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Role of Cluster Demonstration in Enhancement of Soybean Production in Ratlam District of Madhya Pradesh

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ABSTRACT

Background: Soybean (*Glysin max* L.) is one of the most important oil seed cum pulse crop cultivated in Ratlam district of Madhya Pradesh. The present investigation was carried out at Krishi Vigyan Kendra, Ratlam during kharif 2021-22 and 2022-23, to demonstrate the improved variety JS-2029 and RVS 2001-4 with the scientific package and practices to improve the production of soybean.

Methods: The present research of cluster front line demonstrations (CFLDs) was conduct during *kharif* season 2021-22 and 2022-23 by KVK Ratlam, under rained condition. An extensive survey was conducted to collect in sequence from preferred farmers to give them enhanced package of put into practice. Privileged position performance was utilized to categorize the constraint faced by the farmers in soybean crop growing. Based on the evils face by the farmers, the cluster frontline demonstrations were designed.

Result: In conclusion, potential yield of variety can be achieved by imparting scientific knowledge to the farmers, providing need based quality inputs in due time and proper and timely application of inputs. The average yield of demonstrated technology (18.95 q/ha) was higher than of local check (15.87 q/ha).

Key words: BC ratio, CFLD, Soybean, Technology, Yield.

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] was domesticated by farmers in the eastern half of Northern China and recognized as an oil seed crop containing several useful nutrients including protein, carbohydrate, vitamins and minerals. It is a legume that grows in tropical, subtropical and temperate climate. It is an important commercial oilseed crop in Madhya Pradesh. Soybean is a major rainy season crop in central part of the India. It has occupied the first position among the oilseed crops in terms of acreage and production (Kuchlan *et al*., 2019). According to the first advance estimates, Govt. of India, soybean creation is anticipated at 13.60 million tons during *kharif* 2022-23 from 120.90 lakh ha soybean cultivated area. More than 2/3rd area and production has been obtained from the six states of India *viz*., Madhya Pradesh (50.18 lakh ha), Maharashtra (49.10 lakh ha), Rajasthan (11.51 lakh ha), Karnataka (4.43 lakh ha), Gujarat (2.22 lakh ha) and Telangana (1.75 lakh ha).

Soybean is known as 'submissive meat', 'wonder crop', 'phenomenon crop' and 'golden bean' because of its rich and cheap source of quality protein (40- 42%) and oil content (18-20%) having about 85% unsaturated adipose acids including 55% polyunsaturated adipose acids (PUFA) and about 0.3% is flavones (Smith and Huyser, 1987). Fat-free soybean meal is a primary and low-cost source of protein for animal feeds and most prepackaged meals (Nira *et al*., 2020). It is an adaptable crop with innumerable possibilities of improving agriculture production and supporting industry. Its protein is rich in Lysine (4-6%). India has large portion of the population are vegetarians and is in short supply of proteins.

The problem is compounded by the fact that majority of the farmers in the rainfed regions were unaware of new and high yielding varieties and improved package of practices for cultivation. The productivity of crops per unit area could be increased by adopting better practices in an orderly manner along through high yielding varieties (Ranawat *et al*., 2011; Rai *et al*., 2016). The constraints face by the farmers in obtaining higher output is standard and the front demonstrations are considered to overcome the evils in a systematic way in arrange to show the significance of the new evolve variety and improved package of practice for attractive the soybean output (Saravanakumar, 2018). Shaktawat *et al*. (2016) reported that the insignificant, diminutive and huge farmers belonged to low implementation group for seed treatment by fungicides and appliance of fertilizers, medium implementation for application of herbicide and plant safety measures of soybean production technology. The reason may be that the most of the technology have not yet reached to the farmer's fields.

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Hence an efficient production technology transfer system is required in the field. Out of these conducts of demonstration on farmer fields have proved effective for creating awareness and acceptance of improved and advance technologies. Usually farmers of Ratlam district grow up confined variety of soybean during June-July and return in October-November with 100-110 days period but the production and yield is very less. In this regard, to increase the productivity, the Department of Agriculture, Cooperation and Farmers Welfare had sanctioned the project "Cluster Frontline Demonstrations on oilseed'' to ICAR-ATARI, Jabalpur through National Mission Oilseeds and Oil palm. To implement the project the Zone IX had selected KVK Ratlam for soybean cultivation with an objective to boost the production and productivity of Soybean crop through CFLDs with latest and specific technologies. To study the performance of short duration HYV of Soybean with 95-100 days duration (Variety: JS 2029 and RVS 2001-4) under proper management practices well as seed treatment and incorporated pest management was the major goal.

