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Cluster frontline demonstrations in enhancement of production and productivity of green gram

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ABSTRACT

One hundred Cluster Frontline demonstrations (CFLDs) on green gram variety MH-421 in an area of 40 hectares during *kharif* season were conducted to reveal that an average yield of 10.90 q/ha from demonstration plot, as compared to local check (833 kg/ha) was 30.85 per cent more in yield. The technology gap, extension gap and technology index were 111 kg/ha, 257 kg/ha and 9.21%, respectively. Further, mean results of the study revealed that additional average yield (257 kg/ha.), additional return (Rs. 15474), effective gain (Rs. 13895) and benefit cost ratio of 3.67 from one hectare was obtained from the demonstrations as compared to local check. Results of the demonstrations had shown that the use of proven technologies resulted in higher production and productivity of green gram crop.

Key Words: FLD, Krishi Vigyan Kendra, Green gram and Yield.

INTRODUCTION

India is the largest producer, consumer and importer of pulses (Raj *et al*., 2013). Among pulses, green gram (*Vigna radiata*), which is commonly known as *Moong,* is a third important pulse crop after chickpea and pigeon pea in our country and accounts for 6.44 percent of the total production of pulses. It is grown in our country during *kharif,* but it is also grown in spring or summer season in irrigated northern plains and as a *rabi* crop in southern and south-eastern parts, where the winter is quite mild. Being a leguminous crop, it has the capacity to fix atmospheric nitrogen and add substantial amount of organic matter in to the soil. It also helps in preventing soil erosion. It assumes special significance in crop intensification and diversification, conservation of natural resources and sustainability of production system. The green gram production among pulses was 12.21 lakh metric tonne from an area of 24.65 lakh hectare with productivity of 4.95 q/ha. In Rajasthan in the year 2018-19. Whereas, in Sriganganagar district total production of *kharif* green gram was 44,758 metric tons from an area of 1, 01,921 hectare with productivity of 439 kg/ha.

Even though green gram production increased significantly during the last decade, productivity in Sri Ganganagar district (439 kg/ha) was lower than most of the major pulse producing countries. Enhancing production is a challenge for researchers, extension agencies and policy makers.

The Government of India had established a "Technology Mission on Pulses" in the year 1991-92 with the objective to enhance the pulse production and productivity. The concept of front-line demonstrations was put forth under this mission. These demonstrations are conducted under the close supervision of scientists of Krishi Vigyan Kendras, SAUs and their Regional Research Stations with the objective to demonstrate newly released crop production and protection technologies and management practices at the farmers' field under different agroclimatic regions and farming situations along with capacity building of partner farmers. Through this practice, the newly improved innovative technology having higher production potential under the specific cropping system can be popularized and simultaneously feedback from the farmers may be generated on the demonstrated technology (Singh *et al*., 2012).

The Krishi Vigyan Kendra, Sriganganagar was mandatory entrusted with the responsibility of conducting CFLD in Sriganganagar district of Rajasthan. The main emphasis was to maximize production per unit area by using high yielding varieties of green gram in conjunction with the package and practices. Keeping this in view cluster frontline demonstrations were organized in participatory mode to enhance the productivity, economic returns by analyzing difference between demonstrated packages of practices vis-a-vis practices followed by the local farmers in green gram crop.

