LR-4450
[1-5]

RESEARCH ARTICLE Legume Research - An International Journal

Cluster Frontline Demonstration: An Effective Technology Dissemination Approach for Enhancing Productivity and Profitability of Black Gram (*Vigna mungo*)

Upesh Kumar, G.A. Patel, R.P. Chudhari, S.S. Darji, R.S. Raghav 10.18805/LR-4450

ABSTRACT

Background: Pulses are versatile crops that are better for nutritional security and soil health. Black gram (*Vigna mungo* L.) is most important pulse crop, grown throughout the country. The productivity of Black gram is low in Patan district because non-adoption of scientific technologies by the farmers like use of poor quality seeds, water stress at critical stages, imbalance use of plant nutrient, infestation of weeds and incidence of pest especially mosaic, blight, tobacco caterpillar and sucking pest.

Methods: The present study was carried out by the Krishi Vigyan Kendra, Samoda- Ganwada, Taluka- Siddhpur, District - Patan (Gujarat) during *Kharif* season. Krishi Vigyan Kendra, Patan (Gujarat) conducted 225 demonstrations in farmer's field of Patan district during three years *i.e.,* from *Kharif*, 2017-18, *Kharif*, 2018-19 and *Kharif*, 2019-20 on integrated crop management (ICM). Front line demonstrations on black gram were organized in nine cluster in different taluka of Patan District. The demonstrated technology is improved variety (GU-1), Optimum seed rate (20 Kg/Ha), Seed treatment by fungicide and insecticide, Soil inoculation by NPK-liquid consortia Bio fertilizer @ 5 Lit/ Ha, RDF as per STV, water management at critical stages, IWM and application of IPM module for the management of insect (Specially on Tobacco Caterpillar and pod borer) and Yellow Mosaic diseases.

Result: Reduce the pest infestation under demonstrated technology of black gram resulted enhance the productivity is 24.51 per cent in demonstrated plot over farmers practice. The net return from demonstrated technology is ranged from Rs 28530 per ha in 2018-19 to Rs 36830 per ha in 2019-20 whereas in farmers practice, it was ranges from Rs 20700 in 2017-18 to Rs 30200 in 2019-20. The benefit: cost ratio of black gram cultivation under demonstrated technology was 3.10 whereas in farmer's practices, it was 2.77.

Key word: Black gram, Economics, Front line demonstration, Variety - GU-1, Yield.

INTRODUCTION

Pulses are versatile crops that are better for nutritional security and soil health. Pulses are rich in proteins and are the second most important constituent of Indian diet after cereals. Among the different pulses, black gram is a rich source of protein which is one of the essential nutrients of the human diet. Black gram (*Vigna mungo*) is a widely grown legume, belongs to the family Fabaceae and assumes considerable importance from the point of food and nutritional security in the world. It is a short duration crop and thrives better in all seasons either as sole or as intercrop.

Black gram contributes to 10% of the national pulse production. The area under black gram in India is about 32.15 lakh ha with production of 17.66 lakh tones and productivity of 549 kg/ ha. In 2013-14, black gram is cultivated in Gujarat an area of 0.95 lakh ha with 0.62 lakh tones production and an average productivity of 650 kg/ha while in Patan District of Gujarat state, black gram cultivated in 0.13 lakh ha area with 0.7 lakh tones production and in average productivity is 539 Kg/ Ha (Anonymous, 2018). India is the world's largest producer as well as consumer of black gram. Its seeds are highly nutritious which contain protein (25-26%), carbohydrates (60%), fat (1.5%), minerals, amino acids and vitamins. Black gram has been distributed mainly in tropical to sub-tropical countries where it is grown mainly in summer season. This crop is itself a mini-fertilizer factory, as it has unique characteristics of maintaining and restoring soil fertility through fixing atmospheric nitrogen in symbiotic association with *Rhizobium* bacteria, present in the root nodules. The crop improves the soil fertility by fixing atmospheric nitrogen in the soil. It is reported that, black gram and green gram are reported to meet up to 50 per cent of their requirement from the Nitrogen fixed by them (Anonynous 1972) and black gram produces 22.10 kg of N ha^{-1} which has been estimated to be supplement of 59 thousand tons of urea annually (Senaratne and Ratnasinghe, 1993).

It is long established fact that, pulses are important part of daily diets. The net availability of pulses has dropped

Krishi Vigyan Kendra, Patan-384 151, Gujarat, India.

