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Impact assessment of frontline demonstrations on greengram: Experience from rainfed condition of Rajasthan

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Abstract: Pulses being rich in quality protein, minerals and vitamins are inseparable ingredients of diet of majority of Indian population. Despite high nutritive value of pulses and their role in sustainable agriculture desired growth rate in production could not be witnessed. The domestic production of pulses is consistently below the targets and actual domestic requirements are also higher, due to this pulses are being imported. The Krishi Vigyan Kendra Pali has carried out frontline demonstrations on greengram covering an area of 26.5 ha of farmers' field to exhibit latest production technologies and compared it with farmer's practice. The study in total 40 frontline demonstrations were conducted on farmers' fields in villages *viz.,* Kishanagar, Bedkallan, Boyal, Kushalpura and Balara of Pali district of Rajasthan state during 2014, 2015 and 2016, to demonstrate production potential and economic benefit of improved technologies comprising sowing method, nutrient management and chemical weed control and adoption of whole package of practices for the crop. After sowing of seed application of weedicide *Pendimethalin*(within two days after sowing) at 1.0 kg/ha in 500 liters of water used for effective control of the weeds during *kharif* season in rainfed condition. The findings of the study revealed that the demonstrated technology recorded a mean yield of 982 kg/ha which was 35.5% higher than obtained with farmers' practice (755 kg/ha). Higher mean net income of Rs. 46030/ha with a Benefit: Cost ratio of 4.3 was obtained with improved technologies in comparison to farmers' practices (Rs. 38775/ha). The frontline demonstrations conducted on greengram at the farmers' field revealed that the adoption of improved technologies significantly increased the yield as well as yield attributing traits of crop and also the net returns higher than the farmers' practices. So, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. The farmers' should be encouraged to adopt the recommended package of practices realizing for higher returns.

Keywords: Adoption, Frontline demonstration, Greengram, Productivity

INTRODUCTION

Pulses are the major source of dietary protein for the majority of population in our country. Besides being the source of protein, pulses contribute substantially to food production system by enriching the soil through biological nitrogen fixation and improving soil physical conditions. Though pulses are consumed all over the world, its consumption is higher in those parts of the world where animal proteins are scare and expensive (Ofuya and Akhidue, 2005). Pulses are important food crops for human consumption and animal feed. Being leguminous in nature, they are considered to be important components of cropping systems because of their viabilityto fix atmospheric nitrogen, add substantial amounts of organic matter to the soil and produce reasonable yields with low inputs under harsh climatic and soil conditions (Rakhode *et al.* 2011). Moong-wheat cropping system is predominant and is continuously practiced by the farmers in the arid zone of Rajasthan (Dhaka *et al.* 2016). There is evidence of system productivity stagnation, nutrient water imbalances and increased insect-pest and diseases incidence due to prolonged use of this cereal dominated system source. Greengram (*Vigna radiate* L. Wilczek.) is the third important pulse crop in India. It can be grown both as kharif greengram and summer greengram. With the advent of short duration, MYMV (Mungbean yellow mosaic virus) tolerant and synchronous maturing varieties of greengram (55-60 days) there is a big opportunity for successful cultivation of greengram in greengram-wheat rotation without affecting this popular cropping pattern.

Greengram belonging to family *legueminoseae*, is a tropical and sub-tropical grain legume, adapted to different types of soil conditions and environments (*kharif*, spring, summer). It ranks third in India after chickpea and pigeonpea. It has strong root system and capacity to fix the atmospheric nitrogen into the soil and improves soil health and contributes significantly to enhancing the yield of subsequent crops (Tomar *et al.* 2012). Greengram yield is also affected by insect-pests and diseases, especially by greengram yellow mosaic virus (MYMV) and *Cercospora* leaf spot (CLS). There is a strong need to develop the lines/ varieties which give outstanding and consistent performance in *kharif* season over diverse environment. Development of varieties with high yield and stable performance is a prime target of all greengram improvement programmes. The total production of pulses in the world was 14.76 billion tones from the area of 14.25 billion hectares in the year 2015-16 while in India total pulses production was 19.78 million tons from the area of 23.63 million hectares in the year 2015-16. Whereas in Rajasthan, the total pulses production was 1.55 million tons from the area of 3.78 million hectaresin 2015-16. The greengram production among pulses was 3.73 lacstons from the area of 8.85 hectares in Rajasthan in the year 20015-16. The major cultivation of greengram is based upon rainfed conditions (GOR, 2015-16). Pali district stands first rank in term of area and production of greengram in the state. In this district, the greengram crop is grown in an area of 2.46 lacs ha with an annual production of over 1.30 tones (GOR, 2015-16).