MATERIAL AND METHODS

The present study was carried out by Krishi Vigyan Kendra, Padampur, Sriganganagar (Rajasthan) at the farmer's fields of operational area of Krishi Vigyan Kendra during *kharif* season of 2019 and 2020. Sriganganagar district is situated in the north-western part of India between 28.40 to 30.30 N latitude and 72.3^{o} to 75.3^{o}E longitude and at 175.6 meters height above mean sea level. As per the agro-climatic zones of Rajasthan it has been designated as Irrigated North Western Plain Zone-1b. Geographical Zone- 1b forms North West part of '*Thar*' desert and comprised of arid and semi-arid. All 100 cluster front line demonstrations in 40-hectare area were conducted on green gram crop var. MH-421. Each demonstration was conducted on an area of 0.4 ha, and 0.4 ha area adjacent to the demonstration plot was kept as a farmers practice. In case of local check plots, traditional practices were followed in existing varieties like IPM 02-3, SML-668, local by the farmers. The package of proven technologies like improved high yielding variety, proper seed rate, line sowing, seed treatment, fertilizer management, plant protection measure and whole package were applied in demonstrations. In general, soils of the area under study were loamy sand and good in fertility status. The spacing was 30 cm between rows and 10 cm between plants in the rows. Hand weeding within lines was done at 30-35 days after sowing. Seed sowing was done in first week of July with seed rate of 16 kg/ha. Other management practices were applied as per the package of practice for *kharif* crops of Agro climatic Zone Ib Sriganganagar.

Partner farmers were selected through their participation and feedback received during the survey, and training programmes. All the participating farmers were trained to follow the improved practices of green gram cultivation. Regular visits to the demonstrations field by KVK scientists ensured proper guidance to the partner farmers. While demonstrating the technologies in the farmers' field, the scientist observed the factors contributing higher crop production, field constrains of production and thereby generate primary production data from both the demonstration as well as local check plot of partner farmers through personal contacts with the help of well-structured interview schedule and feedback information.

The primary data were collected and the finally extension gap, technology gap and technology index were worked out suggested by Raj *et al*., (2013) as per formula given below:

% increase in yield = (Yield of improved technology–Yield of farmer practice/Yield of farmer practice ×100

Technology gap (kg/ha.) = Potential yield (kg/ha) -Yield of improved technology (kg/ha.)

Extension gap (kg/ha.) = Yield of improved technology (kg/ha) -Yield under farmer practice (kg/ha.)

$$\text{Technology index} = \frac{\text{(Potential yield- Yield of improved technology)}}{\text{Potential yield}} \times 100.$$

Additional cost (Rs./ha.)=Improved technology cost (Rs. /ha.) - Farmer practice cost (Rs. /ha.)

Additional return (Rs./ha.) = Improved technology (Rs./ha.) - Farmer practice return (Rs. /ha.)

Effective gain (Rs./ha.) = Additional return (Rs. /ha.) - Additional cost (₹/ha.)

Yield gap minimized (kg/ha.) =Demonstration yield (kg/ha.) = District/State/Potential yield (kg/ha.)

RESULTS AND DISCUSSION

Difference between technological intervention and farmers practice

Before conducting cluster frontline demonstrations at the farmer's field, participatory rural appraisal was undertaken. Based on this, major gap were observed between technological intervention and farmer's practice of green gram cultivation in Sriganganagar district of Rajasthan. Table 1 reveals that under the demonstrated plot recommended improved high yielding variety, seed treatment by bio-fertilizers and fungicide, herbicide and insecticide for plant protection measure were given to the farmers by the KVK and all other package of practices were timely performed by the farmer itself under the supervision of KVK scientist. Under farmers practice they generally sow seeds of green gram var. IPM 02-3 and SML-668 at low seed rate without treatment. Farmers selected under FLD programme on green gram were provided with the seed of YVM resistance green gram var. MH-421. Similar findings have also been observed by Singh *et al.* (2012) and Raj *et al.* (2013).

Table 1. Difference between technological intervention and farmer practice for green gram crop in Sriganganagar district of Rajasthan.

