J Krishi Vigyan 2020, 9 (1) : 293-297
DOI : 10.5958/2349-4433.2020.00178.6

Role of Cluster Frontline Demonstrations in Enhancing Black Gram Productivity under Rainfed Conditions in District Bilaspur of Himachal Pradesh

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ABSTRACT

The Krishi Vigyan Kendra, Bilaspur conducted 106 number of cluster front line demonstrations (CFLDs) during *kharif* 2017 and 2018 on an area of 42.4 ha under *rainfed* conditions. There was a wide yield gap between the potential and demonstration grain yields in blackgram crop mainly due to technology and extension gaps. The study on black gram crop indicated that increase in grain yield over farmers' practice was 87.4 and 127 per cent, respectively during the years. It was further observed that in terms of economics, black gram crop recorded higher net returns/ha compared to farmer's practice during both the years. The benefit cost ratio was 4.1 and 2.5, respectively, during *kharif* 2017 and 2018 in demonstration plots of black gram. The percent technology index varied between 27.3 to 32.6 per cent indicating urgent need to motivate the farmers to adopt economical viable technologies for increasing production, productivity and profitability of pulse crops.

Key Words: Cluster Frontline demonstration, black gram, technology gap, productivity, economics.

INTRODUCTION

Black gram popularly known as urd bean is one of the important grain legumes and an excellent source of easily digestible good quality protein (24-26%). India currently produces about 1.4 lakh tonnes of black gram annually from about 15 lakh ha area with an average productivity of 451.61 kg/ha. Black gram output accounts for about 13 per cent of India's total pulse production (Anon, 2017). The productivity of pulse crops in hilly state Himachal Pradesh is far below the average national productivity. The major reasons for this gap in productivity are improper nutrient management, non - availability of improved varieties, lack of knowledge of improved agronomical practices and *rain fed* condition in the state. Thus, there is a challenge for agricultural scientists, extension workers, planners and farming community to enhance and sustain the pulse production and diversify their cropping systems to meet out the national pulse requirements. Since last few years, Indian Council of Agricultural Research and Ministry of Agriculture, Govt. of India, have initiated a nationwide programme of cluster frontline demonstrations (CFLD) of pulses in mission mode with main aim to make the country self-sufficient in pulses.

Krishi Vigyan Kendras (KVKs) are playing the role of game changer not only in demonstrating the new and improved technologies and capacity building of farmers but also contributing in checking the country's exchequer drain because of pulses import. Training to the farmers' and participatory front line demonstrations are efficient measures for reducing knowledge gap of farmers and enhancing productivity, generating production data and collection of feedback for large adoption of the technology. The main objective of the study was to demonstrate and popularize the improved agro-technology at farmers' fields under varied existing farming situations.

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MATERIALS AND METHODS

Krishi Vigyan Kendra, Bilaspur at Berthin conducted 106 numbers of CFLD, each consisting of, 0.4 ha area, on Black gram crop during *kharif* 2017 and 2018 at farmers' fields covering an area of 42.4 ha in all the four development blocks of the district (Table 2). In FLD's plot, full package of practices were demonstrated whereas in the adjoining farmer's field, which served as a control/ local check, the crop was grown according to farmer's practice. Yield data for the improved practice as well as from farmers' practice were recorded at the time of threshing and analyzed to draw the inferences. The season-wise detail of sowing and harvesting has been given in Table 1. The yield increase in demonstrations over farmers' practice was calculated by using the following formula as suggested by Yadav *et al(* 2004)

Percent increase in yield over farmers' practice = Demonstration yield – farmers' plot yield x 100

Farmers' plot yield

Estimation of technology gap, extension gap and technology index

The estimation of technology gap, extension gap and technology index was done using following formula (Samui *et al*, 2000)

Technology gap = Potential yield – Demonstration plot yield

Extension gap = Demonstration plot yield – Farmer's plot yield

$$\text{Technology Index} = \frac{\text{Pi - Di}}{\text{Pi}} \times 10$$

Where, Pi = Potential yield of i^{th} crop; Di = Demonstration yield of i^{th} crop