MATERIALS AND METHODS

The present research of CFLD's was conduct during *kharif* season 2021-22 and 2022-23 by KVK Ratlam, under rained condition. An extensive survey was conducted to collect in sequence from preferred farmers to give them enhanced package of put into practice. Privileged position performance was utilized to categorize the constraint faced by the farmers in soybean crop growing. Based on the evils face by the farmers, the cluster frontline demonstrations were designed. The yield data of each demonstration was recorded in a systematic manner and the yield of farmers' practices was also recorded at the same time. Data pertaining to crop growth, yield attributes and yield were collected at harvest and analyzed statistically. The B:C ratio was calculated based on the net return and cost of cultivation in each treatment. The extension gap (q/ha), technology gap (q/ha) and technology index (%) were calculated using the following formula as suggested by Samui *et al*. (2000); Kadian *et al.* (2004); Sagar and Chandra, (2004).

$$\text{Extension gap (q/ha)} = \text{DY (q/ha)} - \text{LY (q/ha)}$$

$$\text{Technology gap (q/ha)} = \text{PY (q/ha)} - \text{DY (q/ha)}$$

$$\text{Technology index (\%)} = \frac{\text{Technology gap (q/ha)}}{\text{PY (q/ha)}} \times 100$$

Where,
DY= Demonstration yield.
LY= Local check yield.
PY= Potential yield of variety.

The expertise was confirmed at Ratlam district of Madhya Pradesh. District has a tropical wet and dry summer season climate. The district's yearly temperature is 28.68°C (83.62°F) and it is 2.71% elevated than India's averages. Ratlam classically receive about 121.39 millimeters (4.78 inches) of rainfall and has 97.18 rainy days (26.62% of the time) per annum. For this lessons total 75 farmers (25 farmers in 2021-22 and 50 farmers in 2022-23) were preferred in 30.36 ha area under 04 clusters. The farmers were trained to follow the put together and practice for systematic cultivation of soybean through on and off campus training, method revelation, by distribute leaflets, grouping and kisan gosthi, farmers scientist communications and all the need based input provided to the farmers (Table 1).

The seeds were treated with *Rhizobium* @ 2 g/kg seed by thorough mixing with its slurry and kept in shade for 5-6 hours before sowing. Seeds were sown in line at the spacing 30 × 15 cm with seed rate 75 kg/ha. The required fertilizer was applied @20:60:40:30 kg N: P_2O_5:K_2O:S per ha respectively. The traditional cultivation of soybean with their own varieties is considered as local check or farmers' practice. To lessons the impact of cluster frontline demonstrations, data from CFLD and farmers practice were analyze.

RESULTS AND DISCUSSION

The results of the present investigation showed expansion parameter and yield data of recently introduce variety of soybean JS-2029 and RVS 2001-4 along with enhanced practices. The performance was found superior than the

Table 1: Adoption of scientific package of practices for soybean under CFLD among farmers practice.

Technology	Improved practice	Farmers practice
Variety	JS 2029 and RVS 2001-4	JS 9560
Seed rate	75 kg/ha	80-100 kg/ha
Seed treatment	*Rhizobium*@ 2 g/kg and fungicide (Carbendazim 12% + Mancozeb 63% WP)	No seed inoculation
Sowing	June-July	June-July
Sowing method	Ridge and furrow method	Ridge and furrow method
Spacing	30 × 15 cm	30 × 10-12 cm
Fertilizer dose	Recommended dose of fertilizer (20:60:40)	Non judicious use offertilizers
Farming situation	Irrigated/rainfed	Irrigated/rainfed
Plant protection measures	Integrated diseases and pest management	Indiscriminate use ofpesticides
Weed control	Chemical and mechanical weeding	No weeding

confined check under same conditions and reported (Table 2 and Table 3). The data on growth parameters revealed that all the growth parameters were superior in CFLD plots to farmers' practice except plant height. Taller plant height (67.85 cm) was recorded at farmers' practice than CFLD plots (58.51 cm) which might be a varietal character of farmers' variety that leads to lodging due to wind and rain during harvesting stage resulted loss of yield and quality. More numbers of pods/plant recorded in CFLD plots (88.41) than farmer's practice (54.18) which must be due to more numbers of primary branches per plant (10.21) in CFLD plots. Less numbers of days to first flowering (41.52 days) days to harvesting (93-98 days) were recorded at CFLD plots than farmers' practice (49.52 days and 100-105 days) which is a varietal character of both varieties. Less pest and disease incidence was recorded at CFLD plots due to adoption of appropriate management practices in comparison to farmers' practice. This present findings confirm the findings of Kalita *et al.* (2019) on pigeon pea cultivation.

Regarding yield, result concluded that highest yield average (18.94 q/ha) was recorded in demonstration plots than farmers' practice (15.87 q/ha) with 19.33% higher yield over the farmer practice (Table 3). This fluctuation in yield might be due to early withdrawal of monsoon so the farmers have been benefitted by the early maturity of demonstrated soybean variety as compared to local variety. This finding is in agreement with those of Kumar *et al.* (2012). Superior growth parameter like more primary branches and pods per plant was the reason for higher yield which was due to combined effect of seed treatments, application of fertilizer, timely intercultural operations and integrated pest diseases management practices in CFLD plots. Similar findings were also reported by Rai *et al.* (2016) and Kalita *et al.* (2019).