Technology Component	Technological intervention	Farmer practice	Gap%
Farming situation	Irrigated	Irrigated	No gap
Variety	Improved variety MH-421	Local, SML 668 and IPM 02-3	Partial
Time of sowing	First fortnight of July	15 June to 1 July or First fortnight of July	Partial
Seed rate	16 kg/ha	12-15 kg/ha	Farmers use less seed rate
Sowing Method	Line sowing through seed cum ferti drill	Line sowing through seed drill	Partial
Seed treatment	Seed treatment with Bavistin 3g/kg seed and Rhizobium & PSB 600 g /ha seed	Partial seed treatment	Partial
Weed management	Weed management by using herbicide Imazethapyr 10% SL @40g a.i./ha as a post emergence	Rarely weed management by using herbicide or One hand weeding at 30 DAS	Partial
Nutrient Management	Nitrogen 20 kg/ha and Phosphorus 40 kg/ha	60 kg DAP (11 kg N and 28 kg P / ha.) or 87 kg DAP (16 Kg N and 40 kg P /ha) or 32 Kg phosphorus through SSP	Less dose of fertilizers than recommendation
Disease management (Leaf spot & BLB)	Spray of Streptocycline @ 20g and Copper Oxychloride 50% WP @ 1.2 kg/ha	No application or Over dose/un-recommended brands of insecticides and fungicide	Partial
Insect pest management Sucking pest and Pod borer	Dimethoate 30% EC @ 1 L/ha (For Sucking pest and Quinalphos 25EC@1 L/ha for Pod borer (Lambda–Cyhalothrin 250 ml/ha.)	Based on availability in local market or (Chlorantraniliprole 18.5 % w/w. @ 0.33 ml/lit. of water)	Partial

Yield attributing traits

Table 2 reveals that under demonstration the number of pods per plant was 34.7 and 31.5 as compared to local check 28.4 and 26.3 during the year 2019 and 2020, respectively. There was an increase of 22.2 and 19.8% in number of pods per plant under demonstrations. The average number of pods per plant in demonstrations was 33.10 and 27.35 under farmers practice, thus there were 20.98% more pods per plant under demonstrations. Similarly, number of seeds per pod in demonstrations was 10.4 and 10.1 as compared to local check 10.0 and 9.7 during year 2019 and 2020, respectively. There was an increase of 4.0 and 4.1% in number of seeds per pod under demonstrations. The average number of seeds per pod in demonstrations was 10.25 and under farmers practice seeds per pod were 9.85. These results confirm the findings of Meena and Singh (2017).

Yield

Table 4 reveals that the maximum average yield of green gram through demonstrations was recorded (1184 kg/ha) during kharif 2019 and minimum average yield was recorded in kharif 2020 (995 kg/ha) and the average yield of two years was recorded 1090 kg/ha over local check (833 kg/ha). The average increase of yield was 30.85 per cent recorded during two years of study. The higher yield of green gram could be attributed due to adoption of improved variety with improved production practices of green gram. These results corroborate the findings of Reager *et al.* (2020) and Meena *et al.* (2020) in green gram.

Extension gap

Evaluation of the findings of study (Table 4) stated that the extension gap ranging between 204 to 309 kg/ha was found between demonstrated technology and local check and on an average basis the extension gap was 257 kg/ha. The extension

Table 2. Yield attributing traits of green gram under demonstration vis a vis local check

Year	Number of pods/plant			Seeds/Pod		
	Demonstration	Local check	% increase	Demonstration	Local check	% increase
Kharif -2019	34.7	28.4	22.2	10.4	10.0	4.0
Kharif -2020	31.5	26.3	19.8	10.1	9.7	4.1
Mean	**33.10**	**27.35**	**20.98**	**10.25**	**9.85**	**4.06**

Table 3. Comparison of yield of green gram (Average of 2019-2021)

Yield (q/ha.)	National*	State**	District**	Potential	Demonstration	Farmers practices	Yield Gap minimized (q/ha)		
							D	S	P
	536	554	439	1200	1090	833	651	536	-110
% Increase						30.85			

*Anonymous (2019), **Anonymous (2018-19); D: District; S: State; P: Potential

Table 4. Production, technology gap, extension gap and technology index in green gram under CFLD.

