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Performance Analysis of Front-Line Demonstrations on Green Gram (*Vigna Radiate* l.) in Jodhpur District of Western 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, Jodhpur-II (Phalodi) has carried out frontline demonstrations on greengram crop varieties GM-6 and IPM 205-7 covering an area of 30 ha of farmer's field to exhibit latest production technologies and compared it with farmer's practice. The study in total 50 frontline demonstrations were conducted on farmer's fields in villages viz. Kali-mali and Baori of Jodhpur district of Rajasthan state during 2020 and 2022, to demonstrate production potential and economic benefit of improved technologies comprising sowing method, nutrient management and chemical weed management and adoption of whole package of practices for crop. After sowing of seed, application of weedicide Imazethapyr 10SL as early post emergence at 50 gm a.i. per 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 687 kg/ha which was 23.7 % higher than obtained with farmers practices (555 kg/ha). Higher mean net income of Rs. 31285/ha with a Benefit:cost ratio of 3.05 was obtained with improved technologies in comparison to farmers practices (24710).The frontline demonstrations conducted on greengram crop at farmer's field revealed that the adoption of improved technologies significantly increased the yield as well as yield attributing traits of crop and also the net neturns higher than the farmer's 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**

I. 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 scarce and expensive (Ofuya and Akhidue, 2005). Pulses are important food crop for human consumption and animal feed. Being leguminous in nature, they are considered to be important components of cropping system because of their viability to 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 its continuously practiced by 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 leguminoseae, is a tropical and sub-tropical grain legume, adapted to different types of soil conditions and environments (*kharif, spring and summer*). It ranks third in India after chickpea and pigeonpea. It has strong root system and capacity to fix the atmospheric nitrogen in to 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 insects-pests and diseases, especially by greengram yellow mosaic virus (GYMV) 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 India was 25.42 million tonnes from the area of 29.80 million hectares with the productivity of 853 kg/ha (Anonymous, 2020). Whereas, in Rajasthan, the total *kharif* pulses production was 3.57 million tonnes from the area of 5.53 million hectares with productivity of 639 kg/ha (Anonymous, 2019). The greengram production among *kharif* pulses was 1.09 million tonnes from the area of 2.39 million hectares with productivity of 458 kg/ha in Rajasthan (Anonymous, 2023). In Jodhpur district, the greengram crop is grown in an area of 258797 ha with an annual production of over 153840 million tons (GOR, 2023).

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 ago-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 ten hectares of land in order to have better impact of the demonstrated technology on the farmer's 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.

I. MATERIALS AND METHODS

Present study was conducted on FLD greengram in rainfed condition in Jodhpur district of Rajasthan state. In total 50 frontline demonstrations were conducted on farmers' field in villages of Kali-mali and Boari of Jodhpur district of Rajasthan, during *kharif* season 2020 and 2022 in rainfed condition. Each demonstration was conducted on an area of 0.4 ha, adjacant-to the demonstration plot was kept as farmer's 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 GM-6 and IPM 205-7 were included in demonstrations methods used for the present study with respect to CFLDs and farmer's 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 Loamy fine to Coarse 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, with a seed rate of 20 kg/ha. Other management practices were applied as per the package of practices for *kharif* crops by Department of Agriculture, Agro-climatic ZoneIa - Arid Western Plains Zone (DOA, 2022). Data with respect to grain yield from CFLD 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 – Farmer's 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.) - Farmer's practice returns (Rs.)

B: C ratio =Gross Returns/ Gross Cost

Table 1. Package of practices followed by farmers under FLD

Particulars	**Technology Interventions**	**Farmer's practices**
Variety	GAM-5, GM-6, IPM 205-7 and MH-421	Local cultivar
Seed rate	20 kg/ha	15 kg/ha
Soil treatment	Trichoderma spp. @ 2.5 kg/ha cultured with 100 kg FYM	No use
Seed treatment	Carbendazim 50 WP @ 2.0 g/kg Seed	No seed treatment
Time of sowing	First week of July	Second week of July
Method of sowing	line sowing, 30 cm (row to row) and 10-15 cm (plant to plant)	Broadcasting
Fertilizer management	15:40:0 (NPK kg/ha)	Use of urea 50 kg/ha and DAP 150 kg/ha
Weed management	Early post emergence application of Imazethapyr 10 SL 500 ml/ha followed by manual weeding at 35-40 DAS	No use
Water management	Light irrigation at flowering and pod formation stage	No use
Plant protection	Sucking pests - Dimethoate 30 EC @ 1 lit./ha and Imidacloprid 200 SL @ 150 ml/ha Pod borer - Quinalphos 25 EC	Products suggested by local pesticide dealers

