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POPULARIZATION OF IMPROVED BLACK GRAM PRODUCTION TECHNOLOGY THROUGH FRONT LINE DEMONSTRATION IN HUMID SOUTHERN PLAIN OF RAJASTHAN

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ABSTRACT

The study was carried out during *kharif* 2007 to 2010 at farmer's fields of six adopted villages of Dungarpur district. Front Line Demonstration on black gram crop was conducted in an area of 56.50 ha with active participation of 246 farmers with the objective to demonstrate the latest technology of black gram production potential, analysis of extension gap, technology gap, technology index economic benefit of improved technologies consisting suitable varieties PU 19 and RBU 38 and integrated pest management (deep ploughing + seed treated with thiram 75% WP at 3g/kg seed followed by bacterial culture *Rhizobium phaseoli* and PSB). The results revealed that maximum grain yield 8.25 q/ha was recorded during *kharif* 2010 with an increase in 71.88 per cent over local check (4.8 q/ha). Improved technologies of black gram recorded progressively increased average grain yield during four years of study, from 6.30 to 8.25 q/ha with a range from 40.88 to 71.88 per cent increase over farmers practice. In addition to increase in yield of black gram, mean extension gap, technology gap and technology index was found 2.51, 3.93 q/ha and 35.36 per cent, respectively. The extension gap can be bridged by popularizing package of practices of black gram including improved variety, use of proper seed rate, balanced nutrient application and proper plant protection measures. Improved technologies gave higher net return of Rs. 16330 per ha with benefit cost ratio 3.08 as compared to local check (Rs. 8972 per ha, benefit cost ratio 2.32). Recommended packages and practices of black gram also gave higher value of yield attributes *i.e.* No. of branches /plant, No. of pods /plant, No. of grains /pod and 1000 grain weight as compared to local check during study period.

INTRODUCTION

Pulses are the major source of dietary protein in the vegetarian diet of our country. Besides being the source of protein, they maintain soil fertility through biological nitrogen fixation and thus play a vital role in furthering sustainable agriculture (Kannaiyan, 1999). Though pulses are consumed all over the world, their consumption is higher in those parts of the world where animal proteins are scarce and expensive (Ofuya and Akhidue, 2005). They are also an important component of cropping systems in marginal and sub-marginal areas of dry land farms as 92 per cent of the pulse production in India is realized from dry lands or rain-fed areas. Pulses are chief source of protein for all sections of vegetarians across the different sections of income, religion and regional classes. These constitute an important ingredient of vegetarian diet in developing and densely populated countries and provide much needed essential vegetable proteins. In our country the continued population escalation and stagnant pulse production between 11-14 million tonnes per annum over last two decades have adversely affected the net availability of pulses compared to the other commodities like cereals and oilseeds. Though India is the largest producer of pulses in the world, the per capita consumption over the years has come down from 61 g/day in 1951 to 30 g/day in 2008 (Reddy, 2009). In India pulses are grown in nearly 23.28 million hectare area with production status of nearly 14.66 million tonnes at an average productivity level of 630 kg/ha (Economic Survey, 2010-11). Black gram is the fourth most important pulse crop after chickpea, pigeon pea and mungbean. At the national level it is

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grown on 3.40 m ha area and produces nearly 1.40 m t with an average productivity of 406 kg/ha (Govt. of India, 2010). In Rajasthan, black gram is cultivated on 1.45 m ha with 0.60 m t production and yield level of 413 kg/ha (Govt. of Rajasthan, 2010).

The concept of front line demonstration was introduced with the purpose of improving adoption behavior of the farmers related to improved black gram production technologies and to harvest the maximum yield of black gram in real farm conditions. Free supply of critical input, guidance by the experts to increase adoption of recommended technologies, monitoring crop performance at critical stages to obtain quality and disease free seeds are important parameters of front line demonstrations. Farmers were motivated to exchange seeds and share their experience with fellow farmers. Extending cultivation of improved varieties, getting feedback from farmers about 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). Keeping in mind, importance of pulses in human diet and to analyses the effectiveness of FLDs among farmers the entire study was undertaken.

