculated following formulae

Client Satisfaction Index = Score obtained by individual ÷ Maximum score possible

RESULTS AND DISCUSSION

Grain Yield: The extension yield gap is the difference or gap between the yield obtained under the demonstration plot and the farmers' practice (control) plot. The extension gap varied between 716 to 742 kg per hectare with a mean extension gap of 729 kg ha^{-1} during both years of the demonstrations. So as to enhance the farmers' income, there is a need to decrease this wider extension gap through the implementation of the latest agro-techniques. This wider extension gap accentuated the need to educate the farmers through various means for the adoption of improved agricultural production technologies to bridge this trend of a wide extension gap. More and more use of the latest production technologies with high-yielding varieties will subsequently change this alarming trend of a galloping extension gap (Fig. 1). These results are in close conformity with those reported by Verma *et al.* (2014), Sharma *et al.* (2016), and Gupta *et al.* (20217). These results are in close conformity with the research findings reported by Shivran *et al.* (2020). Data on wheat yield (Table 2) indicated that the FLDs had a good impact on the farming community of Churu district as they were motivated by the new agricultural technologist.

Technology Gap: Between the two years of the demonstrations, the extension gap ranged from 716 to 742 kilograms per hectare, with a mean of 729 kg ha-1. By using the most recent agro-techniques, it

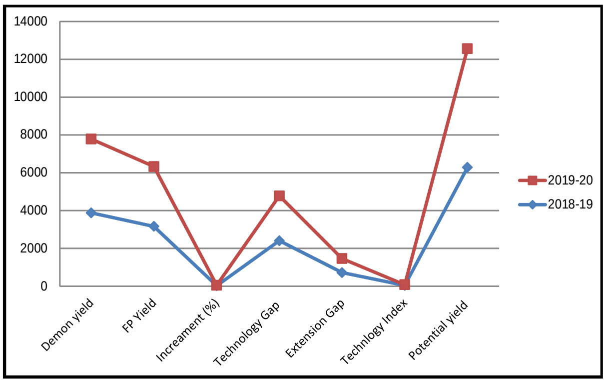

Fig. 1. Effect of improved practices on grain yield and gap analysis in front line demonstrations on wheat at farmers' field.

is necessary to reduce this larger extension gap in order to increase farmers' revenue. This increased extension gap highlighted the necessity of educating farmers via a variety of channels in order to encourage their adoption of better agricultural production technology and reverse the trend of a widening extension gap (Fig. 1). This worrying tendency of the galloping extension gap will be changed as a result of the increasing adoption of high-yielding varieties and the most recent production technology. These results are in close conformity with that of reported by Verma *et al.*, (2014), Sharma *et al.*, (2016) and Shivran *et al.* (2020). Authors do not know what they are going to discuss. Technology gap mentioned in (Table 2).

Technology index: The technology index shows whether the advanced technology is feasible for farmers to use on their farms (Table 2). Adoption of the technology is more feasible when the technology index number is lower. During the trial, the technology index value averaged 38.02% across the years, with a range of 37.77 to 38.26%. (Fig. 1) Soil fertility, insect pest occurrence, and climate fluctuation might all be blamed for the variances in the technology index. The findings support the conclusions of Sharma *et al.* (2016), Verma *et al.* (2016), and Verma *et al.* (2014).

Economic analysis: The economics of the improved technology over farmers' practice were calculated using the prevailing market prices of the inputs and outputs during the particular year (Table -3). On an average an additional investment of Rs 1150 per hectare was made under front line demonstration, resulting in additional return of Rs.12, 599/ha. The higher effective grain of Rs. 11,449/ha was obtained under demonstration (Fig. 2). The higher additional returns and effective grain under demonstration could be due to improved technology, non-monetary factors, timely operations of crop cultivation and scientific monitoring.

TABLE 2

Effect of improved practices on grain yield and gap analysis in front line demonstrations on wheat at farmers' field

Year	Variety	No. of Farmers	Area (ha)	Yield (kg/ha)		Straw yield (kg/ha)		Yield increase over farmer's practice (%)	Technology gap (kg/ha)	Extension gap (kg/ha)	Technology index (%	Potential yield (kg/ha)
				Improved practices	Farmer's practices	Improved practices	Farmer's practices					
2018-19	RAJ-4238	75	30	3877	3161	39381	32108	22.65	2403	716	38.26	6280
2019-20	RAJ-4238	75	30	3907	3165	39685	32148	23.44	2373	742	37.77	6280
Mean				3892	3163	39533	32128	23.05	2388	729	38.02	

TABLE 3

Economic analysis of front line demonstrations as influenced by improved practices of wheat

Years	Cost of cultivation (Rs/ha)		Additional cost over FP (Rs./ha)	Gross return (Rs/ha)		Additional return in demonstrations over FP (Rs../ha)	Sale price of grain (Rs./kg l.)	Net Return (Rs/ha)		Effective grain (Rs/ha)	Incremental B : C ratio (IBCR)
	Improved practices	Farmer practices		DP	FP			DP	FP		
2018-19	23700	22600	1100	71337	58162	12075	1840	47637	35562	10975	10.98
2019-20	24500	23300	1200	75210	60888	13122	1925	50710	37588	11922	10.94
Mean			1150	73274	59525	12599	1883	49174	36575	11449	10.96

TABLE 4
Extent of farmer's satisfaction over performance of FLDs (n=150)

S. No.	Satisfaction level	Number	Percentage
1.	High	76	52.10
2.	Medium	48	33.25
3.	Low	26	14.65

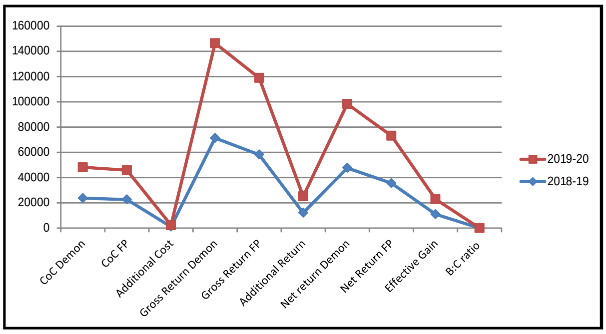

Fig. 2. Economic analysis of front line demonstrations as influenced by improved practices of wheat.

CONCLUSION

The above finding on different aspects observed that there was a wide gap between potential of farmer's yield. Production of the wheat crop was low in zone IC due to lack of awareness on improved variety as wells scientist wheat production technology. Hence, it is conduction that by adopting the improved variety (RAJ-4238) and scientist technology the farmers can obtain substantially hived yield economic return and IBCR in comparison to existing farmers proactive. Further the farmers should be encouraged to adopt the improved technology for higher returns in location specific wheat cultivation. The finding also inferred that the maximum number of respondents satisfied with the demonstrated technology. Moreover, extension gap can be also being minimized by adopting this technology under FLD. The IBCR is much high to motivate the farmers for adoption of technology. Therefore, Front Line Demonstration on wheat was found effective in changing not only the mindset of farmers but attitude, skill and knowledge about improved practices of wheat cultivation including adoption. Farmers and scientist's relationship also improved by this and built confidence between them. Technology Demonstration to farmers is a good primary source of knowledge or information on improved practices of wheat cultivation and source of good quality seed in locality and surrounding area for next season. FLDs helped in speedy and wider dissemination of the improved proven technology to the farming community.

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