Economic analysis of FLD's on blackgram

The cost of cultivation of Black gram include cost of inputs like seed, fertilizers, pesticides etc. purchased by the farmers (in farmers practice)/ provided by the KVK (in demonstration plots) as well as hired labour (if any), ploughing charges by bullocks/tractor (if any) and post harvest operation charges (if any) paid by the farmers. The farmers' family labour was not taken into consideration in the present study. The gross and net returns were worked out accordingly by taking cost of cultivation and price of grain into consideration. Similarly, the benefit-cost ratio was worked out as a ratio of gross returns and corresponding cost of cultivation (Mishra *et al*, 2009). Additional costs in FLD's include expenditure on improved technological inputs in FLD's over farmers' practice plots.

RESULTS AND DISCUSSION

Comparison of production technologies

The perusal of the data (table 1) clearly indicated that farmers generally did not use recommended and improved technologies. A wide gap in use of improved varieties seed due to its non availability was observed and farmers generally use local varieties seeds. In farmers' practice broadcast method of sowing with higher seed rate against the recommended line sowing and optimum seed rate was used. Farmers also did not practice seed treatment with *rhizobium* culture, an important component in increasing the yield and yield attributes of pulse crops (Kumar and Elamathi, 2007). A partial gap in time of sowing, a critical factor in enhancing the productivity of black gram, was also observed. Farmers did black gram sowing in between June15th to June 30th, compared to recommended time of sowing i.e. June end to July beginning. Data in Table 1 further revealed that farmers did not apply any recommended fertilizer and if applied, only urea was given to the crop at the time of sowing. Weed management and plant protection practices also showed a partial or full gap in adoption under farmers' practice over recommended practice in frontline demonstrations. Similar observations for gap in improved technologies and farmers practices were also observed by Burman *et al* (2010) and Kumar *et al* (2014) in different crops.

Grain Yield

The results (Table 2) clearly showed that grain

Table 1. Details of production technologies followed in black gram crop under Cluster Front Line Demonstration and farmers' practice in Bilaspur district of Himachal Pradesh.

Crop Operation	Recommended Practices demonstrated	Farmers' practice	Gap
Variety	UG-218	Local	Full
Land preparation	Two ploughings	One or two ploughings	Nil
Seed rate	20 kg/ha	22-25 Kg/ha	Higher seed rate
Seed treatment	*Rhizobium* culture	Nil	Full
Method of sowing	Line sowing at 30cm row spacing	Broadcasting	Full
Time of sowing	June end to July beginning	June15th to June 30th.	Partial
Fertilizer dose	20:40:20 Kg NPK per ha (On soil test basis)	No fertilizer or urea only.	Full
Method of fertilizer application	Kera/line	Broadcast at the time of sowing	Full
Weed management	Pre emergence application of Pendimethalin @ 1.5 l ai/ha + one hand weeding	No or one hand weeding	Full
Plant protection	Need based pesticide and fungicide application	No pesticide and fungicide application	Full
Irrigation	Rain fed	Rain fed	Nil

yields of black gram in demonstrations plots were higher compared to farmers' plots. The percent increase in yield of demonstration plots over farmers' plots ranged from 87 to 127 per cent. This increase in grain yield of demonstration plots was mainly due to the recommended package and practices followed under the supervision of KVK scientists. Use of UG-218 improved and recommended variety of black gram, optimum sowing time, proper seed treatment, line sowing, judicious use of fertilizers, integrated weed and plant protection measures followed under CFLDs really jumped the yield of black gram compared to farmers practices. In farmer's practices, use of local varieties, broadcasting method of seed sowing, only urea application and no pesticide and fungicide application resulted in poor grain yields (Table 2). The findings were in agreement with the findings of Dwivedi *et al* (2019).

Technology gap

The technology gap means the difference between potential yield and yield of demonstration plot. The technology gap in the demonstration yield over potential yield were 4.9 and 4.1 q/ha, respectively during *kharif* 2017 and 2018 (Table 2). The observed technological gap may be attributed to the dissimilarity in the soil fertility status, insect pest attack and erratic weather conditions that prevailed during crop season at different locations. Similar findings were observed by Chandrakar *et al(* 2018). As the technology gap reflects the cooperation of farmers in conducting the CFLDs, the results were encouraging.