RESEARCH METHODOLOGY

The study was carried out by Krishi Vigyan Kendra, Dungarpur (Rajasthan) during kharif 2007 to 2010 (four consecutive years) at farmers' field of six adopted villages *i.e.* Nalfal, Gatav, Faloj, Dhani, Dabela and Futitalai of Dungarpur district. During these four years of study, an area of 56.50 ha was covered under front line demonstration. Before selection of farmers for FLD a comprehensive list of all black gram growers were prepared. Out of list so prepared, 24 farmers in kharif 2007, 25 farmers in kharif 2008, 42 farmers in kharif 2009 and 155 farmers in the year 2010 were selected among six adopted villages with help of random sampling methods. During selection procedure, repetition of the farmers was completely avoided. Thus a total 246 farmers were included in the study. Intensive trainings were imparted to the selected farmers regarding different aspect of black gram cultivation in each year. The differences between the demonstration package and existing farmers' practices are mentioned in Table 1. The selected region falls under Humid Southern Plain of Rajasthan (Agro climatic Zone IV b). The mean annual rainfall of the region is 760.2 mm, most of which is contributed by south-west monsoon from July to September. The soils under the study were sandy clay loam in texture with a pH ranging between 7.20 to 8.38, low in organic carbon (0.41 to 0.48 g /kg of soil), available nitrogen (236.45 to 246.75 kg/ha), medium in available phosphorus (16.59 to 18.67 kg P_2O_5/ha), high in available potassium (282.43 to 310.45 kg K_2O /ha) and low in available sulphur (SO_4^{2-} 7.95 to 9.23 ppm). All the demonstrations were conducted under the supervision of a team of experts. In demonstration plots, use of quality seeds of improved varieties (PU 19 and RBU 38), line sowing, seed treatment and timely weed control as well as recommended dose of fertilizers were emphasized as per Zonal package (Zone IVb). 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. Field days were also organized at the demonstration site and the farmers from within as well as neighboring villages were invited to interact with the FLDs farmers. The officials from line departments were also invited so that there is collaboration amongst researchers, extension personnel and the farmers. The data on output were collected from FLDs plots as well as control plots and finally the yield attributes, grain yield, cost of cultivation, net returns with the benefit cost ratio was worked out. The extension gap, technology gap and technology index was calculated by using following formulas as given by Samui *et al.* (2000):

Extension gap (q/ha) = Demonstration yield – Farmers practices (local check) yield Technology gap (q/ha) = Potential yield –Demonstration yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

Perusal of data indicated that the average yield of black gram increased progressively over the years of study in demonstration plots as well as in control plots. Highest grain yield was recorded during 2010 and lowest during 2007 (Table 3). Average grain yield of black gram under demonstration plot was 7.07 q/ ha which is 54.64 per cent more than the control (4.56 q/ha). The increased grain yield in term of per cent was ranging from 40.88 to 71.88 higher over the control during four years of study. The results clearly show the positive effects of FLD over the existing practices towards enhancing the yield of black gram in tribal dominated area of the Dungarpur district with its positive effect on yield attributes *viz*., No. of branches /plant, No. of pods /plant, No. of grains / pod and 1000 grain weight (Table 2). Higher value of grain yield and yield attributes obtain under demonstration plots might be due to improved varieties, recommended package and practices and better management. Similar results have been reported in maize crop by Jeengar *et at*. (2006) and Dhaka *et al*. (2010). Cost of cultivation increased successively over the years of study in demonstration plots ranging from 7183 to 8420 Rs/ha except during 2008. Use of costly seeds for sowing, recommended dose of fertilizers, timely pest management could be possible reasons for high cost of cultivation in demonstration plots. The figures in Table 4 clearly explain the significance of front line demonstration at farmers field during four years of study in which greater net returns were obtained under demonstration plots than control. Highest net return was received in the year of 2010 and lowest during 2007 with an average of Rs 16330 /ha. Benefit cost ratio was recorded to be higher under front line demonstrations as compared to control during all the years of study (Table 4). Higher net returns and B C ratio under demonstration plot might be due to higher grain yield and why better pricing of the produce in the market.

The extension gap ranged from 1.80 to 3.45 q/ ha during the period of study emphasizes the need to educate the farmers through various means for the adoption of improved agricultural production to reverse the trend of wide extension gap. The technology gap, which is the difference between potential and demonstration yield was maximum in the year 2008 (5.66 q/ha) and lowest in the year 2009 (2.60 q/ ha). However, overall average technology gap in the study was 3.93 q/ha. The technology gap observed may be attributed to the dissimilarity in soil fertility status and weather conditions. Mukherjee (2003) has also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing system productivity.