Corresponding Author: Upesh Kumar, Krishi Vigyan Kendra, Patan-384 151, Gujarat, India. Email: upeshkvk@gmail.com

How to cite this article: U. Kumar, Patel, G.A ., Chudhari, R.P., Darji, S.S and Raghav, R.S. (2021). Cluster Frontline Demonstration: An Effective Technology Dissemination Approach for Enhancing Productivity and Profitability of Black Gram (*Vigna mungo*). Legume Research. DOI: 10.18805/LR-4450.

Submitted: 27-06-2020 **Accepted:** 04-03-2021 **Online:** 21-05-2021

from 60.70 g per day per person in 1951 to 43.30 g per day per person in 2013 as against recommendation of 65 g per day per person by Indian council of Medical Research.[4] India happens to be the major producer, consumer and importer of pulses (Anonynous 1916). Pulses are a chief source of protein for a massive section of Indian particularly for the poor and most of the conventionally vegetarian population (Reddy, 2004).

The poor yield of black gram is mainly attributed to the use of poor quality seeds, water stress at critical stages, imbalance use of plant nutrient, infestation of weeds and incidence of pest especially mosaic, blight, tobacco caterpillar and sucking pest. 30.0 to 54.3 percent yield loss on black gram due to infestation insect pests at various stages of the crop growth in India (Pandey et al., 1991; Justin et al., 2015). The black gram crop has more importance in rainfed conditions. Farmers are growing local seeds; broadcasting method of sowing, seed treatment is not in practice, not adopting weed management technologies, imbalance use of plant nutrient, not adopting proper management practices against pest etc are the basic reasons of low productivity of black gram in the district. For the production of black gram, numbers of technologies are present but farmers adopt them rarely and are still practicing the unscientific methodologies. In this context, Krishi Vigyan Kendra popularizing the recommended production technologies through conducting demonstration under NFSM programme. The main objective of front line demonstrations is to demonstrate newly released crop production technologies and its management practices in the farmer's field under farming situations and at different agro climatic regions (Meena, 2011 and Narasimha Rao *et al.*, 2007).

MATERIALS AND METHODS

The present study was carried out by the Krishi Vigyan Kendra, Samoda- Ganwada, Taluka- Siddhpur, District – Patan (Gujarat) during Kharif season in the farmer's field under clusters approach during 2017-18 to 2019-20. The District – Patan (Gujarat) is falls under North Gujarat Agro-climatic Zone IV and North West Gujarat Agro-climatic Zone V and it is lies between 23°55' to 24°41' N latitude and 71°31' to 72°20' E longitude.

The Frontline demonstrations were organized on farmer's field to demonstrate the integrated crop management technology on Black gram. In *Kharif*, 2017-18 demonstration is laid out in 20 ha area with 50 No of demonstration in two cluster (Agar cluster in Saraswati Taluka and Orumana cluster in Shankheshwar Taluka), in *Kharif* 2018-19, demonstration is laid out in 50 ha area on 125 No of demonstration in four cluster (Khimiyana cluster in Patan Taluka, Tuvad cluster in Shankheshwar Taluka, kukurana cluster in Harij Taluka and Danodarda cluster in Chanasma Taluka) and in *Kharif*, 2019-20, demonstration laid out in 20 ha area 50 no of demonstration in three cluster (Biliya cluster in Shankheshwar Taluka, Mithivavadi cluster in Patan Taluka and Tharod cluster in Harij Taluka).

Each frontline demonstration was laid out on 0.4 ha under demonstration plot and 0.4 ha area was considered as control for comparison (farmer's practice). Before conduct the demonstration training to farmers of respective villages was imparted with respect on technological interventions. All other steps like site selection, farmer's selection, layout of demonstration, farmer's participation *etc*. were followed as suggested by Choudhary (1999).

The soil under demonstration plot is light to medium black cotton soil and pH value was ranges from 7.2 to 8.0. The demonstrated technology is improved variety (GU-1), Optimum seed rate (20 Kg/Ha), Seed treatment by fungicide and Insecticide, Soil inoculation by with NPK-liquid consortia Bio fertilizer @ 5 Lit/ Ha, RDF as per STV, water management at critical stages, Integrated Weed Management and application of IPM module for the management of pest. Control plot was also kept in parallel at every demonstrative plot. The spacing between Row and Plant was kept 30 x 10 cm for the cluster front line demonstration. Bio fertilizers like NPK-liquid consortia bio fertilizer mix in Vermi compost and apply in soil before sowing. As per soil taste value, recommended dose of fertilizer were also given as basal dose. Spraying of pre emergence weedicide like Pendimethalin or post emergence like imazathypre for effective weed management. IPM Practices like installation of pheromone traps along with spodoptera lures 4 No/acre, spraying of neem oil @ 2.5 Lit/ Ha as prophylactic spray and need based application of recommended pesticides for proper management of pest. Visits for farmers as well as extension functionaries were organized at demonstration plot to disseminate the technology at large scale. Yield data was collected from farmers practice and demonstration plots.

