

Original Research Article

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Impact of Cluster Frontline Demonstration on Soybean Production in Tirap District of Arunachal Pradesh, India

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ABSTRACT

Soybean (*Glysin max* L.) is one of the most important oil seed cum pulse crop cultivated in Tirap district of Arunachal Pradesh. The production and productivity of soybean in the district is found to be low, therefore constant attempts are being made to improve the productivity and to increase the area under soybean by adopting high yielding variety along with improved cultivation practices. A total of 10 Cluster Frontline Demonstrations (CFLDs) at farmers' field were being carried out on soybean in 30 ha areas with 75 farmers to demonstrate production potential and economic benefits of improved practices comprising of high yielding variety JS – 9752 in Tirap District during kharif season 2018-19. Farmers obtained 23.7 q/ha soybean in demonstration plots which was 43.7 per cent higher yield than the farmer's practice (16.5 q/ha). The average extension gap, technology gap and technology index were 7.2 q/ha, 1.3 q/ha, and 5.2 per cent respectively. The improved practices gave highest gross return (Rs. 94,836/ha), net return (Rs. 59,589/ha) and benefit cost ratio 2.69. It can be concluded that soybean production can be enhanced by encouraging farmers through adoption of improved technologies and providing need based inputs in due time which were followed in CFLDs.

Keywords

CFLD, Soybean, Growth, Yield, Production, Improved practices, Tirap

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Introduction

Soybean (*Glycine max* L.) belonging to family Leguminosae is one of the important oil seed crops of the world and has recognized as beneficial source of protein, edible oil and functional food. It is unique in the sense that large numbers of diverse end-products such as fortified soya flour, soya milk, tofu, biscuit, bread, products are made from it. According

to the first advance estimates, Govt. of India, soybean production is estimated at 135.05 lakh tonnes during kharif 2019-20 from 113.98 lakh ha soybean cultivated area (Soybean Outlook, October'2019, Agricultural Market Intelligence Centre, PJTSAU). 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 improved practices in a systematic manner along with high yielding varieties (Ranawat *et al.*, 2011; Rai *et al.*, 2016). Frontline demonstration is an important tool to disseminate new technology at farmer's field. The constraints faced by the farmers in obtaining higher productivity is documented and the frontline demonstrations are designed to overcome the problems in a scientific way in order to show the worth of the new evolved variety and improved package of practices for enhancing the soybean productivity (Saravanakumar, 2018). Shaktawat *et al.*, (2016) reported that majority of the marginal, small and large farmers belonged to low adoption category for seed treatment by fungicides and application of fertilizers, medium adoption for application of herbicide and plant protection measures of soybean production technology. Singh *et al.*, (2014) concluded that training programmes backed by the field demonstrations proved to be the most effective tool for speedy dissemination of knowledge and technical skills to the farmers. Kaur *et al.*, (2014) indicated that Front line demonstration program was effective in changing attitude of farmers towards pulse cultivation.

Generally farmers of Tirap district of Arunachal Pradesh grow local varieties of soybean (phidong) during May/ June and harvest in November/December with 160 days duration but the production and productivity is very less. To full fill the domestic requirement of oil, Indian government imports a huge quantity of oilseeds. In this regard, to sustain the production and consumption system, the Department of Agriculture, Co-operation and Farmers Welfare had sanctioned the "Cluster Frontline Demonstration on Kharif and Rabi oilseed 2018-19" to ICAR – ATARI Zone VI, Guwahati under National Food Security

Mission. To implement the project the Zone VI had selected KVK Tirap for soybean cultivation with an objective to boost the production and productivity of oilseed. To study the performance of short duration HYV of Soybean with 95-100 days duration (Variety : JS-9752) under proper management practices including seed treatment and integrated pest management was the prime objective.