Table 1: Comparision between demonstration package and existing farmers' practices of black gram production

S.No.	Interventions	Black gram	
		Demonstration Package	**Farmers practices**
1	Farming situation	Rain fed	Rain fed
2	Variety	RBU-38 and PU-19	T-9 and local
3	Seed treatment	Seed treated with thiram 75% WP at 3g/kg seed followed by bacterial culture *Rhizobium phaseoli* and	Nil PSB
4	Time of sowing	1-15 July	25-30 July
5	Method of sowing	Line sowing with proper crop geometry	Broadcasting
6	Seed rate	15-20 kg/ha	25-30 kg/ha
7	Fertilizers dose	25:40:0 (NPK kg/ha)	Negligible
8	Plant protection measures	Need based application of Monocrotophos 36 WSC to protect the crop against leaf eating caterpillar	Nil
9	Weed Management	Fluchloralin at 1.0 kg/ ha as pre plant incorporation followed by one hand weeding at 30 days after sowing (DAS)	One hand weeding at 30-35 DAS

Technology index shows the feasibility of improved technology at the farmer's field. Lower the value of technology index, more is the feasibility of the technology (Jeengar *et al.* 2006). The technology index in the present investigation varied between 26 to 47.17 per cent and averaged 35.36 percent during the period of study.

Table 2: Yield attributes under demonstration package and existing farmer's practices

S. No.	Yield parameters	Demonstration Package	Existing farmers practices
1	No. of branches /plant	2.70-3.68	2.56-2.82
2	No. of pods/plant	14.62-18.75	10.56-13.45
3	No. Of grains/pod	9.50-11.50	8.50-9.85
3	1000 seed weight (g)	35.5-37.5	31.0-32.5

Reasons for low yield of black gram under farmer's practices

1. Optimum sowing time is not followed
2. Sometimes due to non availability of quality seed or variety, farmers go for the local seed in hand.
3. More than 90 per cent of farmer's sow their seed by broadcasting method. In most of the farmers fields' plant population was very high.
4. No use of seed cum fertilizer drill for sowing.
5. Use of inadequate and imbalanced dose of fertilizers especially the phosphatic fertilizes by farmers.
6. No proper plant protection measures were adopted .
7. Mechanical weed control is costly and chemical control is quite uncommon in this region.

Specific constraints with marginal / sub marginal farmers

a) Small Holding: The adoption of well proven technology is constrained due to small size of holding and poor farm resources. Small and marginal farmer have less capability to take risk

Table 3: Details of acreage, yield, extension gap, technology gap and technology index of black gram under front line demonstration

Year	Variety	Area (ha)	No. of Demo.	Grain yield (q/ha) Potential	IIP	FP	% increase over control	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
Kharif, 2007	PU 19	5.0	24	10.0	6.30	4.20	50.0	2.10	3.70	37.00
Kharif, 2008	RBU 38	5.0	25	12.0	6.34	4.50	40.88	1.84	5.66	47.17
Kharif, 2009	PU 19	8.5	42	10.0	7.40	4.75	55.79	2.65	2.60	26.00
Kharif, 2010	RBU 38	38.0	155	12.0	8.25	4.80	71.88	3.45	3.75	31.25
	Mean			**11.0**	**7.07**	**4.56**	**55.64**	**2.51**	**3.93**	**35.36**

Table 4: Economics of black gram under front line demonstration

Year	Cost of cultivation (Rs./ha)		Gross Return (Rs./ha)		Net returns (Rs./ha)		B C ratio	
	IP	FP	IP	FP	IP	FP	IP	FP
Kharif, 2007	7183	6540	15700	12400	8517	5860	2.19	1.90
Kharif, 2008	7135	6670	19418	13450	12283	6780	2.72	2.02
Kharif, 2009	7965	6895	28680	18250	20715	11355	3.60	2.65
Kharif, 2010	8420	6990	32225	18880	23805	11890	3.83	2.70
Mean	**7675**	**6773**	**24005**	**15745**	**16330**	**8972**	**3.08**	**2.32**

IP= Improved Practice (Demonstration/FLDs)
FP= Farmer Practice (Local /control)

and do not dare to invest in the costly inputs due to high risk and low purchasing power.

b) Farm Implements and Tools: Traditional implements and tools are still in practice due to small land holdings which are insufficient have poor working efficiency. The lack of simple modern tools for small holdings also hinders the adoption of improved technologies

CONCLUSION

From the above findings it can be concluded that use of scientific method of black gram cultivation can reduce the technology gap to a considerable extent thus leading to increased productivity of black gram in Humid Southern Plain 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 productivity of black gram in the district.

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