The yield data were collected from both the demonstrated technology and farmers practice by random crop cutting method and after that tabulated and analyzed to find out the findings and conclusion. The statistical tool like percentage used in this study for analyzed data. The cost of cultivation, grass returns, net returns and benefit cost ratio (B:C ratio) were calculated by using prevailing prices of inputs and outputs. Other parameters like harvest index (%), Increasing in Yield (%), technology gap (%), Extension gap (%) and Technology index were worked out as suggested by Kadian *et al.,* 1997. The data output was collected from both demonstrated technology as well as farmer's practices and finally the extension gap, technology gap, technology index along with benefit cost ratio were workout (Samui *et al.,* 2000) as given below:

(i) Harvest Index (%) = $\dfrac{\text{Grain Yield}}{\text{Biological yield}} \times 100$

(ii) Increasing Yield (%) =

$$\frac{\text{Demonstration Yield} - \text{Farmers Yield}}{\text{Farmers Yield}} \times 100$$

(iii) Technology gap = Potential Yield – Demonstration yield

(iv) Extension gap = Demonstration Yield – Farmers yield

(v) Technology Index =

$$\frac{\text{Potential Yield- Demonstration Yield}}{\text{Potential Yield}} \times 100$$

RESULTS AND DISCUSSION

The improved package and practices is more important with technological intervention for productivity and profitability of pulses. Detailed package and practices with technological intervention for recommended practice is enclosed in (Table 1). Application of IPM module under demonstrated technology resulted reduce the 50.49 per cent larval infestation as well as 67.76 per cent reduce the yellow mosaic incidence and date presented in (Table 2). Similar finding is found by Kumar and Raghav, 2018.

The result indicates that the frontline demonstration has given a good impact over the farming community as they were motivated for adoption of new agricultural technology applied in the FLD plots. From the data presented in the (Table 3) it is concerned that in frontline demonstration yield of demonstrated technology is better than traditional farmer practices. The Black Gram Variety GU-1 is recorded maximum yield 1120 Kg/ha in *Kharif* season in the year 2017-18.

The data presented in Table 2 indicated that the average yield of black gram under package demonstration was 1120 kg/ha whereas that the yield under farmers practice was 747 kg/ha. This indicated that use of improved production technology for Black gram is contributed 24.09 per cent higher production than the farmers practice. The above findings are in similarity with the findings of Patel *et al.* (2013) and Singh *et al* (2018).

Technology gap

The technology gap is the difference between demonstration yields over potential yield. The technology gap of demonstration plots was 120, 450 and 280 Kg/ ha during *Kharif,* 2017-18, 2018-19 and 2019-20, respectively (Table 4). On an average technology gap under three year

Table 1: Improved production technology and Farmers practices of Black gram under FLD.

Technological intervention	Recommended Practice (CFLD's)	Farmer's practice	GAP
Variety	GU-1	Local	100
Land preparation	Ploughing and harrowing	Ploughing and harrowing	Nil
Herbicide	Pendimethalin as pre emergence or Imizathypre as post emergence	No herbicide	Full gap
Seed rate	20 kg/ha	25 kg/ha	High seed rate
Sowing method	Line sowing	Broad casting	No gap
Seed treatment	Fungicide and insecticide	No seed treatment	Full gap
Fertilizer dose (NPK kg/ha)	RDF as per STV	10:20:0	Partial gap
Plant protection	IPM	Indiscriminate application	Full gap
Grading the produce	Grading followed	Not followed	Full gap

Table 2: Pest infestation.

Year	% larval infestation			Yellow Mosaic disease incidence (%)		
	Demo.	Local	% reduce	Demo.	Local	% reduce
2017-18	7.2	14.6	-50.68	0.52	1.66	-68.67
2018-19	3.6	13.8	-73.91	0.76	2.32	-67.24
2019-20	9.8	13.4	-26.87	0.63	1.93	-67.36
Average	6.87	13.93	-50.49	0.64	1.97	-67.76

Table 3: Grain yield, harvest index, Technology gap, extension gap and technology index of Black gram Variety- GU-1.