The Front Line Demonstration is an important method of transferring the latest package of practices in totality to farmers. By which, farmers learn latest technologies of oilseeds and pulses production under real farming-situation at his own field. Further, these demonstrations are designed carefully where provisions are made for speedy dissemination of demonstrated technology among farming community through organization of other supportive extension activities, such as field days and farmers convention. The main objective of the Front Line Demonstration is to demonstrate newly released crop production and protection technologies and management practices at the farmers' field under different agro-climatic regions and farming situations. While demonstrating the technologies at the farmer's field, the scientists are required to study, the factors contributing to higher crop production, field constraints of production and thereby generating production factor and feed-back information. Front Line Demonstrations are conducted in a block of two to four hectares of land in order to have better impact of the demonstrated technology on the farmers and field level extension functionaries with full package of practices. Keeping in view the present study was done to analyze the performance and to promote the Front Line Demonstration (FLD) on greengram production.

MATERIALS AND METHODS

Present study was conducted on FLD greengram in rainfed condition in Pali district of Rajasthan state. In total 40 frontline demonstrations were conducted on farmers' field in villages of Kishanagar, Bedkallan, Boyal, Kushalpura and BalaraJaitaran block of Pali district of Rajasthan, during *kharif* season 2014, 2015 and 2016 in raifed condition. Each demonstration was conducted on an area of 0.4 ha, and 1.0 ha adjacent to the demonstration plot was kept as farmers' practices. The package of improved technologies like line sowing, nutrient management, seed treatment and whole package were used in the demonstrations. The variety of greengram IPM 02-03 (IIRP Kanpur 2012) was included in demonstrations methods used for the present study with respect to FLDs and farmers' practices are given in Table 1. In case of local check plots, existing practices being used by farmers were followed. In general, soils of the area under study were sandy loam and medium to low in fertility status. The spacing was 30 cm between rows and 10 cm between plants in the rows. The thinning and weeding was done invariably 35-40 days after sowing to ensure recommended plant spacing (10 cm) within a row (30 cm) because excess population adversely affects growth and yield of crop. Seed sowing was done in the first week of July, 2016 with a seed rate of 15-20 kg/ha. Other management practices were applied as per the package of practices for *kharif* crops by Department of Agriculture, Agro-climatic Zone IIb Jalore (DOA, 2016). Data with respect to grain yield from FLD plots and from fields cultivated following local practices adopted by the farmers of the area were collected and evaluated. Potential yield was taken in to consideration on the basis of standard plant population (404440 plants/ha) and average yield per plant 22.5 gm/plant under recommended package of practices with 30 X 10 cm crop geometry (Chandra, 2010). Different parameters as suggested by Yadav *et al.* (2004) was used for gap analysis, technology index and calculating the economics parameters of greengram. The details of different parameters and formula adopted for analysis are as under:

Extension gap = Demonstration yield - Farmers' practice yield

Technology gap = Potential yield - Demonstration yield

Technology index = Potential yield - Demonstration yield/Potential yield x 100

Additional cost (Rs.) = Demonstration Cost (Rs.) - Farmers' Practice Cost (Rs.)

Effective gain = Additional Returns (Rs.)-Additional cost (Rs.)

Additional returns = Demonstration returns (Rs.)- Farmers' practice returns (Rs.)

Incremental B: C ratio =Additional Returns/ Additional Cost

RESULTS AND DISCUSSION

Yield attributing traits: The numbers of productive pods per plant under improved technology were25.8, 22.6 and 24.2 as against local check (farmers' practices), 19.7, 17.3 and 18.9 pods per plants (Table 2) during the year 2012, 2013 and 2014, respectively.

Table 1. Particulars showing the details of greengram grown under FLD and farmers' practice.