Materials and Methods

The present investigation of CFLDs was conducted during kharif season 2018-19 by KVK Tirap, Arunachal Pradesh at Deomali and Khonsa subdivision under rainfed condition. An extensive survey was conducted to collect information from selected farmers to give them improved package of practice. Preferential ranking technique was utilized to identify the constraints faced by the farmers in soybean cultivation. The quantification of data was done by ranking the constraints and then calculating the Rank Based Quotient (RBQ) as given by Sabarathanam (1988), which is as follows:

$$RBQ = \frac{\sum f_i (n + 1 - i^{th})}{N \times n} \times 100$$

Wherein

f_i = number of farmers reporting a particular problem under i^{th} rank

N = Number of farmers

n = Number of problems identified

Based on the problems faced by the farmers, the cluster frontline demonstrations were designed. Scientific interventions under cluster frontline demonstrations were taken as mentioned in Table 1.

The extension gap, technology gap and technology index were calculated using the formula as suggested by Samui *et al.*, (2000).

Extension gap (q/ha) = DY (q/ha) – LY (q/ha)
 Technology gap (q/ha) = PY (q/ha) – DY (q/ha)

Technology index (%) =

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

Wherein,

DY = Demonstration Yield, LY = local Check Yield, PY = Potential Yield of variety

The technology was demonstrated at ten different villages namely Noitong, Otongkhowa, Bera basti, New Subang, Sipini, Namsang, Mopya, Wasathong, Noksan and Natun Basti of the district that lies between the latitude 26^o 38' to 27^o 47' N, longitudes 96^o16' to 95^o40' E and altitude 150-1200 m above MSL. As a whole, the soil of the demonstration site was sandy loam in texture, acidic in reaction (pH 5.2), medium in organic carbon content (0.75 %), medium in available nitrogen content (345 kg/ha), medium in available P₂O₅ (23.2 kg/ha) and low in available K₂O (118.4 kg/ha). On an average the climate of the district is hot and humid at lower altitude and cold at upper altitude. The average annual rain fall of the district is 2520.00 mm with 139.54 rainy days. For this study total 75 farmers were selected in 30 ha area under 10 clusters (3 ha area under each cluster). The farmers were trained to follow the package and practices for scientific cultivation of soybean through on and off campus training, method demonstration, by distributing leaflets, group meeting and kisan gosthi, farmers scientist interactions and all the need based inputs provided to the farmers (Table 2). The farmers followed the full package and practices like soil testing, seed treatment with *Rhizobium*, fertilizer application, line sowing, weed management

practices, integrated pest management. The seeds were treated with *Rhizobium* strain Majuli @ 12 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 x 15 cm with seed rate 70 kg/ha. The required fertilizer was applied @ 20:60:40 kg N: P₂O₅:K₂O per ha respectively. The traditional cultivation of soybean with their own varieties is considered as local check or farmers' practice. To study the impact of cluster frontline demonstrations, data from CFLD and farmers practices were analyzed.

Results and Discussion

Constraints in soybean production

Before conducting the CFLDs preferential ranking techniques were utilized to identify the constraints faced by the respondent farmers in soybean cultivation. The ranks given by different farmers are presented in Table 1. The findings indicate lack of suitable high yielding varieties (82.57 %), inadequate input availability (77.35 %), weed problem (74.64 %) and pest and disease problem (64.67%) were the four major constraints. Similar findings were reported by Dupare *et al.*, (2019), Sreelakshmi *et al.*, (2012) and Arjunkumar *et al.*, (2016). Based on the constraints, the cluster frontline demonstrations were conducted with high yielding soybean variety (JS-9752) and other major critical inputs for cultivation.

Performance of CFLD

The performance on growth parameters and yield data of newly introduced variety of soybean JS – 9752 along with improved practices was found better than the local check under same conditions and reported (Table 3 and Table 4).

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 (88.74 cm) was recorded at farmers’ practice than CFLD plots (78.76 cm) which might be a varietal character of farmers’ variety that leads to

loading due to wind and rain during harvesting stage resulted loss of yield and quality. More numbers of pods/plant recorded in CFLD plots (84.45 nos.) than farmers practice (46.79 nos.) which must be due to more numbers of primary branches per plant in CFLD plots.