Season & Year	Variety	Area (ha.)	No. of FLDs	Potential Yield (kg/ha)	Demonstrations Yield (kg/ha)			Yield of local Check (kg/ha)	(%) Increase over local check	Technology gap (kg/ha)	Extension gap (kg/ha)	Technology index (%)
					Max.	Min.	Avg.					
Kharif -2019	MH-421	20	50	1200	1600	750	1184	875	3531	16	309	1.33
Kharif -2020		20	50	1200	1325	665	995	791	2579	205	204	17.08
Mean					**-**	**-**	**1090**	**833**	**30.85**	**111**	**257**	**9.21**

Table 5. Economic analysis of cluster front line demonstrations on green gram at farmer field.

Crop	Season and year	Average Cost of cultivation (Rs./ha)		Additional cost in demo. (Rs./ha.)	Average Gross Return (Rs./ha)		Additional return in demo. (Rs./ha.)	Average Net Return (Rs./ha)		Effective gain (Rs./ha)	Benefit-Cost Ratio	
		Demo.	Local Check		Demo.	Local Check		Demo.	Local Check		Demo.	Local Check
Green gram	Kharif -2019	15886	14712	1174	69180	50750	18430	53294	36038	17256	4.35	3.45
	Kharif -2020	20584	18600	1984	61282	48765	12517	40698	30165	10533	2.98	2.62
Mean		**18235**	**16656**	**1579**	**65231**	**49758**	**15474**	**46996**	**33102**	**13895**	**3.67**	**3.04**

Cost A1: All actual expenses in cash and kind incurred in production by owner

gap was highest (309 kg/ha) during 2019 and lowest (204 kg/ha) during 2020. Such gap might be attributed to adoption of improved technology especially high yielding varieties sown with the help of seed cum ferti-drill with balanced nutrition, weed management and appropriate plant protection measure in demonstrations. During the study period emphasizes the need to educate the farmer through various means for adoption of improved production technologies to reverse the trend of wide extension gap.

Technology gap

The technological gap in adoption of green gram production technologies under demonstration and local farmer practices were measured. The study exhibited a wide technology gap during demonstrations. The trend of technology gap (ranging between 16-205 kg/ha) reflects the farmer's cooperation in carrying out such demonstrations with encouraging results in subsequent years. The technology gap was highest (205 kg/ha) in demonstrations of MH-421 during 2020 and lowest (16 kg/ha) during 2019. The average technology gap of two-year demonstrations was 111 kg/ha shows the potential of improved varieties and package of practices. The difference in technology gap during two years of demonstration is due to better performance of recommended varieties with different interventions and more feasibility of recommended technologies during the course of study and some extent to dissimilarity in soil fertility status and adverse weather conditions. Similar findings were recorded by (Katare *et al*., 2011 and Singh *et al*., 2012).

Technology index

The technology index showed the feasibility of the evolved technology at the farmer's fields. The lower value of technology index the more is the feasibility of technology and higher technology index reflected the inadequate transfer of proven technology to growers and insufficient extension services. As such fluctuation in technology index (ranging between 22.73 to 34.09 per cent) during the study period in certain region, may be attributed to the dissimilarity in soil fertility status, adverse weather condition, insect-pests and disease attack. These findings are in conformity of the results of study carried out by Meena and Singh (2017) and Dayanand *et.al*. (2012).

Economic analysis

Different variables like seed, fertilizer, biofertilizers and pesticides were considered as cash input for the demonstration as well as farmer practice and inputs and outputs prices of commodities prevailed during the study of demonstration were taken for calculating the cost of cultivation, gross return, net return and benefit: cost ratio (Table 5). On an average additional investment of Rs. 1579 per ha was made under demonstration. The cultivation of green gram under demonstrations gave maximum net return (Rs. 36038/ha.) during the year 2019 due to higher grain yield. The higher additional returns and effective gain obtained under demonstration could be due to improved technology and non-monetary factors, timely operations of crop cultivation and scientific monitoring. The lowest and highest benefit: cost ratio of 2.98 and 4.35 in 2020 and 2019, respectively (Table 5) depends on produced grain yield and MSP sale rates. Overall average benefit: cost ratio was obtained 3.67. The results confirm the findings of Dayanand *et.al*. (2012) and Meena and Singh (2017).

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