Year	Crop	Variety	Area (ha)	No of Demonstration	Grain Yield (Kg/ha)			% increase over FP	Technology Gap (Kg/ha)	Extension Gap (Kg/ha)	Technology Index (%)
					Potential	RP	FP				
2017-18	Black gram	GU-1	20	50	1200	1080	860	25.58	120	220	10.00
2018-19	Black gram	GU-1	50	125	1200	780	600	30.00	420	180	35.00
2019-20	Black gram	GU-1	20	50	1200	920	780	17.95	280	140	23.33
Average	-	-	-	-	1200.00	926.67	746.67	24.51	273.33	180.00	22.78
Total			90.0	225							

FLD programme was 273.33 Kg/ha. The technology gap may be attributed to the dissimilarity in the soil fertility status and weather conditions and similar finding are found by Mukherjee, 2003 and Mitra and Samajdar, 2010.

Extension gap

Extension gap means the differences between demonstration plot yield and farmers yield. Extension gap of 220, 180 and 140 Kg/ha was recorded during Kharif, 2017-18, 2018-19 and 2019-20 (Table-4), respectively. On an average extension gap under three year FLD programme was 180 Kg/ ha which emphasized the need to educate the farmers through various extension programs i.e. front line demonstration for adoption of improved production and protection technologies, to revert the trend of wide extension gap. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and to adopt new technology. This finding is in corroboration with the findings of Hiremath and Nagaraju (2010).

Technology index

Technology Index indicates the feasibility of the evolved technology in the farmers' fields. The lower value of technology index, higher is the feasibility of the improved technology. The technology index varied from 10.00 to 35.00 per cent (Table-4). On an average technology index was observed 22.78 per cent during the three years of FLD programme, which shows the efficacy of good performance of technical interventions. These findings corroborate with the findings of Mokidue *et al.,* (2011) and Kumar *et al. (*2018). This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of black gram.

Economic return

Economics evaluation of the demonstrated package revealed that its adoption involved an additional cost of Rs 1075/- per ha over farmer's practice. The inputs and outputs prices of commodities prevailed during the study of demonstrations were taken for calculating gross return, net return and benefit cost ration (Table 5). The additional cost of cultivation during the period of study is ranges from Rs 425/ ha in 2017-18 to Rs 1450/ ha in 2018-19 and average additional cost is Rs 1075 per ha. The net return from demonstrated technology is ranged from Rs 28530 per ha in 2018-19 to Rs 36830 per ha in 2019-20 whereas in farmers practice, it was ranges from Rs 20700 in 2017-18 to Rs 30200 in 2019-20. The average additional cost during the period of study is Rs 1075 per ha and additional net return is Rs 6758 per ha. The benefit cost ratios of under recommended practices were higher (2.88 in 2018-19 to 3.36 in 2019-20) as compared to farmers practice (2.51 in 2017-18 to 3.11 in 2019-20). This may be due to higher yield obtained under demonstrated technology compared to farmer's practices. Paramasivamn and Selvarani (2017)

Table 4: Economics evaluation of demonstrated package of practices.

Year	Yield (Kg/ha)		% increase over FP	Gross expenditure (Rs/ha)			Gross Return (Rs/ha)			Net Returns (Rs/ha)			B:C Ratio	
	RP	FP		RP	FP	Additional Cost (Rs/ha)	RP	FP	Additional Cost (Rs/ha)	RP	FP	Additiona Return (Rs/ha)	RP	FP
1	2	3	4	5	6		7	8		9	10		11	14
2017-18	1080	860	25.58	14125	13700	425	43200	34400	8800	29075	20700	8375	3.05	2.51
2018-19	780	600	30.00	15150	13700	1450	43680	36960	6720	28530	23260	5270	2.88	2.70
2019-20	920	780	17.95	15610	14260	1350	52440	44460	7980	36830	30200	6630	3.36	3.11
Average	926.67	746.67	24.51	14961.67	13886.67	1075	46440.00	38606.67	7833.33	31478.33	24720.00	6758.33	3.10	2.77

are found similar finding on yield and net profit in black gram. Similarly results has earlier being reported on chickpea by Tomar, 2010 ; Mokidue *et al;* 2011.

CONCLUSION

It is concluded from the study that there exists a wide gap between the potential and demonstration yields in Black gram mainly due to technology and extension gaps and also due to the lack of awareness about new technology of black gram cultivation in Patan. The FLD produces a significant positive result and provided the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technology in farmers, which they have been advocating for long time. This could be circumventing some of the constraints in the existing transfer of technology system in the Patan district of Gujarat. The productivity gains under FLD over existing practices of black gram cultivation created greater awareness and motivated the other farmers to adopt suitable production technology of black gram in the district.