Operation	Existing practice	Improved practices demonstrated
Line sowing	Broad casting of seed	Spacing 40 cm between rows and 10 cm between plants in the rows
Seed treatment	No seed treatment	Seed treatment with *Bavistin* 2gm/kg seed
Weed management	No weed management	Weeds control by using herbicide *Pendimethaline*1kg/ha in 500 liter of water as pre-emergence treatment for effective control of weeds within two days after sowing.
Nutrient management	Only FYM and no fertilizer application	10 tons/ha farm yard manure and 20kg/ha nitrogen
Whole package	Farmers are cultivating the greengram crop without adoption of any improved technology	All the crop (production and protection) management practices as per the package of practices for *kharif* crop by SKRAU, Bikaner, were followed for raising the crop

Table 2. Yield attributing traits of greengram.

Year	Number of pods/plant			Number of seeds/pods			Seed weight (in 100 pods gm)		
	IT	FP	% increased	IT	FP	% increased	IT	FP	% increased
2014	25.8	19.7	30.9	10.5	6.7	56.7	55.7	39.8	39.9
2015	22.6	17.3	30.6	9.0	5.9	52.5	60.0	42.7	40.5
2016	24.2	18.9	28.0	9.5	6.5	46.1	55.0	35.4	55.4
Average	**24.2**	**18.6**	**29.8**	**9.7**	**6.4**	**51.8**	**56.9**	**39.3**	**45.3**

IT= Improved Technology; FP = Farmers Practice

Table 3. Seed yield of greengram as affected by improved and farmer practices in farmers' fields.

Year	Area (ha)	Demonstration (No.)	Yield kg/ha		Additional yield (kg/ha) over farmer practice	% increased in yield over farmers' practice
			IT	FP		
2014	05.5	10	920	785	135	17.2
2015	10.5	15	1045	730	315	43.2
2016	10.5	15	980	750	230	30.2
Average	**08.8**	**13.3**	**982**	**755**	**267**	**35.4**

Table 4. Technological gap analysis of frontline demonstrations on greengram farmers' field.

Years	Number of FLDs	Potential yield (kgha^{-1})	FLD Yield (kgha^{-1})	FP yield (kgha^{-1})	% increased	EG (kgha-1)	TG (kgha^{-1})	TI (kgha^{-1})
2014	10.5	1350	920	785	17.2	135	430	31.9
2015	15.5	1350	1045	730	43.2	315	305	22.6
2016	15.5	1350	980	750	30.2	230	370	27.4
Average	**08.8**	**1350**	**982**	**755**	**35.4**	**267**	368	27.3

EG= Extension gap; TG= Technology gap; TI= Technology index; FP= Farmers practices

There was an increase of 30.9, 30.6and28.0 % in number of productive pods under demonstration of improved technology over farmers' practice. The average number of productive pods per plant in improved technology was 24.2 and as compared 18.6 under farmers' practice (local check), thus there were 29.8% more pods per plant under improved technology demonstrations. The findings confirm with the findings of Yadav *et al.* (2007) and Meena *et al.* (2011) and Meena and Singh (2017) who found more yield in pulses under FLD plots.

Seed yield (kg/ha): The productivity of greengram under improved production technology ranged between 920-1045 kg/ha with mean yields of 982 kg/ha and overall production 2945 kg/ha in three years (Table 3). The productivity under improved technology was 920, 1045 and 980 kgha^{-1} during 2012, 2013 and 2014, respectively as against a yield range between 730 to 785 kgha^{-1} under farmers' practice. In comparison to farmer's practice, there was low than FLD plots of 17.2, 43.2 and 30.2% in productivity of greengram under improved technologies in 2012, 2013 and 2014, respectively. The increased grain yield with improved technologies was mainly because of line sowing use of nutrient management and weed management. The present findings confirm the findings of Singh and Meena (2011), Poonia and Pithia (2011), Meena *et al.* (2012), Math *et al.* (2012), Raj *et al.* (2013) and Meena and Singh (2017). They found more gain yield of FLD plots than the existing practices.

Gap analysis: Evaluation of findings of the study (Table 4) stated that an extension gap of 284 to 320 kg ha^{-1} was found between demonstrated technology and farmers' practice and on average basis the extension gap was 267 kgha^{-1}. The extension gap was highest (315 kgha^{-1}) during 2013 and lowest (135 kg $^{-1}$) during 2012. Such gap might be attributed to adoption of improved technology especially high yielding varieties (IPM 02-3, GM 4 and IPM 125)sown with the help of seed cum fertilizers drill with balanced nutrition, weed management and appropriate plant protection measures in demonstrations which resulted in higher grain yield

Table 5. Cost of cultivation (Rs./ha), net return (Rs./ha) and benefit: cost-ratio of greengrama affected by improved and farmers' practice.