Extension gap

It means the difference between demonstration plot yield and farmer's plot yield. Extension gap of 4.7 and 6.1q/ha was observed during *kharif* 2017 and 2018, respectively (Table 2). The present study was in line with earlier findings of Rachhoya *et al* (2018). Maximum use of the latest production technologies with high yielding recommended varieties of pulse crops will subsequently help in

Table 2. Technology gap, extension gap and technology index in pulse crop in Bilaspur district of Himachal Pradesh.

Crop/Variety	Season/Yr	Area (ha)	Yield(q/ha)		% Increase	Technology gap(q/ha)	Extension gap(q/ha)	Technology index (%)
			DP*	FP*				
Blackgram								
UG-218	*Kharif* 2017	20	10.1	5.4	87.0	4.9	4.7	32.6
UG-218	*Kharif* 2018	22.4	10.9	4.8	127.0	4.1	6.1	27.3

DP Front line demonstration plots. FP* Farmers practice plots.*

reducing this alarming trend of galloping extension gap. This emphasized the need to educate the farmers through various extensions means. The cluster front line demonstration can help in adoption of improved production and protection technology.

Technology index

The technology index shows the feasibility of the evolved technology at the farmers' fields. The lower value of technology index more is the feasibility of the technology (Mishra *et al,* 2007). The data (Table 2) showed that maximum technology index value 32.6 per cent was noticed during *kharif* 2017 whereas, minimum value of technology index of 27.3 per cent was noticed during *kharif* 2018. This variation in technology index might be due to uneven weather conditions in the area during the years of study. Moreover, reduction of technology index in general in blackgram crop over the year of study clearly exhibited the feasibility of technologies demonstrated in frontline demonstrations. The existence of strong gap in technology generated by the research institutes and technology dissemination to the farmers can only be overcome by CFLD programme which can accelerate the level of adoption of improved technologies and help in attaining self sufficiency in pulse production and getting more income of farmers.

Economic Returns

The economic analysis of the data for the study period for black gram clearly revealed that during both the years of study, the gross return, net returns and benefit: cost ratio were higher in frontline demonstrations where recommended practices were followed compared to farmers' practice indicating higher profitability. The benefit cost ratio of demonstration plots was 2.7 and 1.3 during *kharif* 2017 and 2018, respectively. Hence, by adopting proven technologies of black gram, yield potential and economic returns from black gram cultivation can be raised for the farming community. These results were in line with the earlier findings by Kumar *et al (* 2014) and Anuratha *et al* (2018).

CONCLUSION

By adopting the recommended practices and improved technology, the grain yield of black gram crop can be increased to a greater extent even under *rainfed* situations in Bilaspur district of Himachal Pradesh. The increase in grain yield of black gram was attributed to use of high yielding recommended varieties, timely sowing, nutrient management, weed management and plant protection measures taken in accordance of recommended package and practices. Favourable benefit: cost ratio is self explanatory of economic viability of the cluster frontline demonstrations and encouraged the farmers for adoption of interventions imparted. Thus, it was also concluded that technology gaps can be reduced by providing scientific intervention to the farmers which will lead to enhance the production and productivity of black gram in the district. Moreover, higher extension gap emphasized that there is further need to educate the farmers for adoption of improved technologies through CFLDs on black gram crop so that poor farmer with limited resources could improve their livelihood and diversify their farming situation.

Table 3. Economic analysis of FLD's on pulse crops in Bilaspur district of Himachal Pradesh.

Crop/ Variety	Cost of cultivation (Rs/ha)		Gross returns (Rs/ha)		Net returns (Rs/ha)		Additional cost of cultivation (Rs/ha)	Additional net returns (Rs/ha)	Benefit: cost Ratio	
	DP*	FP*	DP*	FP*	DP*	FP*			DP*	FP*
UG-218	27272	21600	111100	59400	83827	37799	5672	51700	4.1	2.7
UG-218	33550	29282	87200	38400	53649	9118	4268	48800	2.5	1.3

DP* Front line demonstration plots.   FP* Farmers practice plots.

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Received on 13/10/2020   *Accepted on 10/12/2020*