REFERENCES

Anonymous (2016). Agriculture: More from less. Economic Survey 2015-16, Ministry of finance, Government of India. 2016b; 70.

Anonymous (2018). Agriculture: District wise area, production and productivity of important food and nonfood crops in Gujarat State in 2018. Directorate of Agriculture, Gujarat State, Gandhinagar. Pp- 32.

Anonymous (1972). The International Rice Research Institute Annual Report for. 1972: 41.

Choudhary, B.N. (1999). Krishi Vigyan Kendra-A guide for KVK mangers. Publication, Division of Agricultural Extension. ICAR. 73-78.

Hiremath, S.M. and Nagaraju, M.V. (2010). Evaluation of on-farm front line demonstrations on the yield of chilli. Karnataka Journal of Agricultural Sciences. 23(2): 341-342.

Justin, G.L.C, Anandhi P, Jawahar D. (2015). Management of major insect pests of black gram under dry land conditions. Journal of Entomology and Zoology Studies. 3(1): 115-121.

Kadian, K.S., Sharma, R. and Sharma, A.K. (1997). Evaluation of front line demonstration trials on oilseeds in Kangra Vally of Himachal Pradesh. Ann. Agric. Res. 18: 40.

Kumar, U. and Raghav, R.S. (2018). Integrated Management of Gram pod borer in Chickpea - A Study. Bhartiya Krishi Anusandhan Patrika. 33(4):133.

Kumar, U. Patel, G.A., Patel, H.P., Chaudhary, R.P. and Darji, S.S. (2018). Impact of frontline demonstration programme on the yield of chickpea (*Cicer arietinum* L.) in Patan District of Gujarat, India. Legume Research. 44(2): 221-224.

Meena, K.C. (2011). An impact assessment of frontline demonstrations (FLDs) on soybean growers. Rajasthan. Journal of Extension Education. 19: 133-138

Mitra, B. and Samajdar, T. (2010). Field gap analysis of rapeseed-mustard through front line demonstration. Agricultural Extension Review. 22: 16-17.

Mokidue, I., Mohanty, A.K. and Sanjay, K. (2011). Correlating growth, yield and adoption of black gram technologies. Indian Journal of Extension Education. 11(2): 20-24.

Mukherjee N. (2003). Participatory, learning and action. Concept, Publishing Company, New Delhi. Pp. 63-65.

Narasimha, Rao, S., Satish, P. and Samuel, G. (2007). Productivity improvement in soybean (*Glycine max* L. Merrill) through technological interventions. Journal of Oilseeds Research. 24(2): 271-273.

Pandey, S.N., Singh, R., Sharma, V.K., Kanwat, P.M. (1991). Losses due to insect pests in some *kharif* pulses. Indian Journal of Entomology. 53(4): 629-631.

Paramasivan, M. and A. Selvarani A. (2017). Response of Improved Production Technologies (IPT) on productivityand economics of black gram (*Vigna mungo* l.) in Nichabanadhisub-basin of Tamil Nadu. Indian Journal of Agricultural Research. (51): 380-383

Patel, M.M., Jhajharia, A.K., Khadda, B.S. and Patil, L.M. (2013). Front-line Demonstration: An effective Communication Approach for dissemination of sustainable cotton production technology. Indian Journal of Extension Education and Rural Development. 21: 60-62.

Reddy, A.A. (2004). Consumption pattern, trade and production potential of pulses. Economic and Political Weekly. 39(44): 4854 -4860.

Samui, S.K., Maitra, S., Roy, D.K., Mandal, A.K. and Saha, D. (2000). Evaluation of front line demonstration on groundnut (*Arachis hypogeal* L.). Journal of Indian Society of Coastal Agricultural Research. 18(2): 180-183.

Senaratne, R., Ratnasinghe, D.S. (1993). Onto genic variation in nitrogen fixation and accumulation of nitrogen in mung bean, black gram, cowpea, and groundnut. Biology and Fertility of Soils. 16(2): 125-130.

Singh, H.R, Tiwari, P.S., Singh, Hem, Kumar Vipin and Kuma Arvind (2018). Increase pulse Production through front line demonstrations. Bhartiya Krishi Anusandhan Patrika. (33): 43-47.

Tripathi A.K (2016). Productivity enhancement of lentil (Lens culinaris Medik) through integrated crop management technologies. Legume Research. 39: 999-1002.

Tomar, R.K.S. (2010). Maximization of productivity for chick pea (*Cicer arietinum* L.) through improved technologies in farmer's field. Indian Journal of Natural Products and Resources. 1(4): 515-517.