Table.1 Ranks given by farmers for different constraints

Sr.No.	Constraint	RBQ	Overall rank
1.	Lack of high yielding varieties	82.57	I
2.	Inadequate input availability	77.35	II
3.	Weed problem	74.64	III
4.	Pest and disease problem	64.67	IV
5.	Lack of technical knowledge	60.00	V
6.	Low soil fertility/problematic soil	54.33	VI
7.	Small and fragmented land holding	51.67	VII
8.	Labour shortage	40.20	VIII
9.	Low price of farm produce	38.50	IX
10.	Lack of post harvest management	31.85	X

Table.2 Details of need based inputs supplied to CFLDs of soybean

Cluster	Numbers of demonstrations	Variety	Technology demonstrated	Need based input
Noitong	9	JS-9752	Improved variety, Seed treatment and Line sowing	Improved seed (JS-9752), Uniting together of small land holder in a cluster of big size, soil testing and soil test based N, P, K application, <i>Rhizobium</i> , insecticide Malathion 50 EC + Chloropyriphos 50%
Otongkhowa	8			
Berabasti	9			
New Subang	8			
Sipini	7			
Namsang	7			
Mapaya	9			
Wasathong	7			
Noksan	5			
Natunbasti	6			

Table.3 Growth parameters of cluster frontline demonstration on soybean

Treatment	Plant height (cm)	Nos. of primary branch/plant	Nos. of pods per plant	Pod length (cm)	Nos. of seed per pod	Days to 50% flowering	Pest and disease infestation
CFLD plots	78.76	10.68	84.45	6.5	4.33	65.52	Less
Farmers’ practice	88.74	5.2	46.79	5.2	4.0	87.63	Medium

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

Treatment	Yield (q/ha)	Gross Cost (Rs./ha)	Gross Return (Rs./ha)	Net Return (Rs./ha)	B:C ratio
CFLD plots	23.7	35246	94836	59589	2.69
Farmers' practice	16.5	26290	49500	23210	1.88

Table.5 Yield, extension gap, technology gap and technology index of the demonstration

Variables	Yield (q/ha)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
CFLD plots	23.7	7.2	1.3	5.2
Farmer's practice	16.5			

Less numbers of days to flowering (65.52 days) was recorded at CFLD plots than farmers' practice (87.63 days) which is a varietal character of JS-9752. Less pest and disease incidence was recorded at CFLD plots due to adoption of appropriate management practices in comparison to farmers' practice. This confirms the findings of Kalita *et al.*, (2019) on pigeon pea cultivation.

Regarding yield and economics, result concluded that highest yield (23.7 q/ha) was recorded in demonstration plots than farmers' practice (16.5 q/ha) with 43.7 % higher yield over the farmer practice. 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 fertiliser, timely intercultural operations and integrated pest diseases management practices in CFLD plots. Similar findings was also reported by Rai *et al.*, (2016) and Kalita *et al.*, (2019). The economic feasibility of improved practices over farmer practices was calculated depending upon the prevailing prices of inputs and output cost and gross return (Rs.94,836), net return (Rs. 59,589) and benefit cost ratio (2.69:1) was found superior in CFLD plots to farmer's practice. 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).

Yield of cluster frontline demonstration plots and potential yield of the crop was compared to estimate the yield gap, further it was categorized into extension gap, technology gap and technology index (Table 5.). The extension gap and technology gap were 7.2 and 1.3 q/ha respectively. The extension gap and technology gap observed may be attributed due to dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers in the district. Hence, to narrow down the yield gaps location specific technologies needs to be adopted. Technology index shows the feasibility of the variety at the farmers' field and it was reported 5.2 percent. The findings of the present study were in line with the findings Saravanakumar (2018).

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 horizontal spread of improved technology might be achieved by successful

implementation of CFLDs and by various extension activities like training, organizing field day, field visit, kisan gosthi, group meeting and exposure visit of nearby farmers to CFLD plots. Training to extension functionaries under District Agricultural Offices is essential for rapid dissemination of the technology to the entire district. It can be concluded that newly introduced variety of soybean along with improved package of practices performed well in the Tirap district of Arunachal Pradesh and adoption is also appreciable among the farmers.

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