Years	Cost of cash input (Rs./ha)		Additional cost in demo. (Rs./ha)	Sale price (MSP)of grain (Rs./qtl.)	Total returns (Rs./ha)		Additional returns in demo. (Rs./ha)	Effective gain (Rs./ha)	INC B:C ratio (IBCR)
	IP	FP			IP	FP			
2014	6000	4500	1500	4500	41400	35100	6300	4800	4.2
2015	6300	5000	1300	4620	48510	39726	8784	7484	5.7
2016	7000	5200	1800	5000	49000	41500	7500	5700	3.1
Average	**6433**	**4900**	**1533**	**4706**	**46303**	**38775**	**7528**	**5995**	**4.3**

IT= Improved Technology; FP= Farmers Practices

than the traditional farmers' practices. The study further exhibited a wide technology gap during different years. It was lowest (305 kg ha^{-1}) during 2013 and highest (430 kgha^{-1}) during 2012. The average technology gap of all the years was 368 kg ha^{-1}. The difference in technology gap in different years is due to better performance of recommended varieties with different interventions and more feasibility of recommended technologies during the course of study.

Similarly, the technology index for all demonstrations in the study was in accordance with technology gap. Higher technology index reflected the inadequate transfer of proven technology to growers and insufficient extension services for transfer of technology. On the basis of three years study, overall 27.3% technical index was recorded, which was reduced from 31.9%, 22.6 and 27.4 during 2012, 2013 and 2014, respectively.. Hence, it can be inferred that the awareness and adoption of improved varieties with recommended scientific package of practices have increased during the advancement of study period. These findings are in the conformity of the results of study carried out by Chandra (2010), Meena and Singh (2016), Meena and Singh (2017), Singh and Chauhan (2010), Dayanand *et al.* (2012), Meena *et al.* (2012) and Rajni *et al.* (2014).

Economics: Different variables like seed, fertilizers, bio-fertilizers and pesticides were considered as cash input for the demonstrations as well as farmers practice and on an average additional investment of Rs. 1533 per ha was made under demonstrations. Economic returns as a function of gain yield and Minimum Support Price (MPS) sale price varied during different years. The maximum returns (Rs. 8784) during the year 2013 were obtained due to high grain yield and higher MPS sale rates as declared by GOI. The higher additional returns and effective gain obtained under demonstrations could be due to improved technology, non-monetary factors, timely operations of crop cultivation and scientific monitoring. The lowest and highest incremental benefit cost ratio (IBCR) were 5.7 and 3.1 in 2013 and 2014, respectively (Table 5) depends on produced grain yield and MPS sale rates. Overall average IBCR was found 4.3. The results confirm with the findings of front line demonstrations on pulses by Yadav *et al*. (2004), Gauttam *et al.* (2011),Lothwal(2010), Chaudhary (2011), Dayanand *et al.* (2012), Meena and Dudi (2012) and Meena and Singh (2017).

Conclusion

It is concluded that Front Line Demonstrations (FLD) was an effective tools for increasing the productivity of greengram. The frontline demonstrations conducted on greengram at the farmers' field revealed that the adoption of improved technologies significantly increased the yield as well as yield attributing traits of the crop and also the net returns to the farmers. So, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training, Kisanghosthies, field days, exposure visits and demonstrations. The farmers' should be encouraged to adopt the recommended package of practices realizing for higher returns. This created greater curiosity and motivation among other farmers who do not adopt improved practices of greengram cultivation. These demonstrations also built the relationship and confidence between farmers and scientists of KVK. It was also concluded that beside other practices of weed management, insect-past management and water stress to be given due attention to enhance greengram production in the area. This will subsequently increase the income as well as the livelihood of the farming community of the district.

REFERENCES

Chandra, G. (2010). Evaluation of frontline demonstrations of greengram in Sunderban, West Bengal. *Journal of Indian Society of Costal Agricultural Research*,28:12-15

Chaudhary, S. (2012). Impact of frontlie demonstration on adoption of improved greengram production technology in Nagaur district of Rajasthan. M.Sc. Thesis, SKRAU, Bikaner.