II. RESULTS AND DISCUSSION

Seed yield (kg/ha): The productivity of greengram under improved production technology ranged between 640-735 kg/ha with mean yields of 687 kg/ha and overall production 1375 kg/ha in two years (Table 2). The productivity under improved technology was 640 and 735 kg/ha during 2020 and 2022, respectively as against a seed yield range between 530 to 580 kg/ha under farmer's practice. In comparison to farmer's practice, there was low than CFLD plots of 20.75 and 26.72% in productivity of greengram under improved technologies in 2020 and 2022, 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 CFLD plots than the existing practices.

Gap analysis: Evaluation of findings of the study (Table 3) stated that an extension gap of 110 to 155 kg/ha was found between demonstrated technology and farmer's practice and on average basis the extension gap was 132.5 kg/ha. The extension gap was highest (155 kg/ha) during 2022 and lowest (110 kg/ha) during 2020. Such gap might be attributed to adoption of improved technology especially high yielding variety (IPM 205-7)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 than the traditional farmer's practices. The study further exhibited a wide technology gap during different years. It was lowest (460 kg/ha) during 2020 and highest (466 kg/ha) during 2022. The average technology gap of both the years was 463 kg/ha. 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 two years study, overall 40.27% technical index was recorded, which was lowest (38.75 %) during 2022 and highest (41.80%) during 2020. 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).

Table 2. Technical impact of green gram crop demonstrations during 2020 & 2022

S. No	Crop	Variety	Technology Demonstrated	Area (ha.)	No. of Demonstration	Potential yield (q/ha)	Yield of the crop under demonstration (Kg/ha)			Yield under local check (Kg/ha)	Increase in yield (%)
							Highest	Lowest	Average		
1	2	3	4	5	6	7	8	9	10	11	12
2020	Green gram	GM-6	Timely sown HYV	10	25	11	700	490	640	530	20.75
2022	Green gram	IPM 205-7	Timely sown HYV	20	25	12	900	660	735	580	26.72
Average	-	-	-	15	25	12	800	575	687	555	23.73

Table 3. Yield gap of variety of green gram crop during investigation year

Years	Variety	Technology gap (Kg/ha)	Extension gap (Kg/ha)	Technology index (%)
2020	GM-6	460	110	41.80
2022	IPM 205-7	466	155	38.75
Average	-	463	132.5	40.27

Table 4. Economic impact of green gram crop

Variety	Average Cost of Cultivation (Rs./ha)		Additional cost in demo. (Rs./ha)	Average Gross Return(Rs./ha)		Average Net Return (Rs./ha)		Additional returns in demo. (Rs./ha)	Benefit-Cost Ratio	
Plots	Demonstration plot	Local check plot	-	Demonstration plot	Local check plot	Demonstration plot	Local check plot	-	Demonstration plot	Local check plot
2020	14910	13690	1220	41990	34450	27080	21760	5320	2.81	2.71
2022	15210	13290	1920	50700	40950	35490	27660	7820	3.30	3.07
Average	15060	13490	1570	46345	37700	31285	24710	6570	3.05	2.89

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. 1570 per ha was made under demonstrations. Economic returns as a function of gain yield and Minimum Support Price (MSP) sale price varied during different years. The maximum returns (Rs. 50770) during the year 2022 were obtained due to high grain yield and higher MSP 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 benefit cost ratio (BCR) were 2.8 and 3.3 in 2020 and 2022, respectively (Table 4) depends on produced grain yield and MSP sale rates. Overall average BCR was found 3.05. The results confirm with the findings of front line demonstrations on pulses by Yadav *et al.* (2004), Gauttam *et al.* (2011), Lothwal (2010), Chaudhary (2012), Dayananda *et al.* (2012), Meena and Dudi (2012) and Meena and Singh (2017).

III. 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. Kisan ghosthies, field days, exposure visits and demonstrations. The farmer's 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 to 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.

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