The extension gap in the demonstrated yield over the farmers yield was 3.07. This indicate to organize various extension activity *i.e.* demonstration, training, meeting etc. for encourage the farming community to adopt the scientific package of practice. This helps to regress the trend of wide extension gap. More and more use of high yielding varieties with latest production technology will subsequently change this alarming trend of race extension gap (Dhakad *et al.,* 2018). The technology gap in the demonstrated yield over the potential yield was 6.03. The technology gap may be attributed to the dissimilarity in the soil fertility status, agricultural practices and local climatic condition (Mukharjee, 2003). The technology index shows the feasibility of demonstrated technology at farmer's field. The observed technology index of the study was 24.14%. The lower the value of technology index shows the more feasibility of the technology (Jeengar *et al.,* 2006). This will accelerate the adoption of demonstrated technical intervention to increase the yield performance. The findings of the present study were in line with the findings of Saravanakumar (2018).

Economic analysis (Table 4) revealed that adoption of improved package of practices required an additional cost of Rs 819 per ha over farmers practice. This additional

Table 2: Growth parameters of cluster frontline demonstration on soybean.

Year	Numbers of demonstrations	Plant height (cm)		Nos. of primary branch/plant		Nos. of pods per plant		Days to first flowering		Days to harvesting	
		D P	FP	D P	FP	D P	FP	D P	FP	D P	FP
2021-22 (JS-2029)	25	58.51	62.84	9.58	5.62	84.57	56.47	41.52	48.59	93-98	100-105
2022-23 (RVS 2001-4)	50	59.23	67.85	10.21	6.12	88.41	54.18	43.25	49.52	93-98	100-105
Average		58.87	65.34	9.89	5.87	86.49	55.32	42.38	49.05	93-98	100-105

Table 3: Yield, yield increase (%), extension gap, technology gap and technology index of the demonstration.

Year	Numbers of demonstrations	Average yield (q/ha)		% Increase over farmer practice	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
		D P	FP				
2021-22 (JS-2029)	25	18.73	15.81	18.46	2.92	6.22	24.92
2022-23 (RVS 2001-4)	50	19.16	15.94	20.20	3.22	5.84	23.36
Average		18.94	15.87	19.33	3.07	6.03	24.14

Table 4: Details of yield and economics of cluster frontline demonstration on soybean.

Year	Numbers of demonstrations	Yield (q/ha)		Gross cost (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		B:C ratio	
		D P	FP	D P	FP	D P	FP	D P	FP	D P	FP
2021-22 (JS-2029)	25	18.73	15.81	24210	23550	73983	62449	49773	38899	2.05	1.65
2022-23 (RVS 2001-4)	50	19.16	15.94	24710	23732	84323	68542	59613	44810	2.41	1.88
Average		18.95	15.87	24460	23641	79153	65495.50	54693	41854.50	2.23	1.77

cost led to increased average gross return (79,153 Rs./ha) and net return (54,693 Rs./ha) was found superior in CFLD plots to farmer's practice. The benefit cost ratios of under recommended practices were higher 2.23:1 than farmer's practice 1.77:1. This may be due to higher yields obtained under recommended practices compared to farmer's practices. Similar results have earlier been reported on soybean (Sharma *et al.,* 2013). The result of front line demonstrations on the package of practices suggested that by its adoption, the farmers can realize higher yields and net profit in soybean cultivation. The result also indicates that the CFLD has given a good impact over the farming community of district as they were motivated by the improved agricultural technologies applied in the demonstration plots. Hence, improved production technologies in soybean have the broader scope for increasing the productivity per unit area. These results confirmed the findings of Khedkar *et al.* (2017).

CONCLUSION

In conclusion, potential yield of variety was achieved by imparting scientific knowledge to the farmers, providing need based quality inputs in due time and proper and timely application of inputs. CFLD programme is an effective tool in changing the attitude, develop skill, increase knowledge and develop enthusiasm toward the improved package of practices not only among the adopted farmers but also others those who seen the results of demonstration. This is the best way to sustain the credibility and reliability of the technology among the farmers. The average yield of demonstrated technology (18.95 q/ha) was higher than that of local check (15.87 q/ha). The adopted farmers for demonstration acted as a primary source of information dissemination among the farmers of the improved package of practices and also acted as a reliable source of good quality of seed in their locality and surrounding areas for the next crop. It can be concluded that newly introduced variety of soybean along with improved package of practices performed well in the Ratlam district of Madhya Pradesh and adoption is also appreciable among the farmers.

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