Dayanand, Verma, R.K. and Mahta, S.M. (2012). Boosting the mustard production through front line demonstrations. *Indian Research Journal of Extension Education,* 12(3):121-123.

Dhaka, B.L., Bairwa, R.K. and Ram, B. (2016). Productivity and profitability analysis of greengram (Cv. RMG 344) at farmer's field in humid southern plain of Rajasthan. *Journal of food legume* 29(1):71-73.

DOA, (2016). Production and productivity of kharif pulses in Agro-climatic zone of Rajasthan. Pp 122-128.

Gauttam, U.S., Paliwal, D.K. and Singh, S.R.K. (2011). Impact of frontline demonstrations on productivity enhancement of chickpea. *Indian Journal of Extension*

Education, 48 (3&4): 10-13.

GOR, (2015-16). Vital Agricultural Statistics, Govt. of Rajasthan, *Pant Krashi Bhawan*, Jaipur. Pp 23-27.

Lothwal, O.P. (2010). Evaluation of front line demonstrations on blackgram in irrigated agro-ecosystem. *Annals of Agricultural Research*, 31 (1&3):24-27.

Math, G., Vijayakumar, A.G., Hegde, Y. and Basamma, K. (2014). Impact of improved technologies on productivity enhancement of sesame (*Sesamumindicum* L.). *Indian Journal of Dryland Agricultural Research and Development* 29 (2):41-44.

Meena, M.L. and Dudi, A. (2012). On farm testing of chickpea cultivars for site specific assessment under rainfed condition of western Rajasthan. *Indian Journal of Extension Education*, 48 (3&4): 93-97.

Meena, M.L. and Singh, D. (2016). Productivity enhancement and gap analysis of moth bean (*Vignaaccontifolia* (Jacq.)) through improved production technologies on farmer's participatory mode. *Indiana Journal of Dryland Agricultural Research and Development,* 31(1):68-71

Meena, M.L. and Singh, D. (2017). Technological and extension yield gaps in greengram in Pali district of Rajasthan, *India. Legume Research,* 40(1):187-190.

Meena, O.P., Sharma K.C., Meena, R.H. and Mitharwal, B.S. (2012). Technology transfer through FLDs on mungbean in semi-arid region of Rajasthan. *Rajasthan Journal of extension Education*, 20:182-186.

Ofuya, Z.M. and Akhidue, V. (2005). The role of pulses in human nutrition: A review. *Journal Applied Sciences and Environmental Management*, 9:99-104.

Poonia, T.C. and Pithia, M.S. (2011). Impact of front line demonstrations on chickpea in Gujarat. *Legume Research*34(4):304-307.

Raj, A.D., Yadav, V. and Rathod, J.H. (2013). Impact of front line demonstrations (FLD) on the yield of pulses. *International Journal of Scientific and Research,* 3(9):1-4

Rajni, Singh, N.P. and Singh, P. (2014). Evaluation of frontline Demonstrations on yield and economic analysis of summer mungbean in Amritsar district of Punjab. *Indian Journal of Extension Education.* 50 (1&2):87-89.

Rakhode, P.N., Koche, M.D. and Harne, A.D. (2011). Management of powdery mildew of greengram. *Journal of Food Legume,* 24(2):120-122.

Singh, B.S. and Chauhan, T.R. (2010). Adoption of mungbean production technology in arid zone of Rajasthan. *Indian Research Journal of Extension,*10(2):73-77.

Singh, D. and Meena, M.L. (2011). Boosting seed spices production technology through front line demonstrations. *International Journal of Seed Spices,* 1(1):81-85.

Tomar, R.K.S., Sahu, B.L., Singh, R.K. and Prajapati, R.K. (2012). Productivity enhancement of blackgram (Vigna mungo L.) through improved production technologies in farmer's field. *Journal of Food Legumes*, 22(3):202-204.

Yadav, D.B, Kambhoj, B.K. and Garg, R.B. (2004). Increasing the productivity and profitability of sunflowers through frontline demonstrations in irrigated agroecosystem of eastern Haryana. *Haryana Journal of Agronomy,*20(1):33-35.

Yadav, V.P.S., Kumar, R., Deshwal, A.K., Raman, R.S., Sharma, B.K. and Bhela, S.L. (2007). Boosting pulse production through frontline demonstration. *Indian Journal of Extension Education,* 7(2):12-14.